REMind: A Robot Role-Playing Game To Promote Bystander Intervention

by

Elaheh Sanoubari

A thesis
presented to the University of Waterloo
in fulfillment of the
thesis requirement for the degree of
Doctor of Philosophy
in
Systems Design Engineering

Waterloo, Ontario, Canada, 2025

© Elaheh Sanoubari 2025

Examining Committee Membership

The following served on the Examining Committee for this thesis. The decision of the Examining Committee is by majority vote.

External Examiner:	Malte Jung Associate Professor, Department of Information Science, Cornell University
Supervisor:	Kerstin Dautenhahn Professor, Department of Electrical and Computer Engineering, University of Waterloo
Internal Member:	James Young Professor, Department of Computer Science, University of Manitoba
	Catherine Burns Professor, Department of Systems Design Engineering, University of Waterloo
Internal-External Member:	Andrew Houston Associate Professor, Dept. of Communication Arts, University of Waterloo

Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

Statement of Contributions

This thesis incorporates content from several peer-reviewed published or in-press papers. For all these publications, Elaheh Sanoubari is the principal investigator and first author. As lead author of the published manuscripts, I was responsible for contributing to conceptualizing study design, carrying out data collection. I was also the primary person responsible for conducting data analysis, drafting and submitting manuscripts. My coauthors provided guidance during each step of the research and feedback on draft manuscripts.

Chapter 1 is entirely new and was written specifically for this dissertation to articulate the overarching research agenda. Chapters 2 through 6 are mostly based on previously published peer-reviewed work. In addition, each chapter contains new connective and reflective material (e.g., chapter introductions and summaries) written specifically for this thesis to explain how the studies build upon one another and contribute to the broader research goals. Chapters 7 and 8 present previously unpublished research that is currently in preparation for submission. Finally, Chapter 9 is also entirely new and solely-authored; it provides an integrative discussion and and conclusions that are being prepared for future publication.

Chapter 2: The literature reviewed in this chapter draws partially from the publication below. This chapter also integrates related-work sections from other publications listed below. The literature review of Robots in Theatre (Section 2.6) has not appeared in prior publications before. Some new synthesis and additional literature review has been added throughout the chapter to provide the necessary theoretical breadth for this dissertation.

> Sanoubari, E., Johnson, A., Muñoz, J.E., Houston, A., and Dautenhahn, K. (2023). Using Robot-Mediated Applied Drama to Foster Anti-Bullying Peer Support. *Social Robots in Social Institutions: Proc. of Robophilosophy 2022*, 194–203.

Chapter 3: The core content is taken largely verbatim from the publication below. New material has been added to clarify the rationale behind the research hypotheses (in Section 3.3).

> Sanoubari, E., Young, J., Houston, A., and Dautenhahn, K. (2021). Can Robots Be Bullied? A Crowdsourced Feasibility Study for Using Social Robots in Anti-Bullying Interventions. *Proc. of the IEEE Int. Conf. on Robot & Human Interactive Communication (RO-MAN)*, 931–938.

Chapter 4: The content in this chapter is based primarily on the publication below. In addition, some qualitative evidence and interpretive insights originating from this study, which were not presented in the original publication, are presented and discussed in Chapter 7 and Chapter 9.

> Sanoubari, E., Muñoz, J.E., Mahdi, H., Young, J.E., Houston, A., and Dautenhahn, K. (2021). Robots, Bullies and Stories: A Remote Co-Design Study with Children. *Proc. of the ACM Int. Conf. on Interaction Design and Children (IDC)*, 171–182.

Chapter 5: The main body of content is adapted largely verbatim from the publication below. The integrative discussion presented in the chapter summary is new.

> Sanoubari, E., Muñoz, J.E., Houston, A., Young, J., and Dautenhahn, K. (2022). Designing an Anti-Bullying Serious Game: Insights from Interviews with Teachers. P*roc. of the Joint Int. Conf. on Serious Games (IJSG)*, 102–121.

Chapter 6: The content presented in this chapter is primarily taken from the manuscript below. In addition to the published material, this chapter includes expanded methodological details and additional qualitative evidence (e.g., participant quotes) that were omitted from the original publication due to length constraints.

> Sanoubari, E., Muñoz, J.E., Yamini, A., Randall, N., and Dautenhahn, K. (2025). What Makes an Educational Robot Game Fun? Framework Analysis of Children's Design Ideas. *Proc. of the International Conference on Social Robotics (ICSR)*, 40–55.

Chapters 7 & 8: These chapters present previously unpublished work that is currently in preparation for publication. For this material, Elaheh Sanoubari is the principal investigator and intended first author. Co-authors - including Keith Rebello, Alicia Pan, Neil Fernandes, Jomills Jose Anand, Andrew Houston, and Kerstin Dautenhahn - contributed to various stages of the research, including experimental design, data collection, data analysis, and manuscript revision.

Abstract

Peer bullying is a pervasive social problem, with bystanders' inaction being a critical challenge despite widespread disapproval of bullying. Effective intervention strategies must move beyond explanation-based instruction to facilitate embodied situated learning. This dissertation explores how social robots can serve as mediators for applied drama to foster prosocial bystander intervention in the context of peer bullying. It introduces Robot-Mediated Applied Drama (RMAD): an innovative framework that integrates drama-based pedagogy with social robotics to create safe, reflective, and embodied learning experiences.

Using a Research through Design (RtD) methodology, this work advances through an iterative sequence of design studies that culminate in the development and evaluation of REMind (short for Robots Empowering Minds): a mixed-reality role-playing game where children engage in dramatized bullying scenarios performed by social robots. In REMind, three robots enact a conflict involving a bully, a victim, and a passive bystander. Players are invited to assume control of robotic avatar, reflect on the unfolding narrative, and improvise an intervention by using the robot as a proxy in order to change the story's outcome. Through this structure, children rehearse bystander intervention strategies within a psychologically safe, yet emotionally engaging environment.

The iterative design process of REMind unfolded across complementary empirical inquiries. A crowdsourced feasibility study first established that observers perceive aggression toward robots as morally wrong, validating the viability of using robots in the intervention. A narrative co-design study with children revealed storytelling patterns such as preferences for emotionally expressive and customizable robot characters. Interviews with teachers grounded the design in classroom realities, identifying gaps in existing programs. A game design focus group study further examined what makes educational robot role-play games pleasurable for children, leading to identifying concrete design elements that informed REMind's interactive components such as core mechanics, use of tangible props, world aesthetics and narrative structure.

This dissertation presents the resulting artifact, REMind, as a system consisting of five interconnected components: Learning Goals, Mechanics, Narrative, Technology, and Aesthetics. The learning goals were defined through consultation with subject-matter experts to ensure grounding in evidence-based best practices. By deliberate aligning the game pleasures identified in prior studies with the learning objectives, REMind introduces a suite of game mechanics that scaffold socio-emotional skills (such as robot-mediated spect-actorship or "puppet mode" for moral intervention, interpretation of immersive affective displays for empathy-training and perspective taking, and custom-made logic-gate puzzles for moral reasoning). Narrative design is scaffolded by borrowing a five-step cognitive

model of bystander intervention from social psychology. The technical implementation is realized through StorySync, a novel spreadsheet-based scripting toolkit developed to synchronize multimodal cues (including multiple robots, graphical interfaces, ambient lighting, and sound) and manage narrative branching for live interactive robot drama. Finally, the aesthetic elements leverages emotional design, ambient cues, and digital scenography to create an emotionally resonant learning experience. This concrete high-fidelity prototype serves as a proof of concept for RMAD.

This research contributes a theoretical and practical foundation for designing robot-mediated experiential learning systems, offering RMAD as a new direction for social robotics and educational technology. It further illustrates how embodied storytelling and interactive systems design might cultivate reflective, prosocial action in a complex domain of social-emotional learning. More broadly, it advocates for a shift in Human-Robot Interaction (HRI) research toward systems thinking, positioning game design as a powerful systems lens for creating and analyzing holistic user experiences.

Acknowledgements

This dissertation is the culmination of many years of research, design, exploration, and collaboration. And I would like to thank everyone who made REMind possible:

First and foremost, I would like to thank my PhD supervisor, **Prof. Kerstin Dautenhahn**, Director of the Social and Intelligent Robotics Research Lab (SIRRL), for guiding this project through the years, for my interdisciplinary academic *upbringing*, and for showing me compassion at times when I needed it most. Her background as a biologist has profoundly influenced my view of robotics; I have been inspired by her intuitive and deeply reflective approach to research, her unique takes on computational cognition, and the fascinating links she draws between biological and artificial socially intelligent agents. I carry with me the invaluable lessons from her lectures on Social Robotics, and Artificial Life and Embodied Intelligence — specifically insights on the Braitenberg Vehicle thought experiments and the emergent nature of complex intelligent behavior; on the Heider-Simmel experiment, movement, embodiment, and the hard-wired human tendency for anthropomorphism; and on rigorous questionnaire design.

I would like to thank my advisory committee, Dr. Catherine Burns, and Dr. James Young, for their questions and feedback throughout this journey. As well as Dr. Jennifer Boger, for her critique of my proposal. I am also grateful to Dr. Malte Jung for his thoughtful feedback on this dissertation as an external examiner, and for his seminal work on affective grounding in Human-Robot Interaction (HRI), which influenced my design philosophy since I first encountered it.

I want to give special thanks to Dr. Andrew Houston, for lending me his theatrical expertise, introducing me to Applied Drama, and shaping this project from the very beginning. I appreciate the scholarly reflections on philosophy of Art that he shared whenever I went to him with abstract questions I was obsessed with (like "where meaning comes from"), and the long conversations that would end up with me taking notes on Semiotics, Mimesis, Phenomenology, Methexis — and jotting down phrases like "Thickening of Signification". And for standing in as the Dramaturgy Director in the many many hours of REMind technical rehearsal sessions (presented in Chapter 7), which were invaluable for the iterative development and affective tuning of the REMind experience; as well as being in my advisory committee. Also, for introducing me Blast Theory and their inspiring interactive art.

I am deeply grateful to Dr. Chrystopher L. Nehaniv, co-director of SIRRL, for his mentorship and support, his continued feedback on REMind, and his lectures on Artificial Life and Embodied Intelligence, as well as Biology and Computation. I value the many thoughtful

and inspiring discussions we shared in SIRRL group meetings; I've been constantly inspired by his unique ability to offer insightful questions and comments that bridge HRI, Applied Neuroscience, and Cognitive Linguistics. I am especially thankful for all I have learned from him on the nature of Metaphor, and for the gift of his book, *Computation for Metaphors, Analogy, and Agents*, which truly opened new doors for me.

I am immensely grateful to the social psychologists, Dr. Christina Salmivalli and Dr. Claire Garandeau from the University of Turku, Finland, who generously shared their unique expertise on Peer Bullying over the years — especially thankful for their invaluable feedback that helped determine the seven learning goals of REMind (reported in Chapter 7). Their well-written thoughtful scholarship on Anti-Bullying Interventions, their well-documented work on the widely adopted KiVa Anti-Bullying Program, and their patience with my many follow-up questions and generosity with offering detailed advice has truly shaped REMind from the roots.

I am grateful to the domain experts from the Centre for Spectatorship and Audience Research (CSAR) of the University of Toronto for their thoughtful feedback on REMind, their critiques of the facilitation structure, and important suggestions for inclusion of the Joker role, and collective debriefing sessions.

To Dr. Sean Geobey, director of the Waterloo Institute for Complexity & Innovation (WICI) and my neighbor, for all the insightful philosophical discussions and talks on Complexity and Complex Systems, Emergence, and Microeconomics — specifically for one unforgettable conversation around the bonfire on understanding Design as a "Boundary Object".

To Dr. Neil Randall, director of the Games Institute (GI), for our inspiring conversations on Semiotics of Games and Game Design, on Rhetoric, Storytelling, and Metaphor; and for all the game design feedback that shaped REMind, especially for his unforgettable advice on the importance of Interactivity and his quote that sunk deep in my mind: "Unlike a movie or a book, a game does not continue if you do nothing".

To Dr. Paul Heidebrecht, director of the Kindred Credit Union Centre for Peace Advancement, for inspiring conversation on Peace Technology, and the role of AI and systems design for advancing peace — and for his quote engraved in my memory: "Peace is everybody's business".

To Keith Rebello, for all that I have learned from him on Emotional Intelligence, and Affective Computing. Also for spending many hours as one of the amazing REMind wizards, for shaping the design of the Empathy Training module in REMind, for his invaluable work on the thematic analysis that is reported in Chapter 8 and for helping with the writing of that chapter.

Thank you to Alicia Pan for spending many hours as a wonderful "wizard" during the REMind playtesting sessions, as well as her help with the qualitative analysis and intercoder-reliability testing presented in Chapter 8. I am also grateful for the many hours she spent during our technical rehearsals; her thoughtful feedback shaped the technical system, enabled the Joker-Wizard coordination, and assisted greatly with the affective tuning of the REMind experience.

To Neil Fernandes, for helping with processing, annotating and editing REMind playtesting videos, and his help with authoring the content presented in Chapter 8, including the many figures he made — thank you for your creative and technical support.

To Dr. John Munoz, for being the first scholar who opened my eyes to the world of Game Design, and truly shaping this project in the early stages of my PhD.

To Heather Dekker, our research ethics advisor — thank you for your kind, thoughtful guidance on research ethics. Your appreciation for design research and your help navigating the ethics approval process was instrumental. Children who enjoyed playing REMind could not have done so without your caring support.

Thank you to Nils Hagberg, for your advice on interaction design, conversational flows, and multi-robot systems over the years.

And to Charlie Capers, for generously sharing advice on dramatizing Furhat robots and sharing his code for changing character parameters.

Also, thank you to Mathieu Rey-Herme, for sharing code that helped us implement multi-robot control in StorySync.

To Jenna Spiers, the drama education teacher who advised me on adding exit tickets for children, and highlighted the importance of symbolic interaction with tangible props.

To Dr. Patrick McGrath for his mentorship. I'm especially thankful for his advice on the importance of "showing thoughts" of the REMind characters and the memorable reflection he once shared with me that when he engages with clients as a psychologist, he seeks to understand their thinking and help change it.

To Jomills Jose Anand, for his creative spreadsheet hacks that saved the day. Thanks to him, we had better narrative branching and were able to integrate light controls into StorySync (presented in Chapter 7).

To Dr. Pourya Aliasghari, for being a good friend and tech support extraordinaire and for the time you heroically transported the massive TV from E7 to EIT.

To our incredible URAs — Mackenzie Snyder, Agam Soni, Isabelle Huang, and Tina Jang — for their contributions to REMind's codebase and StorySync, and to Amanda Johnson, for making the tables in Appendix A.1.

To Ali Yamini, for his help with making the bully detector 3D printed shell and PCB (presented in Appendix C).

To Ali Nourmohammadi, for introducing me to the Engineering Machine Shop, and his help with micro-controller troubleshooting.

I thank Orion Buckman for encouraging me to build the custom-made interactive *Bully Detector* prop for REMind, and for inspiring it by telling me about the *Computer Engineering for Babies* book series and Adafruit. Also for introducing me to the university's Makerspaces and resources, and for giving me practical advice for fabrication—including his important suggestion to use a Hammond project box instead of a 3D printed shell.

And to Marco Aurelio Moran Ledesma, for helping with 3D printing the first shell of the bully detector.

To Dr. Samira Rasouli, for her Furhat expertise, her help with FurGUI, and her kindness and patience while we shared robots.

To Dr. Zachary McKendrick, for being the best child-like adult pilot playtester REMind could ever ask for.

To Dr. Matt Borland, for being a kind mentor at times I needed it the most — thank you for reminding me that art and engineering are not oil and water.

And to Dr. Scott Campbell, for the important lessons on Society, Technology, and Values, and for teaching me that technology is never neutral, and that engineering design must be guided by values.

And to young Ada Geobey, for the refreshing advice, comments, and questions that helped me, the adult designer who had not been a child in decades, step into the shoes of one.

To Dr. Daniel Vogel, for his mentorship, the many inspiring conversations we shared on Human-Computer Interaction (HCI), Interaction Design, and Aesthetics, and his feedback on REMind technical rehearsals.

To Paul Cegys, for feedback on theater light design.

To Joanna Cleary, who helped with the first version of REMind character sheets used in our study on Pleasures of Robot Role-Play Games (reported in Chapter 6).

To Laura Boytim, for sharing insights from anti-bullying workshops, and the practical challenges of role-playing with children.

To Stephan Utter, for solving many mysterious networking issues REMind encountered.

To Andrew Atkinson, for his advice on recording and camera setups.

To all the SIRRL members for all their feedback on REMind over the years.

To Dr. S. Dashti, Musician, for spending many hours on carefully listening to a dataset of affectively-rated instrumental piano pieces and annotating them to help us choose the appropriate affective music for the REMind Empathy Training module.

To Hemn Badri, for spending much time to help me make overleaf tables of REMind script to add to the appendix of this dissertation.

To all the children who participated in my studies — thank you for your playfulness, creativity, and honesty. To the parents who supported their participation, I am deeply grateful for your time, trust, and genuine encouragement.

To the teachers who generously shared their time, wisdom, and anecdotes from the classroom. Their input grounded REMind in the realities of children's everyday school life.

Thanks to the University of Waterloo Computer Museum, for lending us the floppy disk and reader that became REMind's most nostalgic props, and a novelty for the children who played the game.

Finally, last but not least, to my friends and family: thank you for being my support network outside of the lab. To my wonderful parents, for your endless support and encouragement, and for believing in me faithfully even at times that I did not believe in myself. To Narges, Reshma, Xel-Ha, Abbie, Elena, Elham, Brian, Mike, Amirmasoud, Sima, Alperen, for all the times they reminded me that I am more than my research.

Dedication

I dedicate this thesis, with all of my heart, to the bullied women of Iran who at the time of writing this thesis require governmental permission to show their hair in public. I do so in the loving memory of Jina Amini, whose tragic death gave birth to the single most profound event of my life and the great sum of moral beauty my heart has witnessed in one place: The "Woman, Life, Freedom" revolution in Iran.

This thesis is also dedicated to my grandmothers. One of whom was illiterate but raised four daughters to get educated and become educators. The other one was one of the first women in my hometown, and the first of her sisters to learn how to read and write; whose notebooks in which she first learned how to solve calculus problems with fountain pens and neat handwriting remain a family heirlum, and who always wanted to be a teacher.

And finally, to my own mother - the original creative teacher whose innovative pedagogical experiments shaped many afternoons of my childhood and continue to shape my design philosophy to this day. For if it was not for her heart-felt appreciation of the transformative value of education for women, I would not be here and this thesis would not be possible.

Table of Contents

Examining Committee ii

Author's Declaration iii

Statement of Contributions iv

Abstract vi

Acknowledgements viii

Dedication xiii

List of Figures xxiv

List of Tables xxix

1 Introduction 1

1.1 Motivation: Peer Bullying 1

1.2 Applied Drama: a Vehicle for Situating Learning in Embodied Experience 2

1.3 Robot-Mediated Applied Drama (RMAD) 3

1.3.1 REMind: A Proof-of-Concept System 3

1.4 Research through Design (RtD) 3

1.5 Research Questions and Core Contributions 4

1.6 Dissertation Structure 7

2 Literature Review **8**

2.1 Peer Bullying . . . 8

2.1.1 Definition of Bullying . . . 8

2.1.2 Types of Bullying . . . 9

2.1.3 Prevalence of Bullying . . . 9

2.1.4 Consequences of Bullying . . . 10

2.1.5 Group Dynamics in Peer Bullying . . . 10

2.1.6 The Promise of Bystanders . . . 11

2.2 Anti-Bullying Interventions . . . 12

2.2.1 Limitations of Traditional Interventions . . . 12

2.2.2 Interventions Using Applied Drama . . . 12

2.2.3 Interventions Using Technology . . . 14

2.3 Applied Drama . . . 18

2.3.1 Defining Applied Drama . . . 18

2.3.2 Key Concepts . . . 19

2.3.3 Benefits of Applied Drama . . . 20

2.3.4 Forum Theatre . . . 21

2.3.5 Role-play . . . 22

2.4 Game Design . . . 22

2.4.1 Defining Games . . . 22

2.4.2 Game-Based Learning . . . 23

2.4.3 Role-Playing Games . . . 24

2.4.4 Interactive Digital Narratives . . . 24

2.4.5 Mixed Reality Games . . . 25

2.5 Robots in Education . . . 25

2.5.1 Unique Attributes of Social Robots . . . 26

2.5.2 Application in Storytelling and Drama . . . 27

2.5.3 Gap in Anti-Bullying Interventions . . . 28

2.6 Robots in Theatre . . . 28
2.6.1 Theatre as a Testbed for Evaluating Robots . . . 28
2.6.2 Theatre as a Methodology for Robot Design . . . 29
2.6.3 Robots as Performance Partners . . . 29
2.6.4 Robots for Theatrical Learning and Pedagogy . . . 29
2.7 Robot-Mediated Applied Drama (RMAD) . . . 30

3 Feasibility Evaluation: Can Robots Be Bullied? 31
3.1 Related Work . . . 32
3.2 Background . . . 33
3.2.1 Moral Disengagement . . . 33
3.2.2 Perception of Mind . . . 34
3.2.3 Bystander Intervention Model . . . 34
3.3 Research Questions . . . 34
3.4 Methodology . . . 35
3.4.1 Instruments . . . 36
3.4.2 Measurements . . . 36
3.4.3 Analysis . . . 39
3.5 Participants . . . 40
3.6 Results . . . 40
3.6.1 Manipulation Check and Perception of Mind . . . 40
3.6.2 Bullying and Bystander Intervention . . . 41
3.6.3 Moral Disengagement . . . 44
3.6.4 Empathy . . . 46
3.7 Discussion . . . 47
3.8 Conclusion . . . 48
3.9 Chapter Summary . . . 48

4 Ideation: Character and Story Co-Design with Children 50
4.1 Research Questions . . . 51
4.2 Background: Co-Design . . . 52
4.2.1 What is Co-Design . . . 52
4.2.2 Why Co-Design with Children . . . 53
4.2.3 Frameworks for Co-Design with Children . . . 53
4.3 Related Work . . . 54
4.4 Methodology: Guided Cooperative Inquiry . . . 54
4.4.1 Brainstorming . . . 55
4.4.2 Sketching . . . 55
4.4.3 Crafting . . . 55
4.4.4 Story-writing . . . 56
4.4.5 Animation-making . . . 57
4.4.6 Interview . . . 58
4.5 Recruitment . . . 59
4.6 Participants . . . 59
4.7 Procedure . . . 59
4.8 Analysis . . . 61
4.9 Observations . . . 63
4.9.1 Character Design . . . 64
4.9.2 Narrative Design . . . 69
4.10 Lessons learned . . . 72
4.10.1 Emotionally Expressive Social Agents . . . 72
4.10.2 Robots as a Vehicle for Exploring Sensitive Topics . . . 73
4.10.3 Customizability and Sense of Ownership . . . 74
4.10.4 Designing Imperfect Synthetic Characters . . . 74
4.10.5 Scaffolded Improvisation in Interaction Design . . . 75
4.11 Discussion . . . 75
4.11.1 Limitations . . . 76
4.12 Chapter Summary . . . 77

5 Grounding in Context: Elicitation Interview with Local Teachers 79
5.1 Research Questions . . . 80
5.2 Interviews with Teachers . . . 80
5.2.1 Recruitment . . . 80
5.2.2 Participants . . . 81
5.2.3 Procedure . . . 81
5.2.4 Analysis . . . 81
5.3 Qualitative Observations . . . 82
5.3.1 Anti-Bullying Programs in Schools . . . 82
5.3.2 Peer Bullying in Schools . . . 84
5.3.3 Peers' Reactions to Bullying . . . 86
5.4 Discussion . . . 88
5.4.1 Promoting Situated Learning and Meta-Cognition . . . 89
5.4.2 Direct vs. Indirect Bullying . . . 90
5.4.3 Contemporary Dynamics of Peer Bullying . . . 90
5.4.4 Limitations and Future Work . . . 91
5.5 Conclusion . . . 92
5.6 Chapter Summary . . . 93

6 Incorporating "Fun": Focus Groups with Children 95
6.1 Understanding Fun . . . 96
6.2 Aligning Game Mechanics . . . 97
6.3 Methodology . . . 97
6.3.1 Procedure . . . 97
6.3.2 Recruitment & Participants . . . 98
6.4 Data & Analysis . . . 99
6.5 Intercoder Reliability Testing . . . 100
6.6 Quantitative Observations . . . 100

6.6.1 The Inductive Lens . . . 101
6.7 Qualitative Patterns: Pleasures of Robot Games . . . 102
6.7.1 Sensation . . . 102
6.7.2 Fantasy . . . 103
6.7.3 Narrative . . . 104
6.7.4 Challenge . . . 104
6.7.5 Fellowship . . . 105
6.7.6 Discovery . . . 106
6.7.7 Expression . . . 106
6.7.8 Submission . . . 107
6.8 Informing the Design of REMind . . . 107
6.9 Discussion . . . 110
6.10 Conclusion . . . 111
6.11 Chapter Summary . . . 112

7 System Overview: REMind Game Design Elements 113
7.1 Introduction . . . 113
7.1.1 Elemental Tetrad of Game Design . . . 114
7.1.2 Designing for Learning: Adding a Fifth Element . . . 115
7.2 Learning Goals . . . 115
7.2.1 Consulting Subject-Matter Experts . . . 116
7.2.2 Seven Learning Objectives . . . 117
7.2.3 Game Themes . . . 120
7.2.4 Target Audience . . . 121
7.3 Core Mechanics . . . 121
7.3.1 Robotic Avatar . . . 122
7.3.2 Robot-Mediated Spect-Actorship via "Puppet Mode" . . . 123
7.3.3 Debugging Moral Reasoning via "Bully-Detector" . . . 124

7.3.4 Empathy Training via Affective Interpretation . . . 125
7.3.5 Narrative Mechanics . . . 126
7.4 Narrative Design . . . 135
7.4.1 Characters and Setting . . . 137
7.4.2 Cognitive Scaffolding: Modeling Peer Defending . . . 139
7.4.3 Embedded Narrative . . . 140
7.4.4 Emergent Narrative . . . 144
7.4.5 Narrative Development . . . 146
7.5 Technology . . . 149
7.5.1 Robotic Platform . . . 149
7.5.2 StorySync: A Spreadsheet-Based Scripting Toolkit . . . 150
7.5.3 Converting Human Performance to Robot Gesture . . . 157
7.5.4 Custom-Made Logic-Gate Prop . . . 157
7.6 Aesthetics . . . 158
7.6.1 Designing Audio-Visual Affective Displays . . . 160
7.6.2 Programming Emotional Subtext . . . 161
7.6.3 Imaginative Play and Perception of Magical Causality . . . 167
7.6.4 Believable & Realistic Scenario Design . . . 168
7.6.5 Digital Scenography . . . 170
7.7 Discussion . . . 170
7.7.1 Revisiting Design Goals . . . 170
7.7.2 Towards Scalable Authoring Toolkit for Robot Role-Play Games (RPG) . . . 172
7.8 Chapter Summary . . . 173

8 Evaluating REMind: Playtesting with Children 175

8.1 Player Experience Overview . . . 176
8.1.1 Phase 1. Entering the Magic Circle . . . 176

8.1.2 Phase 2. Simulating the Memory & Fixing the Bully-Detector . . . 177
8.1.3 Phase 3. Debug Mode: Empathy-Training & Perspective-Taking . . 178
8.1.4 Phase 4. Puppet Mode: Intervention Rehearsal 179
8.1.5 Phase 5. Outcomes and Resolution 179
8.2 Research Questions 180
8.3 Experiment Design 181
8.3.1 Setup 181
8.3.2 Facilitation 182
8.3.3 Procedure 184
8.3.4 Measurements 187
8.3.5 Data and Analysis 189
8.4 Quantitative Results 190
8.4.1 Participants 190
8.4.2 Perceived Self-Efficacy 190
8.4.3 Empathy 191
8.4.4 Outcome Expectations 191
8.4.5 Descriptive Comparison based on Chosen Strategy 193
8.4.6 Character Affinity 193
8.5 Qualitative Observations 193
8.5.1 Intercoder Reliability Testing 193
8.5.2 Perspective-Taking 193
8.5.3 Narrative Engagement 196
8.6 Latent Thematic Analysis: Empathy Training 198
8.7 Discussion 202
8.7.1 Evaluating Pedagogical Outcomes 202
8.7.2 Use of Prop-Based Narrative Mechanics 204
8.7.3 Importance of Technical Rehearsals for Wizard-Joker Coordination 205
8.7.4 Towards Long-term Real-World Deployment 206

8.7.5 Ethical Considerations . . . 207
8.7.6 Limitations and Future Work . . . 207
8.8 Chapter Summary . . . 208

9 A Reflection on RMAD: Towards Systems Thinking and Experience Design in HRI 210
9.1 Scientific Rigor VS Experiential Pedagogy . . . 211
9.1.1 The Myth of Reproducibility . . . 212
9.1.2 Maximalist Pedagogy vs. Minimalist Experimentation . . . 212
9.1.3 Why a Design-Led Research Framing Is Needed . . . 213
9.2 Towards Experience Design in HRI . . . 214
9.2.1 Understanding Systems . . . 215
9.2.2 Understanding the HRI Experience as Emergence . . . 216
9.2.3 Game Design As A Systems Tool for Experience Design . . . 218
9.2.4 A Paradigm Shift for HRI Design: From Reductionism to Systems Thinking . . . 219
9.3 Towards Design Patterns for RMAD Experiences . . . 220
9.3.1 Revealing Invisible Mental States with the Robot Metaphor . . . 221
9.3.2 Containers & Tokens as Embodied Metaphor . . . 223
9.3.3 Cognitive Scaffolding of the Experiential Learning Journey . . . 225
9.4 REMind as an RtD Contribution . . . 227
9.5 Conclusion . . . 230

References 232

APPENDICES 268

A Robots & Theatre in Learning 269

B Moral Disengagement Questionnaire for Robot Bullying 273

C Bully-Detector Circuit Design **275**
C.1 Schematic Diagram . . . 275
C.2 PCB Layout . . . 276

D Character Design **277**
D.1 Character Sheets . . . 277
D.1.1 AVATAR (Player-Character / Protagonist) . . . 277
D.1.2 FUSE (Non-Player Character / Antagonist) . . . 279
D.1.3 JITTER (Non-Player Character / The Innocent) . . . 280
D.1.4 ORACLE (Non-Player Character / The Sage) . . . 281
D.1.5 MATRIX (Non-Player Character / GUI) . . . 281
D.2 Interpersonal Circumplex of Main Characters . . . 282

E Structural Narrative Mapping Based on 12 Steps of "Hero's Journey" **283**

F Configurations of the AI Assistant for Story-Creation **286**
F.1 Agent Description . . . 286
F.2 System Instructions . . . 286
F.3 Example Prompt . . . 287

G Exit Tickets **288**

H Simplified Game Script **289**
H.1 Phase 1. Entering the Magic Circle . . . 289
H.2 Phase 2. Simulating the Memory & Fixing the Bully-Detector . . . 291
H.3 Phase 3. Debug Mode: Empathy-Training & Perspective-Taking . . . 294
H.4 JITTER's Emotions . . . 294
H.5 JITTER's Thoughts . . . 295
H.6 FUSE's Motivation . . . 295
H.7 Meaning of Compassion . . . 295
H.8 Phase 4. Puppet Mode: Intervention Rehearsal . . . 296
H.9 Phase 5. Outcomes, and Resolution . . . 297

List of Figures

2.1 A screenshot of the FearNot! software – John, an animated character who is getting bullied in school is asking for advice. Source: Adapted from [1]. . 15

2.2 A screenshot of the KiVa Game. Source: Adapted from [2]. 16

3.1 Snapshots of the videos used in the study. Left: bullying a robot. Right: bullying a human. 37

3.2 Perceptions of experience and agency. Left: bullied human. Right: bullied robot. Differences are significant in both dimensions, $p<.05$. 41

3.3 Ratings of the five steps of Bystander Intervention Model in response to the bullied human versus the bullied robot 42

3.4 The mechanisms used for moral disengagement with each bullying scenario 43

3.5 Moral disengagement with the bullied human versus the bullied robot. $p<.05$, Error bars represent 95% CI. 44

3.6 Empathy score for victims and bullies in each condition 46

4.1 Examples of brainstorming ideas and sketches made by children. 56

4.2 Examples of low-fidelity prototypes of robots crafted by children. 57

4.3 A storyboard made by one of the participants. 58

4.4 Children participating in the remote co-design study. (left: making an animation, right: brainstorming and sketching). 60

4.5 Examples of robots crafted by children in the co-design study. 62

4.6 Developed thematic map, showing two correlating diagrams and six main themes. 63

4.7 A storyboard made by a participant. 65

6.1 Distribution of children's design ideas across 8 game pleasures. Numbers on the pie denote count of references. Percentages denote count relative to total references. 101

6.2 Sample ideas brainstormed by participants: (a): *"Project images onto walls & things to see surroundings."*; (b): *"Idea 5: it can pretend to be in different historical ages. Sort of like a teacher but fun"*; (c): *" if you can choose the robot's personality"*. 103

6.3 The first prototype of "Bullying Detector" had a 3D-printed shell. 108

7.1 REMind engages players in role-play with three Furhat robots. 114

7.2 An example of the "Puppet Mode" Interaction: Player's facial expressions and voice are captured and converted to a gesture played on the robotic avatar. 124

7.3 "Bully-Detector" is an interactive prop to practice moral reasoning about bullying. The buttons play yes/no questions. The alarm goes off if bullying is "detected". 125

7.4 Avatar displays 2 emotions it has "detected" in the victim through ambient audio-visual cues. Player explains these emotions to the robot. 126

7.5 Narrative mechanics are implemented via interaction with tangible game props. Players use Access-Clouds to view the story from different robot characters' points-of-view. 128

7.6 Prop-mediated interaction allows players to select different "versions" of a robot character to view alternative story endings. 129

7.7 Player may initiate the dramatization of the conflict scene by pressing a button. 129

7.8 Embodied interaction with Power-Box, a tangible prop reinforcing the morale of the story. 130

7.9 The player opens the "Heart-Meter", a drawer box that symbolizes avatar's social status, before and after intervention. 131

7.10 Error messages signal a narrative breakdown requiring player's intervention. 131

7.11 The "Debug Mode" lists missing values the player must help robot recover. 132

7.12 The player initiates the game via haptic interaction with a plasma light. . . 133

7.13 ORACLE provides narrative guidance via pre-recorded messages on GUI. . 134

7.14 The GUI prompts the player to find a numbered clue hidden in the room. . 135
7.15 Storytelling elements in the REMind game world. 137
7.16 Three Robot Characters in REMind. 138
7.17 Example of dialogues from children's storyboards (a, b) directly adopted in REMind scenes (c, d) to depict bullying. 147
7.18 Example translation of a *StorySync* spreadsheet-based script (right) into a live dramatic scene in REMind (left). 150
7.19 Screenshot from StorySync: As AVATAR recalls a bullying incident, the *Persona* command is used to temporarily adopt FUSE's (the bully's) face and voice, highlighting the dialogue being mimicked. 152
7.20 Example REMind GUI screen: StorySync enables modular control over the areas marked in yellow. 155
7.21 Example of a thought bubble emerging from the character's profile picture on the GUI. 157
7.22 Screenshot from StorySync illustrating the mismatch between semantic label and dramatic function. The final row uses a gesture labeled as *Pleased* to represent AVATAR shrugging off terror, despite the gesture's inherent joyful attribution. 162
7.23 Screenshot from StorySync: AVATAR's reaction after the empathy training module. This snippet was affectively fine-tuned during the technical rehearsals, where we added Furhat robot gestures ($g/$), and pauses ($d/$), and tweaked speech rate ($p/$), and style ($s/$) to enhance robot's dramatic performance. 165
7.24 Children's storyboards from co-design sessions often depicted group laughter as part of peer bullying scenarios. This informed the inclusion of ambient laughter in REMind's bullying scene to evoke the intended emotional context. 166
7.25 Static facial and head pose configurations were used for emotional design of (a) FUSE, the bully robot; and (b) JITTER, the victimized robot. 167
7.26 The behavioral patterns established in REMind backstories (section 7.4.3) were derived from archetypal bully behaviors observed in children's storytelling: antagonistically reacting to a peer's innocent fun activity (a); stealing a victim's homework as a prank (b); socially excluding a classmate from a birthday party (c); and verbal taunting by calling a victim named John "baby-John-dork" (d). 169

8.1 REMind avatar robot customization GUI 176
8.2 Players start the game by placing their hand on the ORACLE (plasma light) and saying the "magic words". 177
8.3 Steps for fixing the Bully-Detector. 178
8.4 Layout of the play-testing room (KERNEL), showing the three designated areas: avatar setup and onboarding, the main game area with robots and Game GUI, and the hidden wizarding station behind room dividers. 182
8.5 Perceived self-efficacy for defending increased post-intervention. Boxes show the interquartile range (IQR); whiskers extend to 1.5× IQR. 191
8.6 Empathy-related findings. (a) Affective empathy scores before and after empathy training. No significant change was observed. (b) Empathy toward human vs. robot. Children with higher baseline empathy were more likely to empathize with the robot avatar. 192
8.7 Outcome expectations before and after the intervention. Red dashed lines shows normative target regarding the bully, and the blue dashed lined shows normative target regarding the victim. 192
8.8 A participant reflecting on how they feel after watching the bullying scenario enacted by 3 robot characters. 196
8.9 Children instruct the robot through embodied expression: (Left) how sadness shapes the eyebrow, (Middle) how bowing the head symbolizes sadness, (Right) how anxiety can be shown through inter interlocked fingers. 200
8.10 Player interaction in REMind demonstrating a participant pre-emptively pressing game buttons. 205

9.1 The idea of visualizing robots' minds on a GUI was inspired by storyboards drawn by children in previous co-design studies. 222
9.2 Participant reflects on the meaning of "perspective" by likening it to an imaginary "bubble above your head" that makes your thoughts visible. . . . 223

C.1 Schematic Diagram of the Bully-Detector prop. 275
C.2 PCB Layout of the Bully-Detector prop. 276

D.1 Character positions mapped onto the Interpersonal Circumplex. 282

G.1 Example Exit Ticket filled out by a participants in the play-testing study. . 288

H.1 In the story, a series of "brain screenshots" visualize avatar robot's decision-making process that led to inaction against peer bullying: although the robot experienced discomfort, it scanned its peers and saw no visible reactions. Assuming that the "class vibe" was reflected approval, it concluded that doing nothing was the correct response. However, other robots in the group used the same algorithm and made the same assumption, leading to a shared misperception of norms, which caused the glitch. 299

List of Tables

6.1 Eight types of game pleasures in the MDA framework [170]. 100

6.2 Robot game pleasures and examples of how they informed preliminary designs of REMind 109

7.1 Robot action syntax in StorySync. The vertical bar ('|') in the examples indicates a column breaks in the spreadsheet. 153

7.2 Narrative controls in StorySync for managing story flow, dialogue choices, shallow branching, and alternative storylines. The vertical bars ('|') indicate column breaks. 154

7.3 GUI controls in StorySync for managing media, feedback, and rewards. The vertical bars ('|') indicate column breaks. 156

7.4 Scene control commands in StorySync for managing ambient sound and lighting. 158

A.1 Overview of related work using robots and theatre as a tool for learning. . 270

E.1 Mapping of the 12 steps of the Hero's Journey [66] (based on Vogler's interpretation [374]) to REMind narrative framework. 283

H.1 StorySync - REMind Act 1 301

H.2 StorySync - REMind Act 2 305

H.3 StorySync - REMind Act 3 307

H.4 StorySync - REMind Act 4 310

H.5 StorySync - REMind Act 5 313

H.6 StorySync - REMind Act 6: Part 1 316

H.7 StorySync - REMind Act 6: Part 2 . . . 318
H.8 StorySync - REMind - Bully Detector - Q1: Repetition . . . 320
H.9 StorySync - REMind - Bully Detector - Q2: Power Imbalance . . . 322
H.10 StorySync - REMind - Bully Detector - Q3: Intent to Harm . . . 323
H.11 StorySync - REMind Act 7 . . . 324
H.12 StorySync - REMind Act 8 . . . 332
H.13 StorySync - REMind - Act 8 - Strategy Choice 1: Firm to Fuse . . . 333
H.14 StorySync - REMind - Act 8 Strategy Choice 2: Comfort Jitter . . . 334
H.15 StorySync - REMind Act 9 . . . 336
H.16 StorySync - REMind Act 12 . . . 338
H.17 StorySync - REMind - Act 9 - Memory Rewatch . . . 342
H.18 StorySync - REMind - Act 9 - Puppet mode . . . 344
H.19 StorySync - REMind - Act 9 - Points: Be firm to Fuse . . . 344
H.20 StorySync - REMind - Act 9 - Points: Comfort Jitter . . . 345
H.21 StorySync - REMind Act 10 . . . 345
H.22 StorySync - REMind Act 10 - Fuse 2.0 . . . 346
H.23 StorySync - REMind Act 10 - Fuse 3.0 . . . 346
H.24 StorySync - REMind Act 11 . . . 348
H.25 End Game . . . 355

Chapter 1

Introduction

Robots hold significant potential for education. Their social presence, embodiment, and interactive capabilities open up new possibilities for creating engaging learning experiences. This dissertation explores one such possibility: the use of social robots as mediators for applied drama to foster peer support in the context of bullying. Specifically, it investigates how Robot-Mediated Applied-Drama experiences might be designed to empower bystanders to act against bullying.

1.1 Motivation: Peer Bullying

Peer bullying is a widespread issue with serious short-term and long-term consequences, which may be understood as a Wicked Problem. Wicked Problems [301, 61] are complex societal challenges that resist resolution through traditional scientific methods. They are characterized by conflicting perspectives and values among multiple decision-makers, unclear problem boundaries, and solutions that are not final but instead must be revisited and adapted over time. Peer bullying involves diverse stakeholders (bullies, victims, bystanders, parents, teachers, school authorities, the broader community, and sometimes law enforcement) each with differing perspectives and objectives. Social dynamics of bullying are shaped by a web of interconnected factors, including individual personalities, social interactions, family environments, and societal norms.

In Canada, 7 in every 10 youth report experiencing bullying, according to the most recent Canadian Health Survey on Children and Youth (CHSCY) [341]. Peer bullying persists worldwide, partially because the traditional approaches, such as punitive measures or zero-tolerance policies, fail to address the intricate social dynamics of bullying. Effectively

addressing peer bullying requires a holistic approach that considers its psychological, and social dimensions and engages with the underlying causes in an integrated manner.

Importantly, bullying is not merely a dyadic problem between a perpetrator and a victim; rather, it is a social phenomenon. Scholars emphasize that bullying is a "group process", involving not only those who bully and are bullied, but also the peers who observe these interactions [310]. Of particular importance are bystanders — peers who witness bullying but do not actively participate. Research shows that when bystanders intervene, bullying stops in more than half of the cases [285]. However, in practice, bystanders seldom take action [309]. The challenge is not a lack of anti-bullying attitudes: many children already disapprove of bullying [311]. The real difficulty lies in translating these attitudes into action. Mobilizing bystanders is therefore a crucial, yet challenging, intervention strategy with high potential impact. To be effective, such interventions must move beyond explanation-based pedagogy, and instead equip learners with embodied, reflective, and situated forms of practice. This is where applied drama offers unique promise.

1.2 Applied Drama: a Vehicle for Situating Learning in Embodied Experience

Applied drama refers to theatrical practices used in non-theatre contexts, such as education, health, or community-building, to facilitate reflection, learning, and social transformation [321]. Rooted in experiential pedagogy, applied drama engages participants through role-play, improvisation, and performative exercises that allow them to explore difficult social scenarios safely and critically.

Role-play engages all three domains of learning in Bloom's Taxonomy [41]: cognitive domain (mental skills, knowledge), affective domain (emotional responses and attitude), and the psychomotor domain (physical skills and abilities), which make it a versatile pedagogical tool. It is widely adopted in educational and therapeutic domains to promote empathy, perspective-taking, and self-reflection.

However, its use with children in the context of sensitive topics such as bullying presents ethical and pedagogical challenges. Asking children to role-play as bullies or victims may risk reinforcing psychological harm or emotional discomfort. To address this challenge, this dissertation proposes a novel pedagogical approach: using social robots as proxies for applied drama practice. We argue that engaging learners in a role-play mediated by social robots, can facilitate reflection-focused exploration of sensitive topics from a safe distance in a hypothetical setting.

1.3 Robot-Mediated Applied Drama (RMAD)

In this dissertation, we introduce Robot-Mediated Applied Drama (RMAD) as a new pedagogical approach at the intersection of applied drama and social robotics to create engaging, safe, and situated learning experiences. RMAD provides a structure where children observe, reflect on, and intervene in dramatized social scenarios enacted by robots.

This dissertation explores RMAD to address the problem of bystander inaction in peer bullying situations. Through a design-led inquiry, the dissertation explores using social robots in a drama-based intervention to promote prosocial anti-bullying peer support among children.

1.3.1 REMind: A Proof-of-Concept System

To explore this concept in practice, we developed REMind (short for Robots Empowering Minds): a pedagogical system that enables children to engage in anti-bullying role-play scenarios by using social robots as a proxy. REMind is inspired by Augusto Boal's *Forum Theatre* [43], where audience members (or "spect-actors") are invited to step into a performance, alter its direction, and enact their proposed solutions.

Building on this tradition of experiential learning, REMind uses social robots in place of human actors. In REMind, children watch a bullying scenario performed by three robots — a bully, a victim, and a passive bystander. They then assume control of the bystander robot to enact interventions, observing how the narrative evolves in response to their actions. In doing so, children become spect-actors, actively participating in and shaping the drama, and engaging in embodied practice of bystander intervention against bullying.

1.4 Research through Design (RtD)

To develop REMind and investigate RMAD as a pedagogical approach, we adopted a Research through Design (RtD) approach [397]. RtD leverages the act of designing as a mode of inquiry and knowledge generation, and is particularly well-suited for addressing wicked problems, employing a holistic, iterative process that integrates knowledge from many disciplines [397]. Rather than seeking definitive solutions, RtD aims to generate situated knowledge, design principles, and reflective insights that can inform future work.

Central to RtD is the creation of an artifact (such as a product, system, or service) that embodies the researcher's evolving understanding of the problem space and and articulates

a vision for a preferred future state [398]. RtD artifacts do not merely instantiate solutions; they serve as a medium for exploration, knowledge generation, and communication, negotiate tensions between theory and practice, and enable reflection [398]. In this sense, knowledge in RtD is produced not only *about* the artifact, but *through* the artifact.

In this work, REMind functions as such an artifact: a concrete instantiation of RMAD that codifies an interdisciplinary synthesis of insights from applied drama, social psychology, game design, and human–robot interaction, as well as empirical findings from children, educators, and subject-matter experts. Across an iterative journey of co-design, prototyping, and evaluation, REMind was used as a probe to explore how RMAD might safely support reflection, embodied rehearsal, and bystander intervention in bullying contexts.

1.5 Research Questions and Core Contributions

This dissertation was guided by the following three research questions:

Q1. Is it feasible for social robots to encourage peer support against bullying?

This was positioned as a foundational question because the viability of the entire intervention depends on whether people perceive aggressive behavior toward robots as morally meaningful. It was crucial to empirically establish that observers recognize robot-directed aggression as morally wrong, thereby validating the possibility of using RMAD in this pedagogical context.

This question is addressed in our initial feasibility study, reported in Chapter 3. We conducted a crowdsourced study to empirically investigate observers' moral, and emotional responses to scenarios where a robot was subjected to abusive behavior compared to a human target. Observers recognized aggressive behavior toward robots as bullying and perceived it as morally wrong, although less strongly than human toward humans. These results support the viability of using social robots as pedagogical proxies for enacting bullying scenarios.

Q2. How might we design and develop a social robotics platform for robot-mediated role-play?

This question was identified as a critical design question because the success of the intervention depends not just on *what* is taught, but *how* it is experienced. To support situated learning and reflective engagement, the platform needed to translate abstract goals

like fostering empathy or promoting peer support into emotionally resonant narratives and meaningful interactions. This required a deep understanding of what makes robot-mediated drama both pedagogically effective and emotionally compelling to its target audience (in this case, children). Therefore, this line of inquiry was essential to move beyond theoretical concepts and create a concrete, high-fidelity prototype that leverages the unique affordances of social robots (such as physical embodiment and emotional expressivity) to create a learning environment that is both highly engaging and effective. As such, the question guided an interdisciplinary user-centered design exploration, which is addressed in three ways in this dissertation.

This question is partially addressed in our narrative co-design study with children reported in Chapter 4. We conducted a co-design study (N=22) to gather insights directly from children on designing relatable characters and believable narratives for the REMind intervention. Qualitative findings revealed patterns in how children envisioned social robots in their character designs and stories. For example, children frequently envisioned robot characters that are highly customizable and emotionally expressive. These findings informed REMind narrative design specifications, and guided development decisions such as selecting the Furhat [9] robot platform because of its capacity to display a wide range of facial expressions. Insights from this inquiry deepen our understanding of the design specifications for believable and emotionally resonant storytelling for robot-mediated role-play.

It is also partially addressed in our game design focus group with children reported in Chapter 6. Grounded in the principles of game-based learning, in order to ensure the REMind platform would be engaging enough to support its pedagogical goals, we explored children's ideas on how to create enjoyable robot-mediated role-play experiences. We conducted a framework analysis of the data gathered in this study by borrowing a taxonomy from game design. This revealed design patterns that informed the development of the REMind platform's interactive components, such as using embodied gameplay with tangible props, customizing robotic avatars, and using multi-modal world aesthetics for environmental storytelling. Insights from this study can be used to create engaging mixed-reality experience leveraging the unique affordances of robot-mediated role-play.

Finally, this question is addressed in Chapter 7 which presents the REMind system as a concrete high-fidelity prototype of a platform that uses social robots for robot-mediated role-play. This chapter provides a systemic breakdown of REMind by establishing learning objectives as a foundational element guiding the systems design; synthesizing insights from prior studies into concrete interactive mechanics (such as Robot-Mediated Spect-Actorship); describing a narrative architecture that is explicitly scaffolded by five cognitive steps outlined in a framework from social psychology (i.e., Latane & Darley's bystander intervention model [222]); detailing the technical implementation of the platform by in-

troducing StorySync, a custom spreadsheet-based scripting toolkit developed to synchronize multi-modal cues (including multiple robots, graphical user interfaces, and ambient lighting/sound) and manage the branching narrative flow required for live and interactive robot-mediated drama; and finally presenting techniques used for enhancing the aesthetics of robot-mediated role-play by leveraging emotional design.

Q3. How might robot-mediated role-play promote peer support against bullying?

This final question evaluates whether the RMAD approach could achieve the intended transformation in learners: promoting peer support against bullying by shifting passive bystander behavior towards defending. While previous questions established the system's feasibility and design, this question addresses the pedagogical effectiveness of the resulting RtD artifact by evaluating whether it can successfully trigger the psychological mechanisms necessary for bystander intervention. By focusing on core socio-emotional competencies (such as empathy, perspective-taking, and self-efficacy) this inquiry ensures the research moves beyond technological innovation for its own sake and toward evidence-based impact. This question was central to validating RMAD as a pedagogical medium capable of enacting meaningful behavioral change. It is addressed in two ways in this dissertation.

This inquiry is partially addressed by outlining seven specific learning goals for the REMind determined through a comprehensive process involving consultation with Subject-Matter Experts (SMEs), drawing on insights from prior qualitative studies (specifically interviews with local teachers), and reviewing literature on peer bullying. The primary source for defining the learning goals was a contextual inquiry consultation with two psychologists from the University of Turku, Finland, who specialized in anti-bullying interventions and had led the KiVa anti-bullying program. This consultation, which is summarized in Section 7.2.2, involved an in-depth discussion focused on gathering guidance regarding safe intervention strategies, integrating meaningful game design choices, determining the target age, and selecting a resonant theme. Also, the learning objectives were grounded in insights from interviewing 13 educators to understand the contemporary dynamics of bullying in local schools, and the gaps in existing anti-bullying programs, which is reported in Section 5. This approach ensured the REMind's objectives were grounded in evidence-based best practices and real-world contexts.

Furthermore, this question is addressed in the play-testing study (N=18) with children (ages 9–10) conducted to evaluate the effectiveness of REMind as an anti-bullying intervention, reported in Chapter 8. This study provides empirical evidence demonstrating that REMind supported all seven pre-determined learning goals. Namely, we present quantitative findings indicating an increase in children's perceived self-efficacy for defending,

and qualitative evidence demonstrating that children meaningfully engaged with pro-social game modules on empathy training, perspective-taking, and rehearsing defending strategies, suggesting that the robot-mediated dramatic structure fostered cognitive and affective reflections essential for bystander intervention.

1.6 Dissertation Structure

This dissertation is structured in nine chapters, tracing the iterative development and evaluation of the REMind system. First, Chapter 2 presents an interdisciplinary literature review spanning peer bullying and anti-bullying interventions, applied drama, game design, robots in education, and robots in theater, and conceptualizes Robot-Mediated Applied Drama (RMAD). Chapter 3 presents a feasibility evaluation via a crowdsourced study to determine if robots can be perceived as bullying victims. Chapter 4 describes a co-design research conducted with children to inform character and narrative development. Chapter 5 incorporates insights from teacher interviews to ground the design in real-world educational context. Chapter 6 uses focus groups with children to define mechanics that align pleasures of robot role-play games with pedagogical goals. The resulting pedagogical platform, REMind system, is comprehensively detailed in Chapter 7 (System Overview), which provides a systemic blueprint by outlining its core learning objectives, mechanics, narrative, technology, and aesthetics. Chapter 8 (Evaluating REMind) presents findings from the playtesting evaluation with children. Chapter 9 concludes the dissertation with reflections on systems thinking in Human-Robot Interaction (HRI) and advocates for a shift from interaction design toward experience design.

Chapter 2

Literature Review

Peer bullying in school is a serious problem that has concerned educators and health professionals for decades. In this section, we overview the definition of bullying, its prevalence, different types, and consequences, as well as the role of bystanders.

2.1 Peer Bullying

2.1.1 Definition of Bullying

Bullying in school is characterized by a student's repeated exposure to negative behavior of peers. According to a definition by Olweus, a student is bullied "when he or she is exposed, repeatedly and over time, to negative actions on the part of one or more other students" [271]. Related work has inferred three main characteristics from this definition: *intent to harm*, *repetition* and *power imbalance* [29]. Others have added to this definitions by clarifying that harm may be caused either by direct physical or psychological means, or indirectly through encouragement of bullying or its avoidance by bystanders [364].

Related work points out that intent to harm can be difficult to detect; for example, because the bully may claim that what they did was an accident [29]. In addition, although bullying is typically categorized as a type of aggressive behavior [14, 312], some argue that it should not be deemed equal to violence; because not all instances of bullying involve aggression and not all violent behavior is bullying [363]. Furthermore, while some researchers highlight that it is important to distinguish bullying from one-time fights or teasing between friends [132], others argue that an action against a victim cannot be

dismissed only on the basis that it has happened once or for the first time [29]. Thus, various resources identify the imbalance of power to be the key component of bullying [329, 29].

2.1.2 Types of Bullying

Bullying takes many forms, from physical attacks to spreading embarrassing pictures of the victim online. It is important for us to develop an understanding of different types of bullying and their prevalence, because this has implications for developing anti-bullying interventions [388, 253].

Broadly speaking, bullying is classified as either direct or indirect: direct bullying may include physical or verbal aggression such as hitting, kicking, punching, pushing or name calling; and indirect bullying may include manipulation of social relationships such as excluding from friend groups or spreading rumors [340, 4]. Prior work shows that indirect bullying typically has longer-lasting psychological effects, is more difficult to address [367], and is also more prevalent in North American schools [294].

Related research reports gender [68] differences in types of bullying behavior with indirect bullying being typically more prevalent with girls while direct bullying is typically more common with boys [68]. A recent review suggests that physical aggression decreases with age, with many bullies growing out of physically intimidating others by adolescence [191]. However, it is unclear whether they resort to other forms of bullying instead.

2.1.3 Prevalence of Bullying

Although many studies show high prevalence of bullying across the globe, inconsistencies in definitions of bullying have resulted in wide variations in how it is measured [248]. For example, a large-scale study in 34 European and North-American countries estimates that approximately 6-36% of school-age children are directly involved as bullies, and 4-37% are bullied, with United States and Canada being in upper side of this spectrum with 30% and 31% of students being bullies, or victims, respectively [340]. A recent large-scale meta-review with an overall sample of 333,000 adolescents estimates a prevalence of 35% for traditional bullying and 15% for cyberbullying, with the two contexts being correlated [258].

According to a 2019 Canadian Health Survey on Children and Youth (CHSCY), the majority of Canadian youth aged 12 to 17 (71%) reported experiencing at least one form of bullying in the past twelve months [341]. Among the youth who experienced bullying, approximately two in five (42%) reported experiencing it monthly or more frequently, while

58% reported experiencing bullying a few times a year [341]. Federal institutions in the US report that at least one in four US students report having been a victim of bullying in school [4]. Because of such variations in prevalence of bullying in different regions, we are primarily focusing on bullying in Canadian schools in this project.

Prior research highlights that bullying typically peaks at age 12-15, and decreases by the end of high school [172]. Other individual factors that set a child apart (e.g. LGBTQ+ status, disabilities, obesity, ethnic minority) makes a child more prone to being bullied, specially in the absence of friends; however, even having one friend can protect the child from being bullied and distressed [191].

Given that bullying typically increases in middle-school [146], and school-age children tend to "legalize" bullying as they grow up, it is recommended by scholars that anti-bullying interventions should begin at the age that bullying behaviors start to emerge [246]. The early research in this project focused on children aged 8-12 year old, and the evaluation study conducted in 2025 had narrowed down the target audience to 9-10 year old children.

2.1.4 Consequences of Bullying

A growing body of research has provided evidence for a range of short-term and long-term consequences of experiencing victimization in school on the health and well-being of individuals [299]. Peers that are bullied often suffer symptoms of low psychological well-being and distress, such as post-dramatic stress disorder [263], low self-esteem, depression, social anxiety, and suicidal ideation [141]. They also show signs of social adjustment problems (such as poor relationship with classmates), as well as physical health problems (such as psychosomatic issues) [141]. They are also reported to have problems with their academic performance [261] and frequently abandon school for fear of further victimization [246]. In the long run, victimization and bullying has been linked to development of mental health problems, teenage suicide [30], and substance abuse [334].

Research shows that negative consequences of bullying go beyond affecting the victims, and impact bullies [334] and bystanders alike [181]. A study comparing the trauma reactions of victims and bystanders of repeated abuse experience suggests that there are no significant differences in levels of physiological distress suffered by the two groups [181].

2.1.5 Group Dynamics in Peer Bullying

Bullying is understood as a "group process" [309]. It typically involves not just a bully and victim, but also peers who observe the situation and, whether through silence or

encouragement, shape its outcome [310]. Perpetrators are motivated by pursuit of visibility, power, and high status within the peer group; therefore, they choose times and places where other peers (spectators) are present, but adults are not [309]. That is, bullying requires an audience.

The peer group provides rewards that allow bullying to persist over long periods of time, through either expressing approval, or failing to express disapproval [310]. Salmivalli has identified four participant roles within the peer group that define the group dynamics: (i) Assistants, who help the bully; (ii) Reinforcers, who encourage the bully's actions through socially rewarding cues such as laughing or cheering; (iii) Silent approvers, who witness the bullying without intervening, whose their inaction is interpreted as approval, and contributes to maintaining the bullying situation; and (iv) Defenders who support the victim or try to stop the bullying [310].

Motivated by this body of literature, the central goal of REMind has been designing an anti-bullying intervention using social robots with the goal of transforming the behavior of bystander peers to take the role of defenders.

2.1.6 The Promise of Bystanders

While research on developing strategies against bullying in schools has traditionally focused on victims and bullies, the majority of people who are involved in peer bullying are observers that belong to neither group [285]. While few anti-bullying interventions target the bystanders, those that do, have shown promising results in reducing bullying [363]. The literature on peer bullying has consistently emphasized that bystanders have a significant role in both stopping, and encouraging the bullies [276, 340, 239, 268, 184, 87]. In fact, studies have confirmed that bullying stops in more than 50% of the cases after a bystander intervenes [285, 239]. Moreover, taking action against peer bullying can enhance bystanders' own well-being and foster a sense of agency and identity [88].

Children that are bystanders to bullying, typically find it morally wrong [184]. However, motivating them to take action against it remains challenging [309]. While bystanders are present in about 85% of peer bullying instances, they only intervene in roughly 10% of the incidents [182, 88]. Researchers argue that this existing negative attitude towards bullying makes bystanders "easier to influence by intervention" than active bullies; therefore, encouraging them to change their passive role and state their opinions may be a more *realistic* goal than changing the attitudes of individual bullies [175]. Others argue that "modifying the cognition of bystanders" so they defend victimized peers is effective because the shift in peer group norms can weaken the social reinforcement mechanism that perpetuates bul-

lying behaviors, thereby undermining the bully's motivation to continue [199]. This makes bystanders a key demographic in bullying prevention.

Prior work sheds light on reasons why bystanders seldom intervene and offers a few potential explanations. Children may fear becoming a new target to the bully's aggression [8], or not want to risk their status in the friend group [309]. Also, it may be that when no one else takes action, thus, the responsibility to help, and the potential blame of not helping gets "diffused" between the observers [96].

2.2 Anti-Bullying Interventions

While there are numerous anti-bullying programs, many show limited effectiveness in real-world school settings. This section explores why traditional interventions often fall short, and reviews emerging recommendations in the literature that point toward more promising directions—particularly those involving interventions using applied drama, and game-based learning. Rather than providing an exhaustive review, we offer a focused overview of key trends and findings that motivate the interdisciplinary approach of this project.

2.2.1 Limitations of Traditional Interventions

Despite the abundance of research in the area, some reviews posit that anti-bullying programs show limited [94, 249, 124] or unclear [294] effects on reducing bullying in schools, or are of little practical significance [125]. There are also reviews arguing that these programs can in fact be effective and attribute their effectiveness to factors such as firm disciplinary methods and improved playground supervision [363]. Overall, the impact of interventions on peers' attitudes appears to be weak [186].

Traditional approaches typically use methods such as increasing knowledge about bullying through curriculum, teacher interventions, peer education, setting school policies and intervening the perpetrators, or encouraging peer interventions. However, researchers confirm that knowledge about bullying is not sufficient for fostering peer intervention by itself, and suggest exploring interactive drama and theatre techniques such as role-playing [21, 311]. Building on this body of work, REMind leverages applied drama.

2.2.2 Interventions Using Applied Drama

Previous work on drama-based interventions in schools provides evidence for its usefulness in improving team-working, problem-solving and social skills of children [389, 79, 70].

Applied drama is also reported to increase children's empathy, pro-social behavior [189], emotional expression and regulation [259], as well as self-confidence [79]. A recent meta-analysis review of drama-based pedagogy confirms that it can improve students' ability to make friends, resolve conflicts, cooperate with peers, and recognize emotions in others [225].

Since these skills are relevant for empowering students to confront difficult social problems such as bullying; there are several interventions that have used applied drama specifically aiming to combat bullying among peers [246]. For instance, Joronen et al., used a longitudinal drama program including classroom drama sessions, follow-up activities at home and meetings with parents to decrease bullying at schools and improve inter-personal relationships [190]. Their findings suggest that compared to the control group, participating schools had a decrease in bullying, and significant improvements in peers' social relationships in the classroom [190].

Win-Win resolution program is another relevant anti-bullying intervention that uses role-playing, drama games and trust-building exercises to teach pupils skills such as interpersonal problem-solving, self-control, and anger management [146]. Win-Win reached tens of thousands of students in America and had encouraging results, including decrease in relational aggression of students from all grades, and physical aggression of high school students, improvements in effective communication skills, and increase in knowledge of anti-bullying strategies [146].

Acting Against Bullying is yet another relevant drama-based intervention: a decade-long program in Australia that combined Forum Theatre and peer-teaching to empower students of all grades against bullying [62]. This project was part of DRACON (DRAma for CONflict), a wide international program that used drama to help students reflect on the nature and dynamics of conflicts and bullying [274]. This program resulted in significant changes in attitudes and behaviors, including decrease in bullying in the participating schools, increase in awareness about the nature and consequences of bullying between peers and teachers, and improvement in self-esteem of the victimized students [274]. In particular, this program emphasized the role of bystanders, which led the majority of students involved to recognize bystanders as being the party most capable of changing bullying situations [274].

Related work has widely used Boal's theatrical frameworks such as *Forum Theatre* and *Image Theatre* to explore, and counter in-person bullying [36, 306, 36], as well as cyber-bullying [382] among peers. Findings of this body of work is in lines with other research suggesting that drama and arts based approaches are effective in preventing bullying and violence in schools [153, 31]. Similarly, REMind draws from *Forum Theatre* [42].

Another related area of work that uses drama and arts for pedagogical and therapeutic purposes is puppet-play. Puppets are used as a role-playing tool to allow children to

experiment with symbolic conflict scenarios and regulate their emotional reactions [34]. Related work identifies puppetry to be both an effective medium to empower children in issues such as bullying, and a mediator to translate their thoughts and emotions into movement and speech [23]. This dissertation will share reflection that draw comparisons between robots and puppets in proceeding chapters.

2.2.3 Interventions Using Technology

In the recent decade, information and communication technologies (ICT) such as serious games, social networks, virtual reality, and virtual scenarios have become increasingly popular in education of youth. Research has recognized their potential to promote psychological growth and well-being [16], and as such, several programs have started to incorporate the new pedagogical modalities offered by these tools [265]. Literature discusses the benefits of ICT-mediated interventions, such as offering tailored education, and personalized experiences (e.g. anti-bullying interventions based on a child's bullying attitude), as well as providing protected environments for children to explore "emotionally hot" topics without feeling pressured by their peers [265]. However, according to a recent systematic review, ICT tools are generally underused in anti-bullying programs [265]. Below, we will review a few projects that are highly relevant to REMind.

FearNot!

VICTEC (Virtual ICT with Empathic Characters) [3], and eCIRCUS (Education through Characters with emotional-Intelligence and Role-playing Capabilities that Understand Social interaction) [19] were EU-funded project with anti-bullying initiatives for school children that use dramatic performances through a virtual environment for empathy training. FearNot! (Fun with Empathic Agents Reaching Novel Outcomes in Teaching) is a software [1] developed in the scope of these projects that uses episodes of drama [20] to teach children strategies to cope with bullying [149]. This interactive environment includes a virtual school populated by animated characters that assume different bullying roles such as bully, victim and bystander. FearNot! software allows students to role-play as an invisible friend and give advice to the characters via a chatbot (see Figure 2.1, [122]). Behaviors of the characters in FearNot! are not pre-scripted; they learn from their experiences, and based on their mental states and goals, choose to follow the child's advice or not [21]. After that, children can observe the outcomes of their suggested strategy. This intervention resulted in a short-term decrease in bullying in UK population and fostered bystander intervention in German schools [371]. We take inspirations from FearNot! to build our narrative

architecture to emerge from the child-robot interactions.



Figure 2.1: A screenshot of the FearNot! software – John, an animated character who is getting bullied in school is asking for advice. Source: Adapted from [1].

KiVa

The KiVa anti-bullying program is an evidence-based, whole-school intervention developed in Finland to reduce bullying behavior and prevent its harmful consequences [136]. KiVa includes both universal actions (targeting all students) and indicated actions (targeting specific bullying cases) [333]. Universal actions in KiVa include 20 hours of student lessons for primary schools delivered by classroom teachers throughout the school year, which aim to raise awareness of the group's role in maintaining bullying, increase empathy for victims, and promote strategies for supporting victims [199].

A core component of KiVa is an anti-bullying computer game that aligns closely with lesson topics (see Fig. 2.2). In the game, students role-play as a student in a virtual

school, allowing them to acquire knowledge and practice intervention skills in a safe environment [313, 199]. Played both during and between KiVa lessons, the game is structured into five levels, each containing 'I KNOW,' 'I CAN,' and 'I DO' components. These guide students through acquiring new information, testing their understanding of bullying, learning appropriate responses, and applying these skills in real life. [199]. Students can explore the virtual school, encounter realistic bullying scenarios, and choose how to respond as bystanders. They may view other characters' thoughts and emotions through thought bubbles, which is designed to support empathy and perspective-taking [136]. The students are encouraged to reflect on which KiVa strategies they used in real life.



Figure 2.2: A screenshot of the KiVa Game. Source: Adapted from [2].

The KiVa program has been rigorously evaluated through randomized controlled trials (RCTs) and during its nationwide implementation. Following the RCTs, KiVa was widely adopted in Finland, with about 90% of comprehensive schools registered as program users by 2011 [313]. It is also currently implemented in 19 countries globally [333]. KiVa has been consistently found to reduce bullying and victimization in several countries [199, 313, 391, 333, 136]. Specifically, an initial RCT involving grades 4–6 showed self-reported victimization decreased by 30%, and self-reported bullying by 17% [199]. Comparative studies report that the odds of a student being systematically bullied were about 1.5 times higher in control schools compared to KiVa intervention schools [313]. The program was found to increase defending behavior in Finnish primary schools after 5 months of implementation [136]. Kiva has also been reported to increase empathy towards

victimized peers and self-efficacy to support and defend them [313, 333, 134]. Beyond direct bullying outcomes, KiVa has contributed to significant reductions in anxiety, depression, and negative peer perceptions, and has improved school liking, and academic motivation [313, 198].

Other Interventions

In addition, several other serious games have been developed that use simulations of virtual worlds with animated characters [390], interactive narratives [210], and mechanism such as scoring systems and mini-games [64] to increase peers' understanding of bullying [307] and cyberbullying [58, 390], encourage empathy [65], promote bystander interventions [109], prevent violence [47], and teach coping strategies to victims [180].

Related work has also used other ICT tools to combat bullying; for example, Mii-School is a virtual reality simulator that evaluates presence of risk factors in adolescents by allowing them to watch scenes related to bullying, drug abuse, and relational problems among peers and respond by choosing from a series of pre-defined choices such as being indifferent, protesting, or showing aggression [69]. Others have used virtual buddies (conversational agents) [400] and peer-led online forums [247] to offer consultation and support to the victims of bullying. Research has proposed developing automated tools to detect when a child is exposed to threats and verbal abuse in messaging applications [279, 228], and facilitate submitting anonymous reports about bullying in schools [83].

Related work exploring interventions against cyberbullying on social media spans from leveraging automatic bullying detection tools [115], to reporting tools that allow users to flag aggressive behavior [82]. For instance, systems such as MCDefender [373] and ReThink [288] utilize mobile keystroke monitoring to detect aggressive words or phrases and issue warnings before a message is sent, acting as immediate psychological deterrents. Others have used human annotations to create a classifier for detecting cyberbullying in Vine videos [291]. However, detection tools are often limited because they struggle to understand subtleties of context (e.g., distinguishing between playful teasing among friends and actual abuse), and require invasive monitoring of user conversations [115]. Finally, Human-Computer Interaction (HCI) researchers have explored designing interfaces that go beyond blocking and encourage reflection in hidden consequences of actions. For example, DiFranzo et al. have explored the effects of interface design on encouraging bystander intervention against cyberbullying, and found that features such as viewing notifications (i.e., telling users "You have read this post"), and indicating audience size (i.e., showing users how many other people viewed a post) can increase bystanders' sense of public accountability and make them significantly more likely to flag or report bullying [113].

Furthermore, a recent systematic review reports that serious games that detect or prevent bullying and cyberbullying target various stake-holders such as children, adolescents, parents and educators, with the majority of them targeting students in the age range of 6-12, or 12-16 [64]. Some applications focus on specific groups of people such as LGBTQ+ teenagers [50, 84], students with disabilities [229] and special needs [158], or children with social skills deficit [315].

Building on prior interventions using interactive virtual agents have shown promising results in anti-bullying programs [371], this dissertation has explored an ICT-based intervention using robots. Studies suggest that compared with virtual agents, people show more trust in robots, enjoy interacting with them more, and perform better in a variety of tasks such as education, and therapy [56, 32]. Human-Robot Interaction (HRI) researchers argue that life-like movements and speech, and physical embodiment of robots in our space gives them a unique sense of agency that elicit a more emotionally-charged interaction experience than virtual agents [394]. Learning from the body of work reviewed in this section, REMind has explored developing an educational anti-bullying game using social robots.

2.3 Applied Drama

As established in previous sections, while transforming peers from bystanders to active defenders is an effective way to reduce bullying [276, 88], it remains challenging. Merely informing bystanders about their responsibilities is simply insufficient for empowering them to take action [8, 309]. This is where applied drama shows promise. In this section, we describe the key concepts in applied drama, its benefits, and core practices.

2.3.1 Defining Applied Drama

Applied drama refers to a range of theatrical practices such as role-playing, socio-dramatic explorations, creative drama, and improvisationally-oriented theatre games. While applied drama has a lot in common with theatre practices and techniques, it is distinct in the sense that it is not concerned with what it does for the audience. It is typically practiced "without a spotlight," in private settings [206], and its value lies in making meaning for the participant of drama without the pressure of putting on a performance [376]. Many practices of applied drama focus on addressing social issues, and empowering the audience to take the matters in their own hands. Prendergast and Saxton [321] define Applied drama as "a social laboratory for developing critical consciousness; that is, a heightened awareness that moves toward action."

Learning from this body of literature, REMind aims to use applied drama in order to empower peers to take action against bullying.

2.3.2 Key Concepts

Applied drama uses three key concepts: dramatic process, role, and improvisation.

Dramatic process

The dramatic process refers to the internal cognitive and emotional activity that arises as participants perceive metaphors, engage with them, and act upon them through drama [85]. In the context of REMind, the dramatic process unfolds as the child observes a robot-mediated role-play, reflects on the unfolding scenario, brainstorms potential interventions, and ultimately decides how to intervene by controlling the bystander robot.

Engaging in the dramatic process fosters the development of *metacognition*—the capacity to reflect on and regulate one's own thinking [38]. Scholars emphasize that metacognition plays a crucial role in cognitive development, enabling young people to become more strategic, aware, and skilled thinkers [215, 38].

Role

The concept of role in applied drama is not concerned with a participant embodying a character naturalistically, so as to convince the audience of a fiction; rather, it is a context-specific investigation in which the participant explores how an individual taking on a particular social role is expected to behave, and how they expect others to behave in response [159]. Dramatic roles can resemble participants' real-life identities or be entirely fictional—what Saxton and Miller describe as "very other than real life" [321]. Crucially, however, the roles must remain believable to the participants in order to facilitate meaningful engagement and reflection. While the robot characters in REMind are fictional, their behaviors and emotional dynamics are designed to be believable and relatable to the target audience of children.

Improvisation

Finally, *improvisation* is a means for drama participants to spontaneously respond to an unexpected situation, test their ideas, and explore the possibilities that lie within a given

context. Improvisation encourages a sense of play that elicits ingenuity. Prior work identifies it to be key practice behind many performance and technology projects, because its revealing nature combined with new technology-enabled interactions can push individuals past the boundaries of their own thoughts and behaviors, which can provide insight into the problem that is being explored [212, 160].

Improvisation calls for a spontaneous unscripted response from the participant of drama to deal with the new situation. Related work in psychodrama posits that such a process enables children to adapt general principles to their own abilities, and prepares them for unforeseen situations by helping them "work out the inevitable *bugs*" of the system [39]. Such safe and playful exploration of a range of possible situations may empower young people to review and revise their own assumptions [40].

REMind incorporates the improvisation, and allows children to observe how the story unfolds based on the choices they made in the roleplay. For example, in a game module we refer to as *"puppet mode"*, children are prompted to decide how the avatar robot should react to the bullying scenario and use improvisation to *puppeteer* the desired behavior.

2.3.3 Benefits of Applied Drama

Practicing applied drama enables *situated learning*, because thoughts are embedded in experiences and learning emerges from building new structures of knowledge through partaking in actions to solve a problem in the real world [102, 13].

Piaget's theory of cognitive development describes two complementary processes of learning: Assimilation and Accommodation [282]. Assimilation involves incorporating new information into existing mental frameworks—such as memorizing facts. Whereas Accommodation entails restructuring those frameworks to integrate new perceptions or experiences, such as acquiring a new skill. Building on this, Blatner, a scholar in the fields of psychodrama and applied theatre who advocates for the use of role-playing in education, argues that *skills go beyond mere knowledge of facts*, requiring experiential engagement: "a process which is closer to learning to swim than learning the capitol cities of the various states" [39].

Along similar lines, research in education emphasizes the importance of providing an *authentic context* for meaningful learning, and illustrates this by an example: a verbal explanation of how to bike has little meaning until a child is sitting on a bike and paddling [13]. Within this framework of reasoning, role-playing is considered "a natural vehicle for learning" [39].

Applied drama also offers an important feature known as *aesthetic distance*, allowing participants to engage with emotionally charged or personally relevant topics within a fictionalized, and therefore safer, context [321]. We argue that using robots for role-playing increases this aesthetic distance by adding another metaphorical layer the participants of drama can work through. We argue that unlike real-life bullying, or a re-enactment of bullying using human actors, role-playing with robots lets participants engage through the proxy of the robot, and as such, they may see, experience, and act on aggressive behavior safely [72]. This is particularly important and practical in the context of addressing sensitive topics such as peer bullying among children.

Another key benefit of applied drama is its potential to foster reflection upon dramatic metaphors. Participants often make connections between what happened in the fictional world of drama and their real life, and this reflection enriches their perceptions [321]. Unlike role-playing with other people, role-playing with a robot proxy gives a participant the option to slow down the emotional reflection process by pausing the performance at any moment, or repeating the process many times in a controlled and replicable format, which can provide ample time and opportunity for reflection on the experience.

2.3.4 Forum Theatre

REMind draws from Theatre of the Oppressed: a set of dramatic games and techniques developed by Augusto Boal [44]. Boal's work aims to promote action against social injustice and has been used extensively in applied drama, empower audience against a range of domains [119, 165, 360]. Boal conceived of theatre not as entertainment, but as a rehearsal space for social change, and a way to empower ordinary people to stand up to social injustice [43].

In Forum Theatre, audience members are invited to move beyond passive observation to become "spect-actors": active participants who can interrupt a performance, and propose or enact alternative actions for the protagonist [43]. He believed by encouraging otherwise passive spectators to become actors, they will be empowered to take matters in their own hands off-stage [44].

In a typical Forum Theatre session, the play is performed twice; the first time without any interruptions. The second time, the spect-actors have an opportunity to identify a scene that they would like replayed. During the replaying, they can stop the performance at any moment that they feel one of the characters could have done something differently, propose a change or replace the actors and lead the scene towards a different ending. This process is repeated many times and with involvement of different spect-actors until an

agreeable ending is reached [44]. Learning from Forum Theatre, the "puppet mode" in REMind engages children in practicing spect-actorship in the context of robot-mediated role-play by allowing them to interrupt a robot drama and control the bystander character.

2.3.5 Role-play

Traditional pedagogy often frames the learner as a passive recipient of knowledge—an approach that has been criticized by philosophers such as Jacques Rancière. In The Ignorant Schoolmaster [292], Rancière radically rejects explanation, arguing that it *"stultifies"* learners by reinforcing their dependence on teachers. He poses that learners achieve *"intellectual emancipation"* when they can use their own resources to solve problems; That is, when they are trusted with agency to think, speak, and act for themselves.

This principle resonates with experiential learning approaches such as role-play, which invite learners to actively engage with real-world scenarios through embodied participation. Role-play is widely used in education, therapy, and professional training to help individuals rehearse emotionally or socially complex situations [383, 95].

Literature emphasizes the capacity of role-playing for developing empathy, self-awareness, and critical ethical reasoning as the strength of the pedagogical form [48]. Thus, we argue that role-play is especially well-suited to address bystander inaction, which is often rooted in emotional and social barriers rather than apathy. Role-play situates learning in experience which makes it a natural vehicle for developing skills [39].

2.4 Game Design

The link between play and learning is well established, with foundational theories from Piaget and Vygotsky presenting play as "the most natural form of learning" and a leading driver of development during early years [284, 375]. Games, as structured forms of play, have been extensively used to support learning, with their capacity for creating engagement, or fun, as the most frequently cited argument [284].

2.4.1 Defining Games

Games are structured play. While a single universal definition remains elusive, there are several widely agreed-upon characteristics [284]: games must be rule-based, responsive to player actions with system feedback, inherently challenging, and their progress must

typically be cumulative, ultimately making them inviting and inherently motivating (fun) for players to engage. In the context of learning, such a system is deliberately designed to support specific educational goals.

Salen and Zimmerman [358] define games as "a **system** in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome". Plass [284] extends this by defining games for learning as "games with specific learning goals".

2.4.2 Game-Based Learning

Games are excellent facilitators of learning because they induce Flow state [284, 91]. Flow states, characterized by deep involvement with an activity and a distorted sense of time, are important in educational settings as they reduce self-consciousness and enhance learning [283]. Furthermore, games create a safe space for learning by eliminating real-life costs of failure, encouraging persistence and self-regulated learning through multiple attempts and immediate feedback [324].

Additionally, games engage learners as active producers of knowledge, unlike the passive consumption often found in traditional education [138]. Game design scholars describe "meaningful play" as a gameplay that "holds significance beyond the moment of play and leaves a lasting impression on the player" and argue that it originates not just from the game itself, but from the dynamics between the players, the game, and the context in which it is played [358].

Broadly defined, Game-Based Learning (GBL) involves the use of games and game-like elements to support the acquisition of knowledge, skills, and attitudes [284]. It differs from gamification, which typically involves adding incentives like stars, points, or rankings to motivate learners to engage with otherwise tedious tasks [284].

Game-based learning (GBL) literature warns against superficially incorporating fun elements into educational components (e.g., by merely transforming a quiz into a digital format with a point system) often falls flat and leads to disengagement if the core task is not fun. Game scholars use the metaphor of *'chocolate-covered broccoli'* to illustrate this point: adding fun to a game as an afterthought is like coating vegetables in chocolate; it does not make them candy [351]. Instead, GBL involves redesigning learning tasks to be inherently interesting and meaningful, and aiming to create experiences that are both effective educational tools and fun games [284, 197]. Hence, a deeper understanding of positive emotions is essential for designing engaging experiences [267]. Motivated by this body of work, in a prior research (reported in chapter 6) we investigated how we might leverage the unique affordances of social robots to make robotic games fun.

2.4.3 Role-Playing Games

Role-Playing Games (RPGs) are interactive, story-driven experiences where players assume fictional roles to shape a narrative. Proven to increase learner engagement, they are used in diverse educational subjects [77, 356] and span multiple formats, from digital games to live-action role-playing (LARP) [289, 48]. Their primary educational strength lies in providing a safe, simulated environment where learners can explore decisions and their consequences without real-world risk. This protective frame fosters critical thinking and problem-solving skills [383, 289], and can even facilitate transformative learning by challenging a person's deeply held assumptions [383, 95]. Central to this process is the mechanism of role-taking, which requires active player agency to make narrative-shaping decisions within the game's fictional reality [49, 380]. The act of narrative enactment through a character is strongly linked to perspective-taking, a skill that directly cultivates empathy, altruism, and a deeper emotional understanding of others [151, 48].

This framework has been successfully applied in technology-based anti-bullying interventions. For example, the FearNot! system immerses children in a virtual school where they advise animated characters, a method shown to increase bystander intervention [149, 156]. Similarly, the KiVa program's game component allows students to role-play as bystanders in realistic scenarios, with large-scale trials demonstrating significant reductions in bullying and victimization [156, 136]. These established principles and successful precedents have informed the design of REMind, which leverages narrative-based role-play with a social robot to foster empathy and empower bystander intervention.

A robot's physical embodiment is crucial for generating social presence and engagement, which is evidenced by children focusing more on physical robots than on virtual agents [302]. Consequently, agents with greater social presence are more adept at building rapport, earning trust, and facilitating therapeutic outcomes, which results in more salient changes in user behavior and attitude [302]. Grounded in this literature, our approach leverages the unique power of RPGs to engage students in active, story-driven contexts [75]. Since narrative is a core mechanism for facilitating empathy and learning [289], we developed REMind as a narrative-driven game that uses role-playing with social robots to empower bystanders to defend victims of peer bullying.

2.4.4 Interactive Digital Narratives

Storytelling is a central element in role-playing games. REMind, as a narrative-driven game, functions as an interactive digital platform for storytelling. Chapter 7, borrows terminology from Interactive Digital Narrative (IDN) [208] to describe some of the REMind's

narrative design elements. IDN [208] is a theoretical framework proposed by Koenitz that rooted in cognitive narratology. Koenitz defines Interactive Digital Narratives as "a form of expression enabled and defined by digital media that tightly integrates interactivity and narrative as a flexible cognitive frame" [208]. IDN shifts the traditional understanding of narrative away from a fixed series of past events residing solely in the text. Instead, it conceptualizes narrative as a flexible cognitive frame that the interpreter constructs in their embodied mind in response to the text or interaction [118]. This makes IDN a better fit than linear narrative models for REMind, where the story emerges through children's embodied decisions during live role-play with robots.

A related term is transmedia storytelling, which is defined as the "systematic dispersal of integral fiction elements across various delivery channels" to create a cohesive entertainment experience [183].

2.4.5 Mixed Reality Games

There is lots of debate in the field over the meaning of Mixed Reality (MR), and several working definitions [339]. The widely cited Milgram & Kishino's Reality–Virtuality Continuum places MR as everything that lies between a fully real environment and a fully virtual environment (VR), involving a mix of real and virtual objects [254]. Another view frames MR as an alignment of a physical and a virtual environment [339]. Exemplifying this, Yannier et al. present a mixed reality game where a Kinect depth camera observes real building block towers placed on a table and synchronizes their state with digital towers in a projection, providing interactive feedback in a virtual environment from hands-on interaction with physical objects in the real world [393].

Comparative studies suggest that experiencing physical phenomena in MR, coupled with interactivity, significantly improves learning outcomes [392]. Furthermore, they argue that seamless integration of physical and digital worlds creates a "sense of reality and believability" that fosters deeper sense-making [393]. REMind has elements of mixed-reality games. However, we do not generally use this term throughout this dissertation.

2.5 Robots in Education

Social robots are emerging as valuable tools in education, supporting children's cognitive, conceptual, language, and social development [362, 196]. A growing body of research shows that social robots can enhance children's development, with studies demonstrating

improvements in subjects such as math and science, as well as skills like teamwork and social interaction when robots are integrated into educational environments [196]. Robots embodied presence and life-like interactivity fosters engagement in learners, and has been found to boost motivation, attention, and creativity among learners [32, 193], positively impacting their overall educational experience.

According to a recent review, social robots used for education show promise in enhancing cognitive and emotional outcomes, and on restricted tasks their effectiveness is comparable to human tutors [32]. Additionally, studies have shown that incorporating robots into mental health interventions can reduce distress and increase positive affect in children [192].

2.5.1 Unique Attributes of Social Robots

Social robots possess unique attributes that make them well-suited for educational purposes. Their social presence and life-like behavior can elicit pro-social behavior and enhance engagement among learners [205]. Robots' predictable and non-judgmental nature can reduce anxiety and create a more supportive learning environment [101, 205]. This is especially beneficial for children on the autism spectrum, where robots' social responsiveness and non-judgmental nature can foster a more conducive learning environment [101]. We argue that unlike humans, robots are *inherently non-judgemental*, unless we program them to be, and lack the *self-consciousness* that can disrupt a human's centre of gravity [89]; this makes them an apt vehicle for dramatic explorations of sensitive topics with children.

Prior work highlights the capacity of robots to elicit *playful* behaviors in children [101]. This is significant as play is recognized as the "most natural form of learning," and seminal psychologists such as Piaget and Vygotsky have emphasized the key role of play in children's development [284]. Structuring educational experiences with social robots as games leverages their unique attributes to create engaging learning, and the convergence of social robots and game-based learning opens a promising frontier in the realm of technology-driven pedagogy [284, 324].

Belpaeme et al. speculate that the effectiveness of social robots in education is "largely because of their physical presence, which traditional learning technologies lack" [32]. Robots' physical embodiment in our space affords a performative approach to story-telling. To bring a story to life, humans leverage their embodiment and use motion, timing, gestures and variations of their voice. Robots can similarly exploit their physical presence, capacity of movement, and multi-modal communication capabilities to realize stories in our space. Research confirms that embodiment helps agents improve learning and impact behavioral change more substantially and elicit more trust and enjoyment [56, 32].

Robots' infinite patience and ability to provide individualized feedback and adapt to learners' needs makes them well-suited for personalized education [33]. Also, robots being programmable lends itself to repeatable and consistent pedagogical interventions [240] and makes it possible to learn about the users and offer tailored education and personalized solutions [265].

2.5.2 Application in Storytelling and Drama

Social robots have been integrated into storytelling and drama-based learning to create engaging, multi-sensory educational experiences [278]. A line of research has involved students in programming robots to enact stories, often as a means of promoting STEM education (e.g., [354, 15, 347]). Another line of work positions students as passive or interactive audience members, allowing them to influence the storyline or engage with robotic actors. Research highlights the advantages of using robots as actors, such as repeatability, consistency, and adaptability [240].

Notably, So et al. found that role-playing with a robot improved narrative and gestural communication skills in Chinese-speaking preschoolers with ASD, with lasting effects [335]. Lytridis et al. designed a theatrical play scenario where a robot actor prompted children to identify, describe and act out emotions [240]. Verhoeven et al. designed a role-play activity for second-language learning, where children taught French to a robot elephant which periodically 'forgot" words, reinforcing learning through teaching [372]. Similarly, in an intervention by Leite et al., children observed multiple robots role-playing a scenario and were presented with choices on how the story proceeds, highlighting role-playing with robots as a promising method for developing social and emotional skills [227].

A relevant area of work that uses drama for pedagogical and therapeutic purposes is puppet-play. Puppets are used as role-playing tools to allow children to experiment with symbolic conflict scenarios and regulate their reactions [34]. We argue that in this sense, using robots are analogous to puppets; robots also offer a tangible way to simulate phenomena that may be otherwise difficult to grasp [54]. For example, many robots have embedded cameras that allow children to take on another's perspective *quite literally*; they can see what the robot sees [385].

Prior work shows that children tend to project their own feelings onto robots and can envision them taking roles such as bullies, victims and bystanders [320, 387, 278]. A study by Bethel et al. suggests that children are more likely to open up about certain bullying incidents to robot interviewers compared to human interviewers [35].

2.5.3 Gap in Anti-Bullying Interventions

Despite the recommendations of prior research and the potential benefits of social robots in other educational contexts [32], social robots are generally underused in anti-bullying interventions [121, 111]. Related work has discussed frameworks for using a story-telling robot in schools to increase children's awareness about bullying [121]. Research on using social robots in a classroom setting demonstrates that robots can estimate the friendship relationships among peers with a reasonable accuracy and suggests that robots can use this capability to analyze social networks within a classroom in order to identify and moderate bullying among peers [195]. However, despite the recommendations of researchers and educators, social robots are generally underused in anti-bullying interventions [121, 111].

2.6 Robots in Theatre

The term *robot* originated in theatre. It was coined in R.U.R, a 1920 science fiction play by Karl Capek about a dystopian future of technology that featured human-like artificial organisms called roboti [67]. However, robots and theatre have a shared history that goes back a few centuries; at least to early 1500s when Leonardo da Vinci designed a mechanical lion to amuse the king of France by walking and placing flowers at his feet. With mechanized animals and puppets built by European and Japanese clock-makers in the 16^{th} and 17^{th} centuries and animated automata capable of complex tasks such as writing and speaking built in the 18^{th} century [130, 345], the practice of making mechanical robots for entertainment grew more popular over time. As robotics technology is maturing, its applications in entertainment are also becoming more sophisticated. Advances in speech recognition and navigation allow robots to converse, sing, walk and dance in live performances, paving the way for artists and researchers to explore using robots in theatre. We have reviewed the literature and identified four themes[1] in prior research at the intersection of theatre and robotics.

2.6.1 Theatre as a Testbed for Evaluating Robots

Theatrical performances provide an accessible and playful setting that makes exploring challenging research questions (e.g., in social robotics) more approachable. Breazeal et al. argue that this is similar to RoboCup Soccer competitions providing a constrained scenario for exploring collaboration and competition in multi-agent robots [55]. That is,

[1] Themes are not necessarily mutually exclusive.

used as a metaphor, theatre supports embodied interactions: the scripted dialogues ease the narrative and conversational barrier to entry; the constrained environment makes it simpler to control the robots; the audience may provide valuable human-centred feedback; and the stage can support exploring additional computational infrastructure. Prior work has used theatre to investigate people's perceptions of robots and their future applications [187, 76]. Others have proposed improvisation an ideal testbed for conversational agents [244] and explored using improvised comedy delivered by agents versus humans as a Turing test [245].

2.6.2 Theatre as a Methodology for Robot Design

Human-Computer Interaction (HCI) research has a history of borrowing from and contributing to interactive art [185]. Laurel argues that interactive theatre is applicable to HCI research because both domains are interested in making representations of the real world and are concerned with human communication, engagement, and problem solving [223]. Related work has explored borrowing methodology from theatre to model robot behaviors, or conduct design research [237]. For example, prior research has discussed lessons learned from robot theatre, such as how robots can use movement to convey intentionality [207]. Human-Robot Interaction (HRI) researchers have turned to performative arts to create and sustain social engagement [10, 233], explore embodied meaning-making [139, 150], and learn about fluent coordination in human-robot interaction [161]. Others have borrowed ideas from performance art to generate emotionally-expressive behaviors with drones [71, 328], or creative believable agents [60]. Research has also leveraged theatre for exploring the moral implication of future assistive robots [234].

2.6.3 Robots as Performance Partners

Related work has used robot actors and performance partners a novel space to create performance pieces (e.g., [280, 93]), for instance to challenge improv performers and explore AI-led "augmented creativity" [256, 51]. A portion of this literature is dedicated to theatre research and education (e.g., [46, 241, 235])). Related work has discussed a framework for describing qualities of robots appearing on stage [78]. Others have developed systems to facilitate the appearance of robots in contemporary performances (e.g., [231, 245, 395]).

2.6.4 Robots for Theatrical Learning and Pedagogy

Finally, prior work has explored various applications for robots in theatrical practices, including a wide range of goals and target audiences. These applications also vary in

terms of the roles of robots and audience; for example, while participants are only passive spectators in some applications, they practice spect-actorship in others. Table A.1 in Appendix provides an overview of related work in this theme. The majority of this research is concerned with robots as tools for pedagogical interventions. Considering that research has established usefulness of educational drama and educational robots, merging these forces may provide a multimodal environment that facilitates learning by engaging peers in embodied story-telling [54].

2.7 Robot-Mediated Applied Drama (RMAD)

Based on the review in the previous section, this dissertation proposes Robot-Mediated Applied Drama (hereafter referred to as RMAD) as a promising pedagogical tool that may enable *situated learning* in a playful and engaging setting. When looking at the literature through the lens of themes identified in section 2.6, RMAD best fits under the last theme.

Definition Robot-Mediated Applied Drama (RMAD) refers to using interactive drama practices (such as role-playing and audience participation) by proxy of a social robot, in order to promote internal reflection and practice situated learning. This definition emphasizes *drama practices*, instead of theatre, to clarify that we are concerned with the *process* of drama and the reflections that it brings for its participant, rather than putting on a performance. Also, this definition underlines interactivity to exclude related work in which the target participants are merely passive spectators.

In previous sections, we established applied drama as a natural vehicle for provoking empathy and transformational learning, and argue that incorporating social robots as mediators can facilitate safe reflection-focused exploration of sensitive topics. REMind has been developed as a proof of concept of RMAD. Throughout this dissertation, we use anti-bullying interventions and REMind as example application and preliminary design to anchor our discussion of RMAD. However, we argue that future work could explore RMAD's applications in other domains.

Chapter 3

Feasibility Evaluation: Can Robots Be Bullied?

In the preceding chapters, we introduced REMind—a game-based intervention that leverages robot-mediated applied drama (RMAD) to encourage anti-bullying bystander intervention. At the heart of REMind is the idea that robots can serve as socially meaningful proxies in role-play scenarios, offering children a safe and emotionally manageable context in which to explore difficult social dynamics such as bullying. This design premise is supported by early evidence that children may empathize with robots and attribute emotional states to them [387, 278].

Yet before such an intervention can be meaningfully developed, a foundational question must be addressed: Is it even feasible to use robots in the context of bullying? That is, do people perceive robots as entities that can be mistreated or bullied in morally meaningful ways? While robot mistreatment in public settings has been observed and documented [314, 296], it remains unclear whether these actions are interpreted through the same moral lens as human bullying, or whether they are dismissed as inconsequential due to the perceived non-human status of robots.

This chapter addresses this feasibility question by empirically investigating how people perceive and evaluate scenarios in which a robot is subjected to abusive behavior, compared to parallel scenarios involving human targets. Specifically, we ask: do observers morally recognize robot-directed aggression as bullying, do they feel empathically engaged with the robot, and would they be inclined to intervene?

To answer these questions, we conducted a crowdsourced video-based study (N=147) comparing participants' moral, emotional, and behavioral responses to robot versus human victims of mistreatment. We used qualitative and quantitative methods to explore

the differences in participants' perceptions of each video, perceived morality of violent behaviors, and their affective empathy with the agents. Additionally, we borrowed a model of bystander intervention from social psychology and investigated bystander behavior in response to the abusive conduct.

3.1 Related Work

There is a body of work providing anecdotal evidence of people bullying robots in public areas by means of physical assaults, verbal violence, or sabotaging their tasks [314, 296]; for example, Kanda et al. report children abusing an unsupervised robot in a shopping mall by kicking, punching, and pushing it or obstructing its path [59].

As this phenomenon raises concerns about safety of urban robots, related work has designed intelligent robot behavior to escape or counteract bullying [59, 323, 214], or to induce bystander intervention [355]. Darling proposes extending legal protection to social robots by drawing parallels to animal abuse [97]. Some researchers have attempted to operationalize robot bullying by studying how robot characteristics such as its size [236], perceived intelligence [27], anthropomorphic looks [298] or behavior [399] could influence empathy towards the robot, or lead to its mistreatment. Others have explored the underlying psychological mechanisms of the behavior by interviewing people who bullied a robot [266], or investigating the effect of the person's feeling of power [203], their dehumanization of the robot [203], or prior interaction with it [106] on their aggressive behavior.

However, it is often members of a research team that describe the violent behavior in relation to robots by adopting terms such as *bullying*, or *abuse*, rather than the research participants. For instance, Salvini et al. argue that the abuses suffered by the robots are more appropriately described as bullying than vandalism, *"acts of vandalism could be, for instance, crashing the touch screen monitor, getting fire to the robot, or keying the robot cover. On the contrary, what we noticed during the behavioural study were actions aimed at forcing the robot to do or not to something or, in a few cases, simulations of 'physical' attacks"* [314]. While scholars' subjective insights are valuable, we argue that there is room for more empirical research on whether onlookers of robot mistreatment would also perceive it as bullying.

This has been investigated to some extent by related work. For instance, prior work in which participants observed a confederate verbally and physically mistreat a robot, reports that the majority of participants intervened to stop the robot from being bullied, and considered the behavior as mistreatment [355]. Others report that participants felt bad and perceived empathy with a robot after watching a video of it being tortured [106].

Kahn et al., provide evidence suggesting that children conduct moral reasoning in their relationship with a humanoid robot and believe that it deserves fair treatment [194]. In a recent study, Bartneck et al. compared differences in people's perceived morality of violent behavior towards robots versus humans by showing them videos of violent behavior towards each agent. Their findings suggests while they found no significant differences in the perceived morality of abuse towards robots or humans, they perceived robots fighting back as more abusive compared with humans fighting back [28]. We build on this body of work and further explore how people respond to robot bullying.

3.2 Background

We borrow three model from social psychology to explore perceptions, cognitive mechanisms of moral disengagement, and bystander responses to robot bullying.

3.2.1 Moral Disengagement

Social cognitive theory of moral agency describes moral disengagement as the psychosocial maneuvers that enable one to selectively disengage their moral self-sanctions from an inhumane conduct [24]. In other words, it is the cognitive process that convinces an average person to commit immoral acts against others. This theory describes four major psychosocial mechanisms via which observers morally disengage with a harmful conduct. These categories include the following:

1. *Cognitive Restructuring* refers to framing the harmful behavior in a positive light by means of moral justification, euphemistic labeling, or advantageously comparing it to a much more negative act.

2. *Minimizing Agency* involves using strategies to diffuse one's own moral responsibility by deferring it to authorities or others in the group.

3. *Disregarding and Distorting the Negative Impacts* refers to the strategies used to distance oneself from a misconduct by de-emphasizing harmful consequences and instead highlighting positive outcomes of it.

4. *Blaming and Dehumanizing the Victim* involves seeing the victim as being partially responsible for, or deserving of the detrimental behavior.

Hymel et al. developed an 18-item questionnaire to investigate moral disengagement in the context of bullying among peers that reflects each of the moral disengagement categories described above [171]. In this research, we used a modified versions of this survey to explore participants' moral disengagement with robot bullying. The full list of adapted questionnaire items is included in Appendix B.

3.2.2 Perception of Mind

Mind perception theory suggests that people see the minds of others along two broad dimensions of *agency* or the capacity to think and act, and *experience* or the capacity to feel [147]. In their research, they asked participants to rate their perception of dimensions of mind of various characters on these scales. Participants in this study rated robots high on agency, but low on experience; whereas animals were rated low on agency, and high on experience. Inspired by their theory, we made a map of experience and agency of a variety of characters, and used that to investigate perceptions of mind of a bullied robot compared to a bullied human.

3.2.3 Bystander Intervention Model

Latane and Darley proposed a model for bystander intervention that describes a five-step cognitive and behavioral process that one needs to go through in order to intervene in an emergency [222]: notice a potentially problematic situation, interpret it as an emergency, assume a degree of personal responsibility to intervene, know how to intervene and choose a form of assistance, and finally, take action. We developed a five-item questionnaire reflecting on the steps outlined in this model in order to investigate participants' bystander behavior.

3.3 Research Questions

This research aims to evaluate the feasibility of using social robots as pedagogical proxies for bullied characters, and to surface key design considerations for robot-mediated interventions in moral education. To do so, we investigate the following research questions:

Q1. Can robots be bullied? How do people perceive robots being bullied compared to humans being bullied?

Q2. How do bystander behaviors compare in response to a robot being bullied versus a human being bullied?

Q3. How does people's moral judgement compare between a robot being bullied versus a human being bullied?

Q4. How does people's empathy differ towards a bullied robot versus a bullied human?

In response to these research questions, we formed several hypotheses grounded in the theoretical tension between the *Media Equation* [295] and *Mind Perception Theory* [147]. The Media Equation posits that individuals instinctively apply social rules to technology that exhibits social cues [295]. However, Mind Perception Theory suggests that we cognitively know the robot is a machine, and attribute less 'Experience' (capacity to feel pain/pleasure) to machines [147]. Therefore, the moral violation might feel less severe because the robot "victim" cannot truly suffer due to its lack of biological vulnerability. Based on this, we hypothesize that participants will consider both scenarios bullying, though they will more strongly associate the scenario involving the human victim with bullying (**H1**). Following this logic, we predict that while participants will be willing to intervene to help both victims, they will be more inclined to do so for the bullied human (**H2**). Furthermore, we expect that participants will find both scenarios immoral but will be more morally disengaged in response to the bullied robot (**H3**); similarly, although they will empathize with both agents, they will empathize more strongly with the bullied human than with the robot (**H4**).

Finally, to confirm that these differences stem from the robot's mechanical nature, we hypothesize that participants will qualitatively distinguish between the human and robot agents in their responses (**H5**), and explicitly rate the human as having higher levels of 'Experience' (i.e., the ability to feel), compared to the robot (**H6**).

3.4 Methodology

We designed a between-subjects video study suitable for crowdsourcing. The study was conducted on Amazon's Mechanical Turk crowdsourcing platform [12]. We showed participants comparable videos that depicted mild violence such as pushing or kicking towards a robot, or a human. We asked the participants to answer a questionnaire battery after watching each video to explore the research questions outlined above.

3.4.1 Instruments

In this study, we used segments from a video published by Corridor Digital[1], an American production studio. This video is a parody of Boston Dynamics[2] robustness test videos of their robots and depicts mild violence towards their humanoid robot Atlas. Corridor digital approached creating this video by having a human actor wear a motion-capture suit and act out the scene as the humanoid robot. They later used computer generated imagery (CGI) to replace the footage of the actor with the Atlas robot. This unique video enabled us to compare participants' perceptions of human bullying versus robot bullying. That is, we used the video with the human actor for the human bullying condition[3], and the CGI version for the robot bullying condition[4]. The two videos were identical otherwise. See Fig. 3.1 for a side-by-side comparison of one of the frames. Each video lasted 54 seconds and depicted 9 instances of abusive behavior (e.g., kicking, hitting with a hockey stick). The videos were used with permission and are publicly available on YouTube. We used the Amazon's Mechanical Turk platform to recruit participants, and implemented all surveys and the consent protocols on Qualtrics[5].

3.4.2 Measurements

At the beginning of survey, participants answered a few questions about their age, gender and level of education. After watching each video, participants answered a questionnaire battery including the following questions:

Affective State Rating

Inspired by prior work [371], we define affective empathy as the degree to which an observer's emotional reaction aligns with their understanding of the internal affective state of another character. Building upon their work, we asked participants to rate their own affective state in response to the video they watched as well as their perceived affective state of the characters in the video. Participants rated the affective states across the following seven emotions: anxious, sad, angry, happy, aggressive, relaxed, and calm (on a scale of not at all, somewhat, pretty much, very much). This question enabled us to investigate their affective empathy with the different characters.

[1] corridordigital.com
[2] bostondynamics.com
[3] youtu.be/u5bX6QNZ8CI
[4] youtu.be/FtNM8zkKkY8
[5] qualtrics.com



Figure 3.1: Snapshots of the videos used in the study. Left: bullying a robot. Right: bullying a human.

Describing the Video

We asked the participants to describe the video they watched by providing brief open-ended answers to *"who are the characters"*, *"what happened"*. These questions served as attention checks, which is a common practice in crowd-sourced studies.

Brainstorming Character Tags

We showed participants a cropped frame of the video that included a picture of one of the characters (i.e., bullied robot, aggressor of the robot, bullied human, or aggressor of the human) and asked them to brainstorm three words that would describe the character. This was to explore what type of associations participants made with each character, for example, if they associate the robot with words related to bullying.

Sentence Completion

We presented the participants with cropped images of the video that included pictures of the victim and aggressor characters (labeled with A and B), and asked them to complete

a few sentences with short answers. For example, *"I think the behaviour of (B) can be defined as _____"*, or *"If I were there, I would probably _____"*. These open-ended questions provided a clean-slate allowing the participants to express their impressions of the behaviors in their own words.

Moral Disengagement

The moral disengagement questionnaire [171] described in section IV was originally designed to investigate bullying among school-aged children. For the purposes of this study, we devised two modified versions of this scale: (i) a scale for measuring moral disengagement with bullying against an adult human, in which we modified all the references to children and made them about adults, and removed all the references to bullying and made them about kicking/pushing to avoid biasing the participants with this term (e.g., we modified the item *"some kids get bullied because they deserve it"* to *"some people get kicked/pushed because they deserve it"*); and (ii) a scale for measuring moral disengagement with bullying against a robot, in which we modified all the references to human victims and made them about the robot in the video, and removed all the references to bullying (e.g., we changed the item *"some kids get bullied because they deserve it"* to *"robots like this get kicked/pushed because they deserve it"*). We used these scales to shed light on participants' perceived morality of the aggressive behavior, and the psychosocial mechanisms they may use to morally disengage from it.

Perception of Mind

Inspired by the mind perception theory described in the previous section, we made a two-dimensional figure of experience and agency and mapped our own perceptions of the mind of a variety of characters (i.e., rock, computer, autonomous car, tree, baby, pet, and human; see Fig. 3.2). For instance, we indicated low agency and high experience for babies, but high agency and low experience for an autonomous car. We used this figure to quickly introduce the participants to mind perception theory and asked them to click on where they think the victim from the video (the robot, or the human) would be on this graph.

Bystander Intervention

We took inspiration from the bystander intervention model described in the previous section and devised a five-item questionnaire that investigates the five cognitive steps outline in the model, in respect to each video on a 5-point Likert scale from strongly disagree to

strongly agree. For example, to probe for the first step, which is noticing the problem, we used the following item:*"I think B was being bullied."* As this question makes a direct reference to the term *bullying*, we only used this question at the end of the study and after all the other measurements, in order to avoid biasing the participants.

3.4.3 Analysis

We used both quantitative and qualitative analysis to confirm or reject the hypotheses.

To ensure data quality, two researchers analyzed participants' answers to the two video description questions described above. Researchers voted on whether the participant paid attention to the videos or not, based on their open-ended responses. That is, we voted for inclusion of a participant if they had hinted at anything clearly relevant to the video (e.g., had mentioned *"robot"*), and voted for their exclusion if their responses was deemed completely irrelevant (e.g., if they had described the video as *"Nothing"*). We planned to only exclude the participants for which both researchers had agreed on exclusion.

To avoid any potential biases in interpreting the data, we conducted qualitative analysis before analyzing the quantitative data. We used the NVivo software[6] to conduct thematic analysis on the responses given for the open-ended question in the survey. One of the researchers used inductive coding to extract initial codes from each response, categorized by which question they were extracted from. We then collated the data into potential themes. For example, one of the sentence-completion questions was phrased as *"If I were there, I would probably _____"*. One participant had responded to this question as "not interfere", which was initially coded as *doing nothing*, and later collapsed into a theme of *ignoring*, along with other codes such as *watching*, and *leaving*. Furthermore, in some of our qualitative analysis, we distinguish between adjectives that require an object to be meaningful, and those that do not; here we refer to the former as *transitive*. For example, we consider the term *abusive* as transitive, because one cannot be abusive without directing abuse to another; whereas, we do not consider the term *angry* to be transitive, as one can be angry in isolation. This is an important distinction, as perceptions of bullying and mistreatment are focal points in this study.

To examine the participants' bystander behavior towards each agent, we conducted a paired T-test for each of the five items in the bystander intervention scale. In addition, we computed moral disengagement scores for participants and administered paired T-tests to compare their overall disengagement in response to the bullying of each agent; and conducted heuristic comparisons to explore differences in their use of disengagement

[6] qsrinternational.com

mechanisms. Furthermore, we interpreted empathy with each character as the extent to which their perception of the character's affective state rating was aligned with their own affective state. That is, we computer empathy scores by calculating the distance between the ratings for each emotion, averaging the values for all emotions, and inversing them for more interpretability. This resulted in scores between 0-7 for each character, with higher scores indicating higher levels of empathy. We conducted two paired T-tests to compare their affective empathy with the bullied robot versus the bullied human, and abusers of the robot versus abusers of the human. Finally, we conducted two paired T-tests to compare participants' perceptions of agency and experience of the bullied robot, versus the bullied human, which were extracted on continuous scales. This resulted in nine planned comparisons (serving our hypotheses), and five heuristic comparisons. We applied Bonferroni correction to adjust for family-wise errors.

3.5 Participants

We recruited 163 participants from Amazon's Mechanical Turk platform [12], and excluded 16 participants that had failed the attention check. This resulted in 147 participants with an exclusion rate of less than 10%. These participants (83 female, 63 male, 1 non-binary) were between the ages of 18 to 74 (M=37.0, SD=11.9). Over 80% of the participants had not seen any of the presented video, and over 95% had not interacted with any robots prior to the study.

3.6 Results

3.6.1 Manipulation Check and Perception of Mind

Participants' ratings of experience (the capacity to feel) were significantly and positively correlated between the bullied robot, and the bullied human $p<.05$. On average, participants rated the bullied robot significantly lower in terms of experience or the capacity to feel (M=290.74, SE=9.36), than the bullied human (M=118.68, SE=9.36)[7], $t(146)$=-13.90, $p<.0001$, indicating a large effect size of r=.75. Furthermore, the ratings of agency (the capacity to think/act) were also significantly and positively correlated between the bullied robot and the bullied human $p<.0001$. Participants perceived a significantly lower agency

[7]Note that higher scores here indicate lower perceptions of experience.

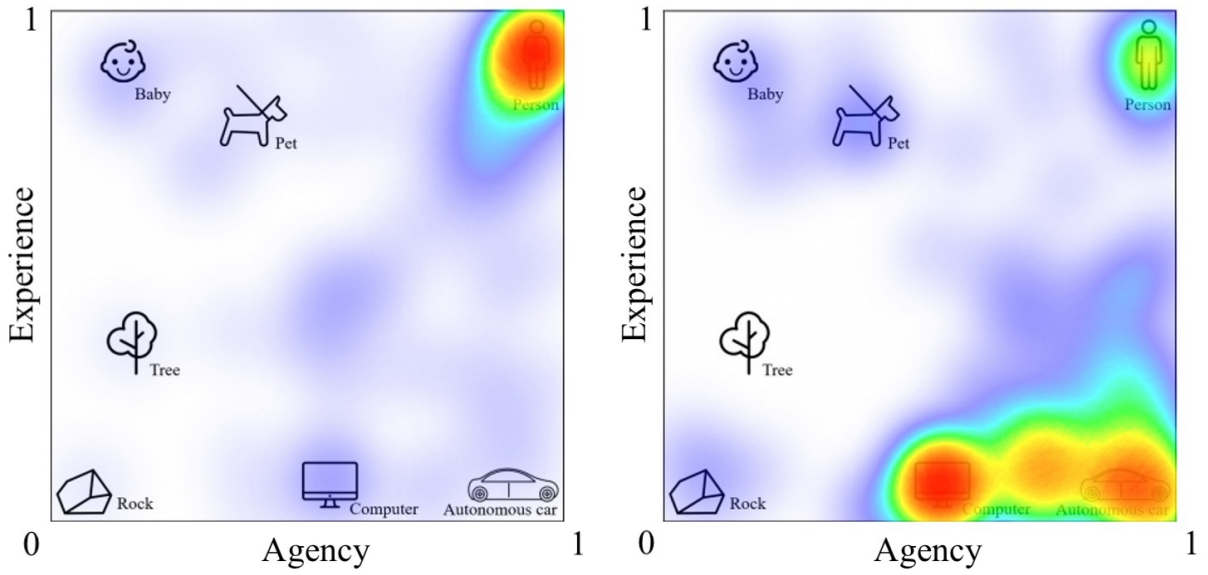


Figure 3.2: Perceptions of experience and agency. Left: bullied human. Right: bullied robot. Differences are significant in both dimensions, $p<.05$.

for the bullied robot (M=337.80, SE=7.48) compared to the bullied human (M=366.83, SE=7.56), $t(146)=3.57$, $p<.0001$, with a small effect size of r=.28.

We observed a theme of participants referring to the robotic or human nature of agents in their response to *brainstorming character tags*. Of the 190 excerpts coded for the **bullied robot** in this theme, over 80% were coded as *robot* and over 15% were coded as machine. Only one participant described the robot as *"alive"* [P111], and about 1% of the responses were ambiguous (e.g., *"robot-man"* [P31]). Furthermore, a total of 181 excerpts were extracted for the **bullied human** character in this theme, over 60% of which were coded as *human* (e.g., *"human carrying out tasks"* [P83]). Over one third of the excerpts were coded as *robot* (e.g., *"human like robot"* [sic][P39], and the remainder were coded as *machine* (e.g., *"mechanical"* [P58]). This confirms our hypotheses (H5 and H6) suggesting that, despite limitations, participants perceived the robot and human characters in the videos differently (see Fig. 3.2).

3.6.2 Bullying and Bystander Intervention

Analysis of the bystander intervention scale revealed significant positive correlation between the two conditions in all five cognitive steps $p<.0001$ (see Fig. 3.3). On average, when

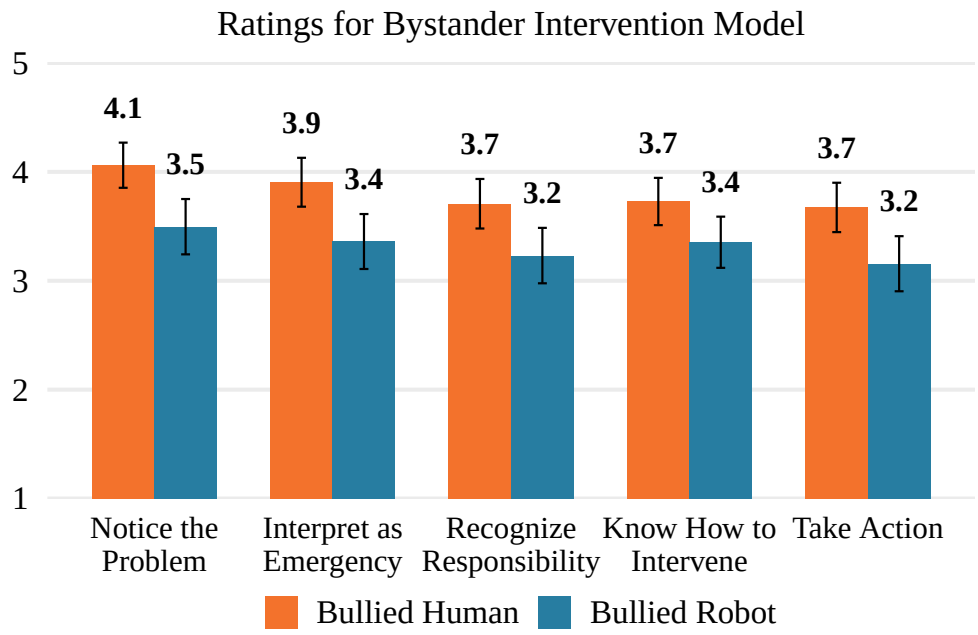


Figure 3.3: Ratings of the five steps of Bystander Intervention Model in response to each bullying scenario. $p<.0001$, Error bars represent 95% CI

participants were asked whether the character was bullied, they reported significantly lower levels of agreement for the robot condition (M=3.50, SE=.12) than for the human condition (M=4.06, SE=.10), $t(146)=5.88$, $p<.0001$, indicating a medium effect size of r=.44. Participants also interpreted the robot bullying as significantly less of an emergency (M=3.36, SE=.13) compared to the human bullying (M=3.90, SE=.11), $t(146)=6.00$, $p<.0001$, with a medium effect size of r=.44.

In addition, participants felt a significantly lower degree of responsibility to stop the aggressor of the robot (M=3.53, SE=.13) compared to the aggressor of the human (M=3.73, SE=.12), $t(146)=4.59$, $p<.0001$, with a medium effect size of r=.35. When participants were asked whether they could think of a way to help the bullied character if they were present in the situation, they reported significantly lower levels of agreement in the robot condition (M=3.35, SE=.12) compared to the human condition (M=3.72, SE=.11), $t(146)=4.38$, $p<.0001$, indicating a medium effect size of r=.34. Finally, participants' willingness to intervene and help the bullied character was significantly lower for the robot character (M=3.16, SE=.13), compared to the human character (M=3.67, SE=.11), $t(146)=5.60$, $p<.0001$, suggesting a medium effect size of r=.42. These findings confirm our hypotheses regarding people's perceptions of bullying (H1) and willingness to intervene (H2).

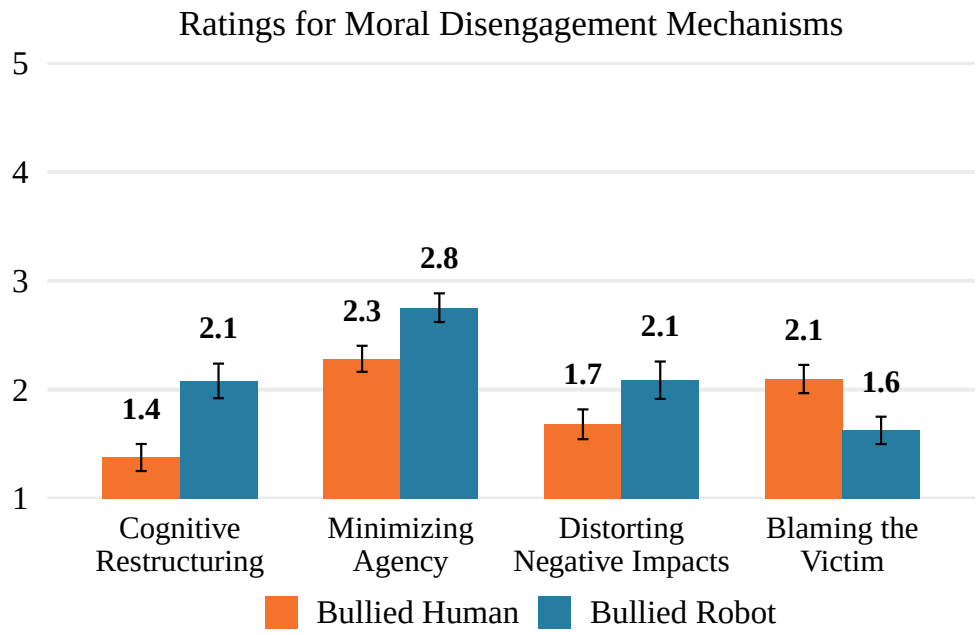


Figure 3.4: The mechanisms used for moral disengagement with each bullying scenario. $p<.0001$, Error bars represent 95% CI.

Furthermore, we found some qualitative evidence consistent with our hypothesis regarding participants' willingness to intervene (H2). We analyzed the responses to a sentence completion question indicating *"If I were there, I would probably _____"*. In response to the **robot bullying** video, we observed a theme of willingness to intervene in nearly half of the responses; with 45% of all excerpts indicating that they would stop the bully (25%), help the robot (8%), intervene verbally (8%, e.g., *"say is all this necessary"* [P53]), or intervene physically (3%, e.g., *"grab a chair and hit (B) [abuser] with it and see how he likes it"* [P129]). Only 5% stated that they would help the abuser, e.g., *"do what B [abuser] is doing"* [P137]. We also observed a theme of ignoring the abusive behavior with nearly 30% of the excerpts indicating that they would watch (20%), do nothing (5%), laugh (3%) or leave (less than 1%), e.g., *"sit back and watch"* [P160]. A few responses hinted at asking questions, feeling confused, or feeling bad.

In response to **human bullying video**, almost 60% of the answers were coded with willingness to intervene. That is, over 30% indicated that they would stop the abuser (e.g., *"stop the beatings"* [P166]), 9% would help the victim (e.g., *"call 911"* [P35]), 11% would intervene verbally (e.g., *"yell at B [abuser] to stop"* [P149]), 5% would intervene physically (e.g., *"smack B [abuser]"* [P13]). Only 4% indicated that they would help the abuser. Similar to the other condition, we observed a theme of ignoring the abuse, with

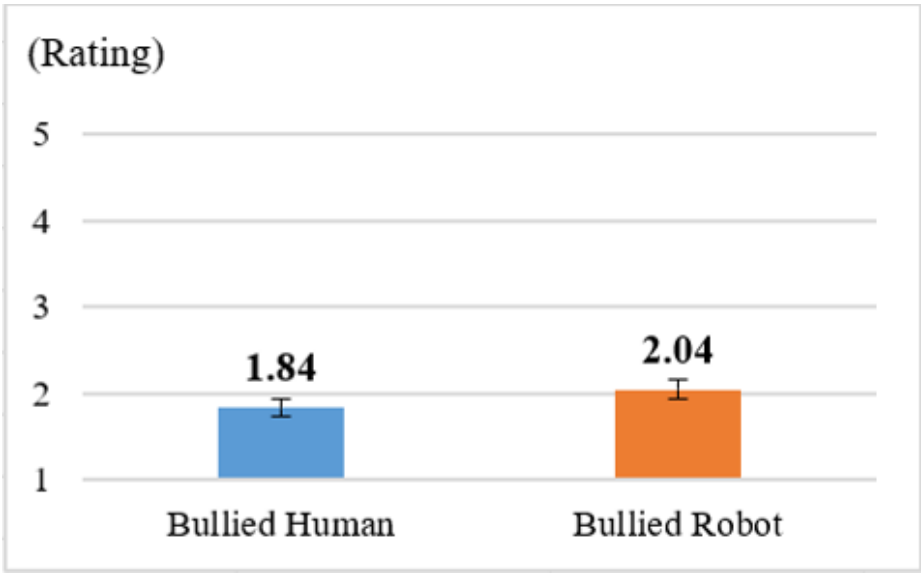


Figure 3.5: Moral disengagement with the bullied human versus the bullied robot. $p<.05$, Error bars represent 95% CI.

25% of the participants indicating that they would watch the incident (15%, e.g., *"observe"* [P20]), enjoy it (5%, e.g., *"enjoy the show"* [P114]), or do nothing (5%). A few participants mentioned that they would ask questions, be confused, or cry. The remainder of the excerpts were ambiguous, e.g., *"help out"* [P109].

3.6.3 Moral Disengagement

Participants' moral disengagement scores towards robot bullying and human bullying were significantly and positively correlated $p<.0001$. On average, they reported significantly higher degrees of moral disengagement with the robot bullying (M=2.04, SE=.06), than with the human bullying (M=1.84, SE=.05), $t(146)$=-5.60, $p<.0001$, with a medium effect size of r=.42. This is in line with our hypothesis (H3) indicating that people will be more morally disengaged with the bullied robot, compared to the bullied human.

Heuristic comparisons revealed that all four mechanisms of moral disengagement (cognitive restructuring, minimizing one's agency, disregarding the negative consequences, and blaming and dehumanizing the victim) were significantly positively correlated between the two conditions, $p<.0001$ (see Fig. 3.4). On average, participants used cognitive restructuring to morally disengage with robot bullying significantly more (M=2.08, SE=.08) compared to human bullying (M=1.38, SE=.06), $t(146)$=-9.57, $p<.0001$, with a large effect size

of r=.62. Similarly, participants used minimizing agency as a mechanism for moral disengagement with robot bullying significantly more (M=2.75, SE=.07) compared to the human bullying (M=2.28, SE=.73), $t(146)$=-7.32, p<.0001, indicating a large effect size of r=.52. In addition, participants used disregarding the negative consequences as a mechanism for moral disengagement with robot bullying significantly more (M=2.08, SE=.09), than with the human bullying (M=1.68, SE=.07), $t(146)$=-5.91, p<.0001, indicating a medium effect size of r=.44. However, participants used blaming and dehumanizing the victim as a moral disengagement mechanism with the robot bullying significantly less (M=1.63, SE=.06), compared to human bullying (M=2.10, SE=.07), $t(146)$=7.82, p<.0001 with a large effect size of r=.54.

To gain a better understanding of participants' moral judgement of each video, we qualitatively analyzed their responses to the following sentence completion questions: *"I think what happened in this video is _____"*, and *"I think the behaviour of (B) can be defined as _____"* (B denotes the character depicting abusive behavior). In response to the **robot bullying** video, nearly 60% of all the extracted experts were describing the incident with connotations of wrongness, immorality or negativity; and therefore were coded under with the theme of *wrong*. Within this theme, we observed a strong subtheme of transitive excerpts with over 40% of participants referring to the incident as aggressive (16%), bullying (6%), cruel (5%), mean (4%), etc. For example, P31 describes the behavior of (B) as *"sad as it depicts assault and bullying, even though only on a robot"*. The intransitive excerpts within this category were commonly coded with describing the behavior as wrong (5%, e.g., *"kind of messed up"* [P35]), disturbing (4%), and terrible (2%). That said, over 30% of the excerpts described the video with positive connotations and were coded under an opposing theme of *not wrong*. Over half of the observations in this theme (17%) were describing the video as test, training, or scientific, e.g., *"some tests to improve the robot"* [P46]. Others commonly described the video as interesting (5%), and normal (2%). The remainder of the excerpts were incoherent.

Similarly, of the excerpts extracted from the **human bullying** video, nearly 70% were categorized as *wrong*. Within this theme, 45% were transitive, with participants commonly describing the behavior as aggressive (15%), bullying (10%), cruel (3%), or attack (3%), e.g., *"disruptive and that of a bully's"* [P24]. Frequent intransitive excepts in this category included terrible (7%), unethical (6%) and disturbing (3%). Additionally, less than 25% of the participants were judging the behavior depicted in the video as *not wrong*. More than half of the excerpts in this category (13%) were describing the video as test, training, or scientific, e.g., *"standard for training"* [P156]. The remaining excerpts were incoherent.

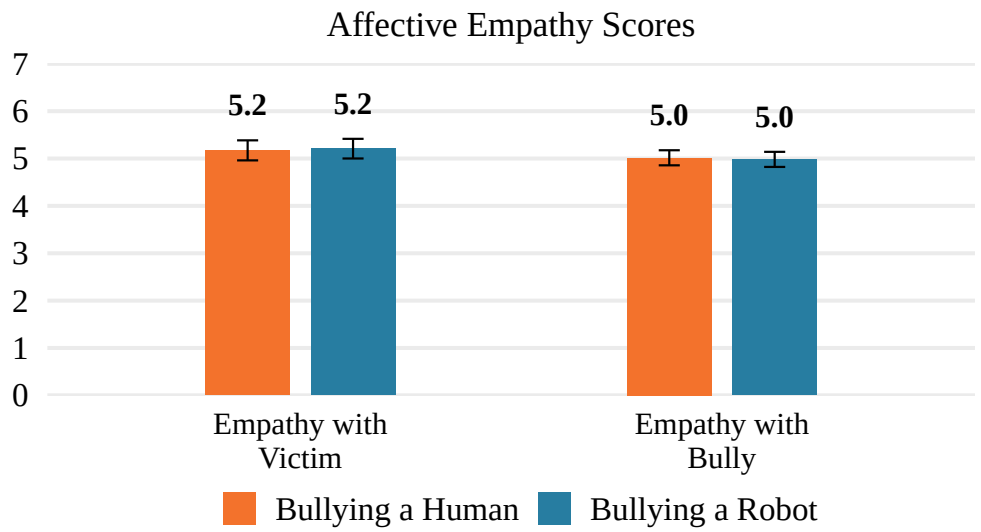


Figure 3.6: Empathy score for victims and bullies in each condition. $p>.05$, Error bars represent 95% CI.

3.6.4 Empathy

Finally, even though participants' empathy scores were significantly correlated towards the bullied robot versus the bullied human ($p<.0001$), and the aggressor of the robot versus the aggressor of the human ($p<.0001$); we did not find any significant differences within either pair (see Fig. 3.6). As such, our hypothesis about participants' empathy (H4) is neither rejected, nor confirmed.

However, we found some qualitative evidence that were in lines with our hypothesis (H4). We analyzed participants responses to the following sentence completion question: *"I can empathize with _____"*, which was asked after watching each video where participants were presented with screenshots of bully and victim characters. In response to the **robot bullying** video, over 65% percent of the participants picked the bullied robot, nearly 15% chose the abuser of the robot, nearly 10% responded with neither, and 2% responded with both. One participant responded with *"whoever owns the robot"* [P6]), and the remainder of the excerpts were incoherent (e.g., *"the experiment"* [P68]). Whereas in response to the **human bullying** video, over 80% of the participants stated that they can empathize with the bullied human, and only 3% chose the abuser. Furthermore, nearly 7% responded with neither, 2% responded with both, and the remainder were coded as incoherent.

3.7 Discussion

In this research we conducted a crowdsourced video study to compare perceptions of robots being bullied to humans being bullied. Our qualitative and quantitative findings consistently indicated that while participants perceive both instances negatively, there are significant differences in their perceptions, with mistreatment of robots being associated with bullying less strongly. Results from the moral disengagement questionnaire indicated that people may use different mechanisms to morally disengage with bullying of robots versus humans. That is, while in 3 out of 4 categories of disengagement mechanisms participants seem to be more disengaged with robot bullying, we see a reversed pattern in the category of *blaming and dehumanizing the victim*. This is in lines with related work by Keijsers and Bartneck suggesting that *"humans do not dehumanise robots in the same way they dehumanise humans"* [203]. Another potential explanation may be that the items in this category of the moral disengagement questionnaire seem to be mostly focused on blame attribution, and in order to blame an entity, one should presume that they have a certain degree of agency. However, as it was demonstrated here, robots are perceived to have significantly less agency that humans.

Furthermore, despite qualitative evidence suggesting a difference in participants' empathy with the bullied robot versus the bullied human, we observed no significant differences in their empathy score. This may be a limitation of our study design, as we did not use a validated measurement for affective empathy. For example, while conducting qualitative analysis, we noticed that many participants state that watching the video made them feel angry, which implies that they empathized with the victim. However, using our measurement, participants would be likely to also rate the abuser as angry; which our model of affective empathy would interpret as empathy with abuser. Another limitation of this study was the use of a Boston Dynamics parody video. Boston Dynamics' robustness tests of their videos are publicly available on YouTube and have millions of views, and our qualitative findings suggest that some participants may have simply assumed that the abusive behavior is standard for testing robots. In addition, as we had randomized the order of the videos, half of the participants would have seen the video with the human actor first, and may have guessed that the robot bullying video is fake, which could have implications for their perceptions. This is evident in the perceptions of mind heatmap (Fig. 3.2), as a group of participants seem to have clicked on the human icon to mark their perceptions of the bullied robot.

Despite all the limitations, we believe that findings of this work imply that social robots may indeed be relevant for use in the context of anti-bullying pedagogical tools. We argue that participants being more morally disengaged with the robot bullying (compared to

real-life bullying), may be an advantage for anti-bullying systems using social robots as it may mitigate the potential psychological harm that could arise from exploring emotionally hot topics such as bullying.

3.8 Conclusion

We conducted a crowd-sourced feasibility study to explore people's perceptions of robots being bullied, compared to humans being bullied. While scholars acknowledge robot bullying as an existing phenomenon, empirical evidence for whether or not participants associate abusive behavior towards robots with bullying is scarce. This work presents qualitative and quantitative findings that suggest that while people describe both instances with connotations of wrongness, they use different cognitive mechanisms for morally disengaging with robot bullying versus human bullying, and associate aggressive behavior towards robots with bullying less strongly in comparison. Future work can be geared towards gaining a deeper understanding of this phenomenon by exploring how various design factors, such as robot's morphology or sociality, can impact people's perceptions of its bullying.

3.9 Chapter Summary

This chapter addressed a foundational design question for REMind: can robots serve as believably bullied characters in the context of anti-bullying interventions? Through a feasibility study, we found that the answer is broadly affirmative—people do ascribe moral weight to robot mistreatment, and often perceive it as wrong. However, these perceptions are more fragile and subject to disengagement compared to analogous human scenarios.

These findings highlight both the promise and limitations of using robots in emotionally charged educational settings. On one hand, robots may provide a safer, more emotionally buffered medium for engaging with sensitive social topics (see discussion on *Aesthetic Distance* in 2.3.3). On the other hand, designing compelling bullying scenarios with robots requires careful attention to how stories are framed and characters are constructed. This raises important design challenges: how might we craft robot characters and stories that are believable and emotionally resonant enough to engage learners meaningfully?

In the next chapter, we explore how to design compelling characters and dramatic narratives for REMind. To do so, we turn to the imaginations of children themselves to explore this challenge: how do children make sense of robot bullying through storytelling? What kinds of characters, plots, and conflicts feel meaningful to them? And what can

we learn from their narrative instincts to inform the design of effective robot-mediated interventions?

Chapter 4

Ideation: Character and Story Co-Design with Children

"[Stories] are the primitive instruments of thought."

— George Eliot, *From Leaves from a Notebook*

The previous chapter examined whether robots could be meaningfully perceived as bullied entities. Our findings suggested that while people do recognize robot-directed mistreatment as morally problematic, they empathize with robot characters less readily than with human characters. This raises an important challenge: if the intervention is to rely on role-playing with robot characters to foster moral reasoning and prosocial behavior, it must present narratives that are believable, emotionally engaging, and relatable to children's lived experiences.

Stories have long been linked to empathy and prosocial behavior. For example, a cross-cultural study of 18 hunter-gatherer societies found that groups with more skilled storytellers exhibited significantly higher levels of cooperation [332]. In educational contexts, recent work confirms that digital storytelling activities can promote prosocial behavior in children by positively shaping their values and improving their emotional and empathetic skills [337].

Psychological research attributes the persuasive power of stories to the phenomenon of *narrative transportation*: when lost in a story, brain regions associated with the sense of 'self' become inhibited, leading individuals to experience the emotions and perspectives of characters as if they were their own, effectively fostering empathy [348]. A meta-analysis of 132 studies [370] found that narrative transportation can significantly influence beliefs,

attitudes, and intentions, aligning them with the moral themes of the story. Furthermore, unlike analytical persuasion, which relies on logical evaluation, narrative persuasion operates primarily through affective mechanisms, *reducing critical thinking* while increasing openness to the story's message [370]. Notably, authors report that the persuasive effects of narrative transportation tend to be long-lasting and may even strengthen over time [370].

This raises a key practical question for REMind: *how might we tell a good story?* Practitioners suggest that compelling stories are typically character-driven. According to Haven, an effective story is a "character-based" presentation of a protagonist's efforts to overcome conflict or risk while pursuing a meaningful goal—told with enough sensory and emotional detail for the audience to visualize and connect with the experience [154].

To inform the design of such character-based narratives, we draw on co-design methodology. We argue that by observing how children conceptualize a phenomenon such as peer bullying can reveal how to best tap into their social understanding and moral intuitions [330]. To this end, we conducted a remote co-design study with children aged 8–12 (N=22) to inform the development of REMind. Children participated as design *informants* [116], and were guided through a series of tasks in which they designed a fictional "student robot" character and created stories about its positive and negative social interactions in a school setting.

In this chapter, we describe the methodology and structure of our remote co-design sessions with children aged 8–12. We then present a qualitative analysis of children's designs, focusing on two key aspects: *character design*, and *narrative design*; identifying recurring themes in how children conceptualize robot characters, social roles, and peer conflict. We conclude with a discussion of the implications of these findings for designing child-centered educational technologies, highlighting how children's perspectives can inform future development of anti-bullying tools involving social robots.

4.1 Research Questions

In this work, we investigate how school-age children conceptualize and narrativize social dynamics involving robots in the context of peer relationships. We aim to derive design insights for REMind by understanding how children imagine the robot's appearance and behavior, and how they construct social narratives around it.

Although the study is exploratory, we focus on the following research questions:

Q1. How do children envision the design of a robot peer? What physical features, personality traits, and behaviors do they attribute to a robot classmate?

Q2. How do children construct school-based social narratives involving robots? What kinds of social conflicts, alliances, and interactions do they imagine between robots and human characters?

Q3. Do children represent robots as capable of being bullied or bullying others? If so, how are these scenarios framed, and what roles do bystanders and supporters play?

Q4. What themes, story structures, and interaction dynamics emerge as believable and emotionally resonant for children in their imagined scenarios?

By exploring these questions, we seek to uncover children's intuitive understandings of robot sociality and school life, and to inform the design of role-playing narratives and character behaviors for use in the REMind intervention.

While highly exploratory, this study was guided by ethical and methodological considerations. In particular, while the themes of bullying and peer support were focal points, we deliberately avoided using the term *bullying* in our sessions. This decision was made both to protect children from potential emotional discomfort that might arise from recalling personal experiences, and to avoid biasing their narratives towards clichés (e.g. by depicting a character as a stereotypical victim rather than an average student).

4.2 Background: Co-Design

4.2.1 What is Co-Design

Over the last few decades, co-design has gained momentum in design research and practice, demonstrating numerous benefits for both users and organizations [343]. Sanders and Stappers define co-design broadly as "the creativity of designers and people not trained in design working together in the design development process" [316]. This definition encompasses any activity that allows end users to influence the design process.

Traditionally, user-centered design has adopted an expert-driven model: researchers observe passive users interacting with technology and analyze these observations through expert-derived frameworks to generate insights [316]. In contrast, co-design recognizes users as experts of their own experience [316]. Users possess unique and situated knowledge about their habits, behaviors, and values—insights that are critical in service and product design [343]. Co-design has been shown to result in higher-quality system requirements, more effective solutions, and better alignment with user needs [217].

4.2.2 Why Co-Design with Children

A primary challenge in co-design is that users often struggle to articulate their needs for a new technology [163]. This issue is particularly salient when co-designing technologies with young children, as they often find it difficult to verbalize abstract ideas or reflect on hypothetical scenarios [116]. Despite the challenges, scholars argue that it is essential to involve children in the design process, rather than only relying on adults as proxies; that is, adults' experience of being a child is limited to when they were children which differs from the technological complexity, and richness of a child's environment today [148]. Even though adults involved in children's development (e.g. teachers, parents) are a valuable resource for the design process, prior work reports that despite their best intentions, often their ideas are influenced by how they work with children and their own needs (e.g. classroom organization) [148].

Furthermore, design scholars emphasize that researchers should refrain from undermining children's ideas as *fantastical* or *impractical*, and instead suggest that, as an integral part of partnering with children in design, to involve thoughtful adults that listen to children's creative ideas and extract the big concepts that are pragmatic for the technology [148]; and rather, we should acknowledge that our technology would stagnate without visionary, cutting-edge ideas. This resonates with Steen's argument that "(co)-design can be understood more adequately as a process of abduction"; that is *what may be*, rather than induction (*what is*), or deduction (*what must be*) [342]. This is specifically important for REMind, as design of robots in a bullying scenario should be grounded in children's reality and their understanding of bullying and robots in order to engage them effectively.

4.2.3 Frameworks for Co-Design with Children

Despite growing interest, there are few structured frameworks for co-designing with children [80]. One such framework is Cooperative inquiry (CI): a subset of participatory design that includes guidelines and techniques for partnering with children to design future technology [116]. CI emphasizes multidisciplinary partnership with children, understanding contexts, and iterative prototyping [377]. As young children may need more structure in various design steps such as idea-generation, CI techniques can be used to facilitate such co-creation. For example, *Bags of Stuff* is a low-fidelity prototyping technique that uses bags filled with art supplies (e.g. glue, papers, markers, strings, socks, scissors) as a medium for creating low-fidelity prototypes. The authors posit that this technique "can strongly support bringing children into the design process" [148]. Many of CI techniques are designed to facilitate collaboration with groups of children, rather than individuals. For example,

stickies uses sticky notes and frequency analysis to critique prototypes, or *big paper* uses large-sheets of paper to facilitate collaborative brainstorming between different children in the group [377].

As abilities in expressing ideas vary between children, it is recommended that methods for generating ideas and collecting information should be diverse to accommodate for children with different sets of skills [366]. Building on this body of work, this work uses a diverse set of tasks inspired by cooperative inquiry techniques to engage children in co-design of REMind. We detail our approach in section 4.4.

4.3 Related Work

Traditionally, social robots have been designed by either following the practices in the field, or surveying the target user group about their expectations [17]. While these methods contribute by exploring people's attitudes and perceptions towards robots, they miss the opportunity to harvest children's imagination of how social robots should be [17].

There are numerous examples of co-design in the human-robot interaction (HRI) field. YOLO is a social robot designed to encourage creative thinking in children [11]; expressive movements and creative behaviors of this robot have been co-designed with children using improvisation, pupeteering techniques, and storyboarding. Sunguitan and Hoffman partnered with children and used crafting material to design accessories for their handcrafted robot, Blossom [349]. Others have used techniques such as cooperative inquiry's *bag of stuff*, or *mixing ideas* [148] to co-design robot characteristics [80] and craft low-fidelity prototypes of "friend robots" [17], or storytelling robots [117] with children, or used Do-It-Yourself platforms to make high-fidelity prototypes of social robots [128].

Furthermore, HRI researchers have used user-centred design methods to support developing technologies for under-represented populations such as older adults with depression [226], or visually impaired children [250]. However, despite an abundance of research in the development and use of robots for children, we argue that intergenerational co-creation is generally underexplored in the field of HRI.

4.4 Methodology: Guided Cooperative Inquiry

We had planned to use cooperative inquiry techniques described in section 4.2.3 to conduct this co-design project in local elementary schools. However, this was not feasible at the

midst of the COVID-19 pandemic. CI methodology is intended for group ideation and relies on the presence of researchers to monitor and facilitate the design steps.

To accommodate for the pandemic lockdown, we used modified versions of several of the commonly used CI techniques, and conducted the study remotely with individual children and minimal involvement from researchers. We detail this approach in the next section.

Our methodology consisted of 6 steps that we detail below: brainstorming, sketching, collecting art supplies and crafting, story-writing, animation-making and brief interviews.

4.4.1 Brainstorming

As children need more structure in brainstorming, we encouraged idea generation in smaller steps. That is, we asked children to brainstorm their design ideas for the robot by breaking it into three steps of robot appearance, personality, and names. We took inspiration from CI's *stickies* technique that asks children to write down one idea per note, and encouraged children to briefly think about each concept, and then use one-minute timers to write down one idea on one sticky note. Children repeated this procedure four times for each of the sub-concepts of design. See an example in Fig. 4.1.

4.4.2 Sketching

We used a variant of CI's *paper prototyping* technique and asked children to sketch their favorite brainstorming ideas on a piece of paper. This helped children narrow down their ideas, and provided participants that were more comfortable with expressing themselves through sketching with another medium for idea-generation. See an example in Fig. 4.1.

4.4.3 Crafting

We used a variant of CI's *bags of stuff* to facilitate low-fidelity prototyping. As we were not able to provide children with art supplies ourselves, we instructed them to collect clean and safe recycling material (e.g. egg cartons, plastic bottles) and some basic crafting supplies with the help of an adult. Once they gathered their own bag of stuff, we encouraged them to make low-fidelity prototypes of their robots based on their sketches and brainstormed ideas. For examples, see Fig. 4.2.

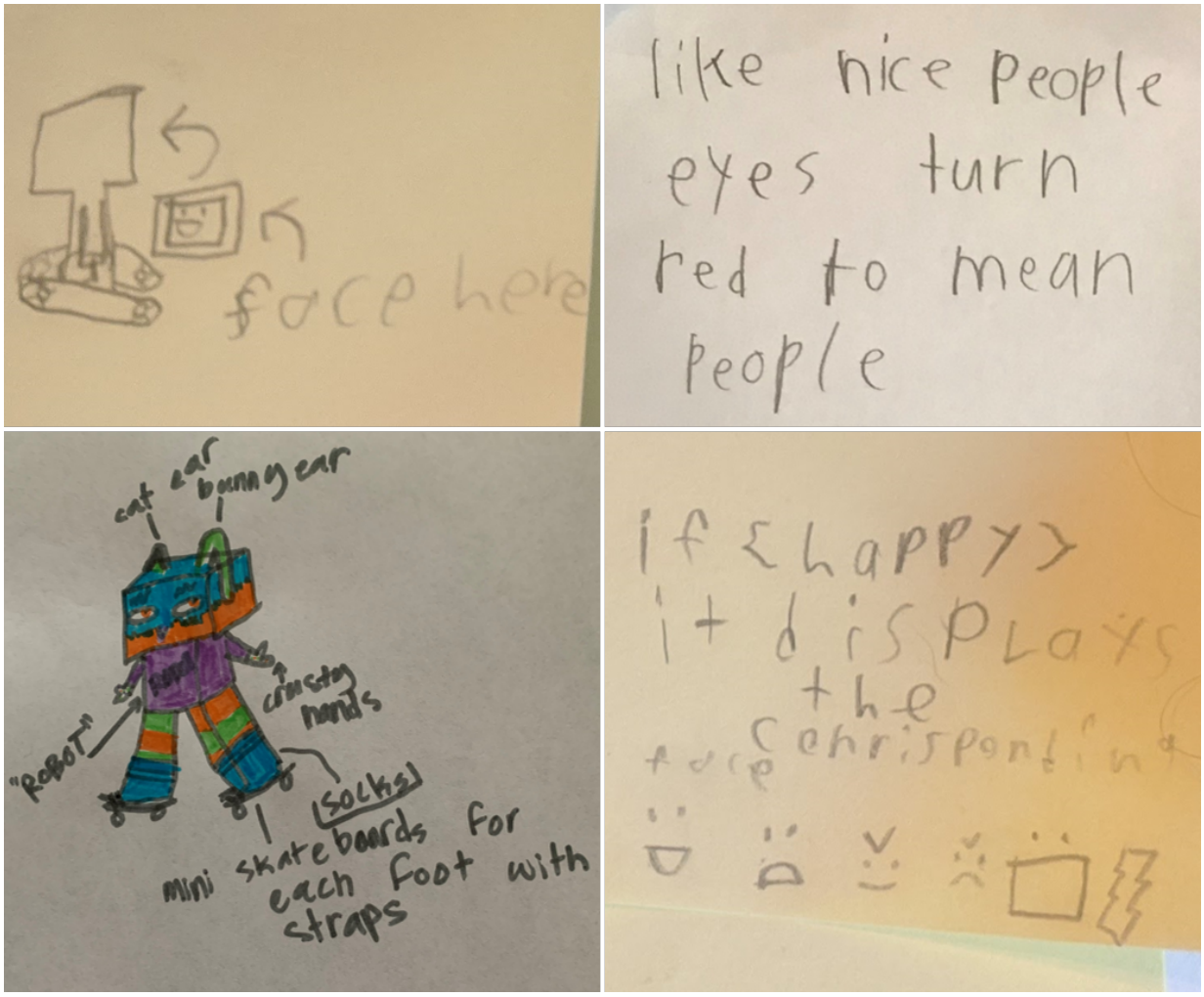


Figure 4.1: Examples of brainstorming ideas and sketches made by children.

4.4.4 Story-writing

Inspired by CI's *storyboarding* and *comicboarding* techniques, we encouraged children to write stories about various positive and negative interactions of their robot at school by using our story-planner and storyboarding templates. Children first used the planners to provide short answers to key questions about a story they had in mind (i.e. who, where, what, why, what next). This helped by introduced some structure into the procedure, and helped shape up the stories. Following this, children used the storyboard templates to sketch their story in up to six frames, and added a line or two to explain each frame. For



Figure 4.2: Examples of low-fidelity prototypes of robots crafted by children.

example, Fig. 4.3 shows a storyboard made by a participant describing a robot's negative interaction with a classmate, followed by the robot reaching a resolution, and confronting the classmate. CI's *storyboarding* establishes the time-line and aesthetics of the system by drawing stories about it.

4.4.5 Animation-making

We included an optional step for children to make animations in order to support idea expression using bodystorming and role-playing [325]. We introduced children to *stop-motion*: a simple animation-making technique in which one can move inanimate objects in small increments and take photos at each step such that when the photos are viewed sequentially, they create an illusion that the objects are moving. We instructed participants to use a free application[1] on a smartphone, and craft DIY simple tripods out of recycling material.

[1]Stop Motion Studio, see cateater.com

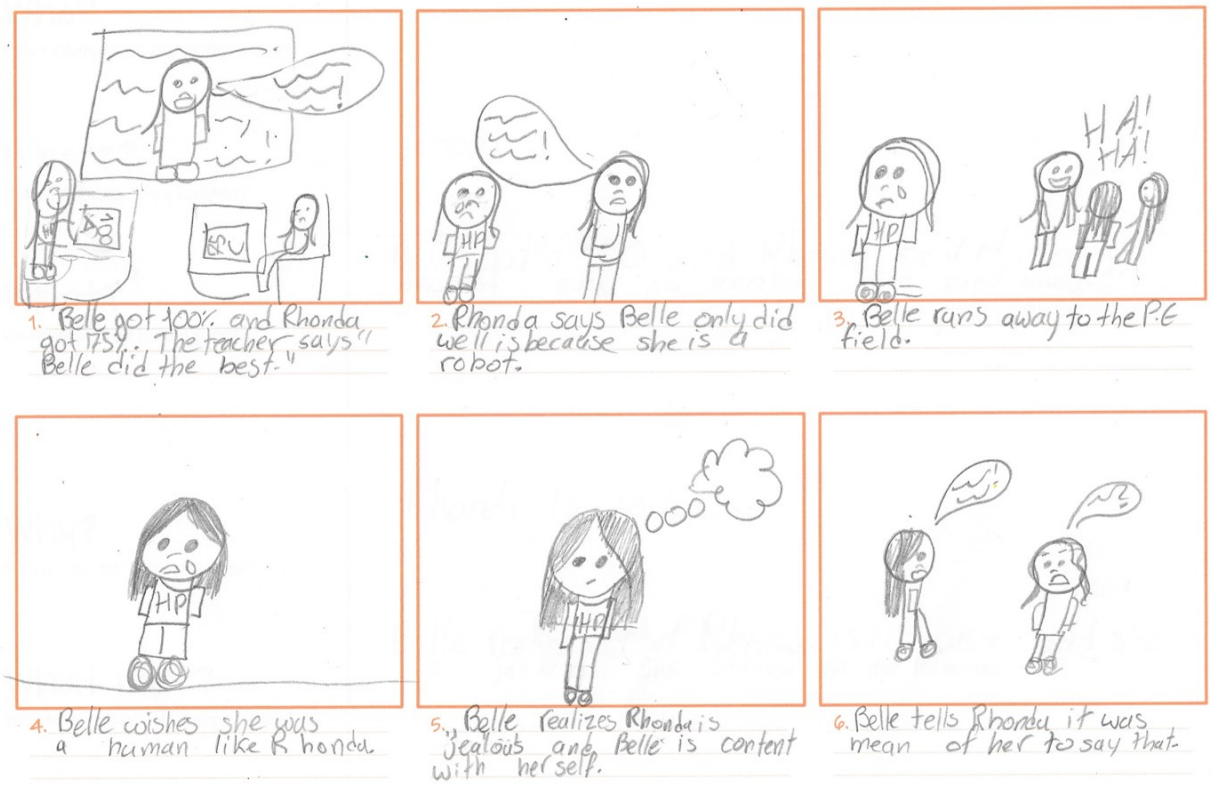


Figure 4.3: A storyboard made by one of the participants.

4.4.6 Interview

At the end of the design process, we conducted brief semi-structured interviews with children to go over their designs together and make sure we understood their ideas (e.g. could read their hand-writing). This is similar to the group discussion phase that usually takes place at the end of CI sessions when adults and children ask critical questions about the designs to understand the underlying big ideas.

Finally, to accommodate for the lack of facilitation and direct supervision from researchers, we provided detailed instructions for children on our project website[2] in both written and audio format and in simple language that children could follow. We also asked parents to help us with conducting the study, for example, by obtaining assent and assisting their children with certain steps (e.g. to set up the interviews).

[2] sirrl.wordpress.com

4.5 Recruitment

We advertised the study in relevant social media groups (e.g. a Facebook group titled *Elementary School Parents - at home social distancing activity ideas*), asking interested families to contact a researcher on the team. Families that contacted the researchers received an information letter about the project, and an assent letter explaining the study, its benefits and risks, how we collect data, and how we plan to use it in a simple language to read for their child. Parents digitally signed a consent form confirming that they have read and understood the information letter, and they have obtained assent from their child for participating in the study. In addition, we explained to parents that while their presence in the interview is not mandatory, we highly recommend that they either participate in it, or set up the call such that they can hear our conversations. We also obtained verbal assent from children before starting the interview for recording their voice. We gave children participation certificates, and thanked their parents with a $15 e-gift card in their local currency. We also offered them a free family tour of our lab upon re-opening of the university that they could schedule by the end of 2021. This protocol was approved by the University of Waterloo Human Research Ethics Board.

4.6 Participants

We conducted this study with 22 children (13 female, 9 male) between the ages of 8-12 (M=9.5 years, SD=1.4), located in Canada (N=6) and United States (N=16). Several families were not able to complete all the steps for various reasons. We encouraged all of them to send us their available data and sent them the full honorarium and certificates. Overall, all participants completed brainstorming, over 95% completed sketching, over 90% completed crafting, and story-writing, about 60% made animations (voluntary step) and over 70% participated in the interview.

4.7 Procedure

Parents of children that were eligible and interested to participate received a link to our project's website. The website provided instructions for six co-design steps through which children design a robot and write stories for it at home. The first half of this study focused on *designing the robot* through brainstorming, sketching their designs, collecting crafting material, and making a low-fidelity prototype based on their sketch. The second half

focused on *designing the stories* using story-boarding and animation-making (see Fig. 4.4, photos are used with permission).



Figure 4.4: Children participating in the remote co-design study. (left: making an animation, right: brainstorming and sketching).

In the robot design steps (1-3), we first described a brainstorming technique that involved briefly thinking about each topic, then writing one idea per minute on a piece of paper. Children used this technique to brainstorm four ideas about the robot's appearance, four ideas for its personality, and four potential names (step 1). Next, we asked children to sketch a robot while having the ideas they brainstormed in mind (step 2). We then guided them to look for safe crafting material such as recycling items (e.g. egg cartons, empty plastic bottles) with then help of an adult (step 3.a). Finally, we instructed them to craft a robot based on their sketches by using the material they had collected (step 3.b, see Fig. 4.5).

The narrative design component of the study was completed through steps 4 and 5. We provided printable material for story-planning and making storyboards, along with instructions to draw the templates on a piece of paper in case they did not have access to a printer. Children started by taking their crafted robots and giving it a name that they had come up with earlier as we envisioned that this may facilitate their imagination. Then, they proceeded to create four stories using the printable material. To do this, they

first provided short answers to a few key questions on their story planners to form their story (i.e. who, where, what, why, what next). They then used the storyboard to draw their story in up to 6 frames and add one or two lines to describe each drawing. In the first story we asked them to imagine their robot comes home unhappy from school because of something that happened with a classmate that was not nice, and come up with a story of what happened. They followed the same steps in the second story, but this time they imagined their robot coming home happy from school because of something good that happened with a classmate. Finally, in the last two stories, they introduced a new character: a robot very similar to the first one who is classmate of the first robot. Similarly, they created two more stories where the second robot notices that the first robot is either unhappy or happy in school, and reacts to it. In step 5, children learned how to make stop-motion animations at home. Stop-motion is a simple technique that uses inanimate objects and a camera. In this technique, you move the objects in small increments and take photos at each step; when the photos are viewed sequentially they create an illusion that the objects are moving. Our website provided links to install the free version of an application called "Stop Motion Studio" by Cateater [357] on a smartphone or a tablet. We guided children to find simple recyclable material to make an easy tripod or stand for their device. Children made stop-motion animation using their crafted robot, and other objects such as stuffed toys.

After children finished all the steps, their parents uploaded their designs on a web-form and schedule a brief online interview with us. During the interview, we asked probing questions whenever appropriate to gain more in-depth information (e.g. can you tell me why you think that happened?). At the end, we showed them photos of three robots (i.e. Miro [219], QTrobot [238], and Nao [304]), and asked them which robots they would choose to play their stories like an actor and why, and probed for their order of preference. We concluded the interview by thanking them and encouraging them to contact us if they have any questions. Given that the study took place during a global pandemic and many parents were working from home, we let children know that if their parents were too busy to help them with particular steps (e.g. animation-making), they could contact us and opt out of it. In which case, we still provided tutorial videos for them to watch and learn about the technique in case they were interested.

4.8 Analysis

We analyzed the data following a mixed method approach. As the collected data was primarily qualitative, we used thematic analysis [52] and affinity diagramming [164] for analyzing it. Two researchers collaborated in all the qualitative analysis steps from coding



Figure 4.5: Examples of robots crafted by children in the co-design study.

the data to creating the affinity diagrams and analyzing the emergent themes. We coded interesting features of the data across the entire set of observations gathered from all steps of the co-design including children's brainstormed ideas, sketches, low-fidelity prototypes, story-planners, storyboards, animations, and transcribed interviews in a systematic fashion.

We started by safely storing all the data on a private university server to facilitate remote collaboration of researchers. Considering the richness the collected data, we decided to create two different affinity diagrams corresponding to our two research questions about exploring children's robot design and narrative design. We coded the data by discussing instances of it, and writing down the key information that capture the specific characteristics of the robot, or the narrative context on sticky notes. We denoted the source of data on each sticky note by jotting down the participant number and color-coding the excerpts based on the co-design steps they were extracted from (i.e. robot design steps, or narrative design steps). We captured both facts from the data, and our interpretation of

the facts. For example, a brainstorming idea by P6 reads "”Wall-e like, but white, orange, grey and blue, with a calm voice; which resulted in three excerpts extracted by the researchers: *robot is inspired by fictional characters (Wall-e)*, *robot is colored (white, orange, grey, blue)*, and *robot has a calm voice*. Upon extracting all the excerpts, we "walked the wall" [164], collated the data into potential themes, and built the two affinity diagrams. We then reviewed and discussed the themes within each diagram and in relation to the entire data-set, refined the themes, and generated the thematic map of analysis (see Fig. 4.6).

Finally, we analyzed the question related to children's preferences of the three robots using the Wilcoxon signed-rank test, which revealed no significant differences.

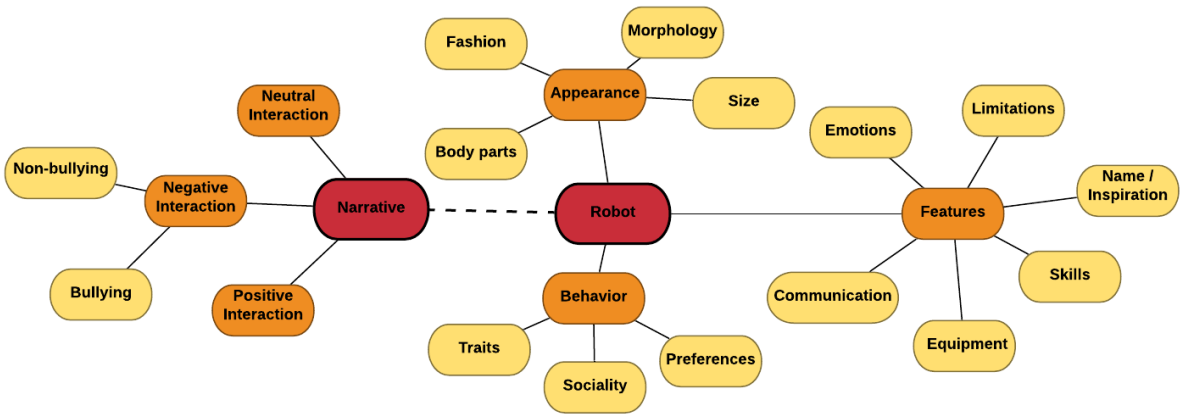


Figure 4.6: Developed thematic map, showing two correlating diagrams and six main themes.

4.9 Observations

In this section we present our analytic narrative of what we have observed in the themes emerging from the data, in relation to our research questions. As a rule of thumb, we considered a concept an emergent theme if we observed it in data from more than 20% of participants. However, following guidelines of conducting thematic analysis that recommend researchers to retain flexibility and avoid entirely depending themes on quantifiable measures [52], we have also reported a few themes that we believe capture important concepts in relation to our research questions.

4.9.1 Character Design

The themes emerging from the robot design affinity diagram were identified as appearance, behavior and features.

Robot Appearance

This theme includes excerpts coded with robot *morphology*, *size*, *body parts*, and *fashion*.

Morphology: While we did not find a well-defined preference in the shape and morphology of the student robot, human-like designs were by far the most popular among children in this study with over 80% of children designing at least one robot [3] that we coded as human-like, e.g. "*Shape: Human. Color: Yellow. Sound: Kid*" [P19-B][4] Animal-like and machine-like designs were also mentioned, but were not as popular. For instance, some children included animal parts in their robot design, "*[robot has] one bunny ear and one cat ear*" [P8-B]. However, a few children mentioned that they think it is not appropriate for the student robot to look like a *dog* when explaining why they would not choose the Miro robot [P38, P48, P44-I][5]. This is in lines with prior work suggesting children tend to anthropomorphize robots [327]. In addition, a few explicitly mentioned a preference for hybrid designs. P45 described her robot as "*it will wak like me and a robot*" [sic] in her brainstorming notes and in the interview she explained that this means the robot should take one step like a human, and one step like a robot. Several children mentioned that robots can look identical to other robots, for example, P21 compared two robots in her story as "*Rob is Jeff's alter-ego*"; she clarified in the interview that this means the two robots have identical appearance, but opposite personalities. Finally, while all children used gendered pronouns for their robots, less than 20% of them referred to it as female.

Fashion: This category includes excerpts tagged with robot clothing, accessories, decorations, and colors. Half of the participants sketched their student robots wearing human-like clothes and accessories, such as shirt, pants, dress, hat, shoes, backpack, glasses, bow. Over one third of children used decorations such as printed shapes, or tags such as robot's name on their crafted robots or sketches (see examples in Fig. 4.5). While some of these were only decorations (e.g. printed heart, [P1-I]), some represented a robot's

[3]Note that several children designed more than one type of robot. That is, the sum of some reported percentages may exceed 100.

[4]The second letter denotes which co-design step the excerpt is from - B: brainstorming, SK: sketches, C: crafting, ST: stories, A: animation, I: interview

[5]Note that even though we only had 22 participants, they were numbered based on the invitations sent out from P1-57.

functionality (e.g. lightning icon for robot's built-in taser that it can use if it is threatened, [P48-I]), or its characteristics (e.g. tag that says "*love*", for a robot described as "*likes being loved*", [P10-B,C]), or its responsibilities (e.g. tag that says "*Drinks*" for a robot whose job is to carry drinks [P19-B,C]). Finally, over 20% of children explicitly mentioned specific colors (e.g. neon orange [P8-B]) as a feature of their robot or its body parts.

Size: Children's designs indicated that they were able to envision robots to be of diverse sizes, from table-top to child-sized robots. For instance, P10 described her robot as "*small and cute*", whereas P37 specified that his robot is 4'7" tall (140 cm). Several children opted for asymmetric designs, or disproportionate body parts (see Fig. 4.5 for examples).

Body parts: Face and facial features (e.g. eyes, mouth) were seen in designs of all participants, suggesting children perceive these characteristics important for robots (see Fig. 4.7 for examples). Several participants included human-like facial features such as

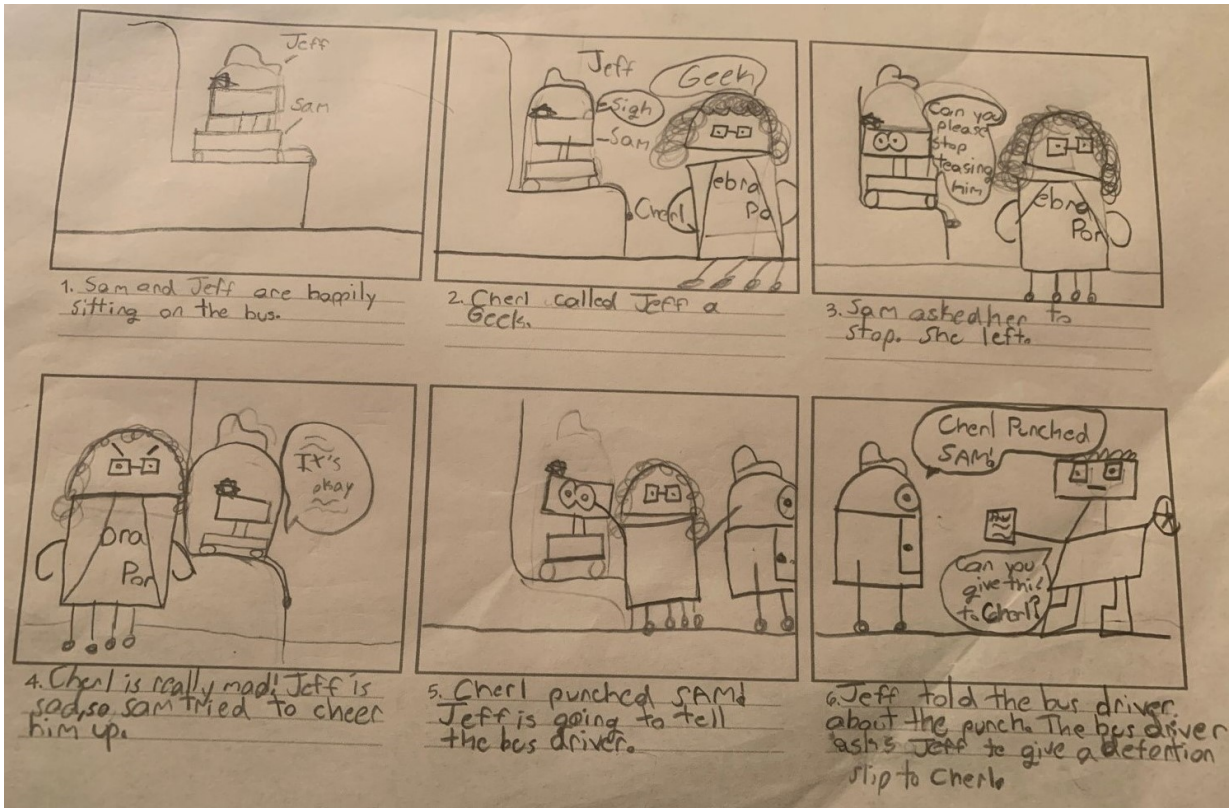


Figure 4.7: A storyboard made by a participant.

facial hair, teeth, eyebrows, and specific hairstyles in their robot sketches [P23-SK]. About 30% of children described their robot's facial features to be machine-like (e.g. "*tablet face*" [P48-B], "*camera eyes*" [P10-B], "*mouth LEDs*" [P7-I]. Also, over 60% of the participants explicitly specified that their robot has upper and lower limbs.

Robot Behavior

This theme includes excerpts that were coded with robot *traits*, *preferences* and *sociality*.

Traits: This category includes excerpts coded with robot's values, characteristics, and bad habits. Some of the designs implied that children envisioned robots as capable of having certain values. For example, over 40% of children explicitly mentioned that a robot dislikes bullying, bullies, or mean people, or defends its classmates that are bullied, e.g. "*It will not like mean people*" [P45-B], "*Dislikes rainy days and bullying*" [P21-B]. Near 30% of children explicitly described their robot as caring about grades, listening to the teacher, and working hard at school, e.g. "*Obeys teacher*" [P37-B]. A few also mentioned other values, for example P37 explained that a shot of the garbage in the garbage can in his animation was to show that the robot does not litter. Finally, a few children described their robots values to be embedded in the design, for instance, P48 described a certain robot was "*designed to be nice*", but got the "*bully virus*" in the interview. Furthermore, excerpts from 15% of children were coded with robots having bad habits like cheating, stealing, and lying. Of the 110 excerpts coded as characteristic, nearly 60% were positive traits, with the majority of participants (over 85%) describing at least one robot to as nice, helpful, friendly, or empathetic, and over 35% describing their robot as intelligent, or knowledgeable. Others described their robots as happy, grateful and funny. About 25% of the extracted characteristics were coded as neutral (e.g. ambitious, emotional). The neutral traits were quite diverse, and only one emerging theme was identified with 20% of participants describing a robot as shy, or quiet. Finally, less than 20% of children described a robot with negative traits such as lazy, evil, rude, annoying, mean, impatient or clumsy.

Preferences: This category includes excerpts coded with robot's general preferences, social needs, and hobbies. Children mentioned diverse activities that the robot would enjoy, e.g. swimming, watching Korean dramas. 45% of participants explicitly mentioning that their robot enjoys playing with others, e.g. "*S-e [robot] was having so much fun [playing with a friend] that he ignored the signs that he needed to charge*" [P6-ST]. Nearly 20% described their robot as having social needs and preferences, e.g. "*likes to hang out with friends*" [P51-B], or "*likes hugs*" [P10-B]. Over one third described robot's personality by its general preferences (e.g. food, colors, school subjects).

Sociality: This category includes excerpts coded with robot's relationships, and experiences. More than 40% of children envisioned robots to have family members such as parents and siblings, e.g. "*Angelina [Robot] is taking her siblings home from school*" [P24-ST]. Also, over 70% explicitly mentioned their robot having or making human or robot friends, e.g. P2's storyboard shows two robots shaking hands and is described by "*He makes a new freind*" [sic]. Children also described robots capable of having diverse experiences such as being scared, writing homework, waking up, or having birthdays. The main theme that emerged from the experiences was related to bullying. While there were many stories that involved aggressive behavior, we only coded excerpts with bullying experience in this category if the child had mentioned the term. Over 45% of the participants described a robot as being bullied, or having bullies, e.g. "*He [robot] cries. The bullies call him a cry baby.*" [P44-ST], or "*[Robot's mom about robot:] I don't know what to do he's been bullied again.*" [P23-ST]. Also, two children mentioned that the bully character in their story is also a robot, or sketched it as a robot; and two children explicitly described a robot in their story taking a bystander or defendender role, "*the Snuggler #2 saw the Snuggler #1 being bullied so she went up to the bully and yelled STOP.*" [P10-ST].

Robot Features

This theme includes excerpts from children's designs that were coded with one of the following categories: *equipment*, *skills*, *emotions*, *communications*, *limitations*, *names and inspiration.*

Equipment and Functionalities: Themes emerging within this category suggest that children imagine robots with various built-in equipment and functionalities. Nearly 80% of participants indicated that the robot can move, or designed equipment that help the robot move. Many children described robots with wheels, legs, or slides; e.g. "*it moves on roller blade feet. it has a mini skate-board but for each foot, that has straps like a sandle*" [sic][P8-B]. A few children came up with more other ideas such as robots being able to move with a spinning stick on its head [P45-I], hop on a single stick [P36-SK], hover [p1-B], or use "*movers*" with tiny wheels [P24-B, SK]. About 20% of children indicated that the robot has gripper hands, while a few other children described other equipment on robot's upper limbs; P24 describes that when the robot's sibling falls down, "*she helps them up with her magnetic pencil*". Children also described robots with other embedded tools, for exmaple to help them perform their job (e.g. sensors that diagnose diseases for a doctor robot [P1-I]), or their hobbies (e.g. built-in 3D printer and lego instructions for a robot that likes building legos [P11-I]) or is in lines with their design values (e.g. solar-panels for an environment-friendly robot [P48-I]), or for general purposes (e.g. speaker, control buttons, programs, charging station).

Skills: Participants envisioned robots with diverse perceptual and physical capabilities. One of the themes emerging from this category was learning and adaptive robots. Over 30% of children described their robot's ability to learn, improve, or adapt; P47 described in his brainstorming notes that the robot "*learns like monkeys*", and explained in the interview that this means the robot learns by imitating people. Another participant described his robot as "*it is ai, with an everchanging personaLity*"[sic][P48-B], or P6 explained in the interview that his robot can use "*big vocab*", but will also adapt and explain things to children in understandable way. One third of the participants described the robot having art-related capabilities such as dancing, drawing, and playing musical instruments. Robots were also envisioned as getting good grades, and being good at certain subjects (e.g. robotics, math) by 30% of children.

Emotions: We identified themes in the data that indicate children envisioned robots capable of experiencing, expressing, and understanding emotions. While only 30% of children explicitly mentioned robots experiencing emotions, (e.g. "*Belle [robot] learns being nice feels good*"), the majority (over 85%) indicated that robots are capable of expressing emotions (see Fig. 4.7). While most designs used facial expressions, some also described robots using other modalities such as crying and sighing. Finally, about 30% of children hinted that robots' emotions are dynamic, e.g. "*student e [robot] talks to the inventor and is comforted by the fact that he is loved*" [P6-ST].

Communication: While the majority of children described robots communicating with others verbally, none of them explicitly specified this as a requirement. Some children indicated other details or modes of communication for the robot, such as speaking multiple languages [P36-B], sounding like a kid, or jingling [P10-B], or its battery beeping before it dies [P6-ST]. Finally, nearly 30% of children explicitly designed robot's voice (pitch, tone), and accent, e.g. "*not computerized, mabe aplfyed [maybe amplified]*" [sic] [P23-B], or "*voice is American*" [P48-B].

Limitations: About 70% of the participants indicated that their robot had certain failures, needs, and limitations. Over one third described the robot failing or being bad at school, or sports, e.g. "*crystal [robot] did not study and she got a F-.*" [P51-ST], "*he came last in standing long jump*" [P6-ST]. Over 30% indicated that the robot needs food, and one mentioned robot battery needs recharging. Finally, more than half mentioned their robots having limitations such as imperfect speech, motion, memory, pr attention, for instance, P8 has described her robot's behavior as "*Odd (quirky). questionable (mistakes)*" [P8-B], and P50 describes her robot as "*nice but gets distracted a lot*".

Names and Inspiration: Children's preferences of robots' names were diverse. Half of the participants gave their robot human-like names, e.g. "*Trevar*" [P21-B], or "*Mary Jane Goldenstein*" [P24-B]. Some children gave their robot machine-like names, such as "*CSH*

(Computerized Student Helper" [P20-B], or "*fr0a*" [P2-B]; or named them after fictional characters such as "*Andrew 2.0*" after Animal Crossing video game [P19-B,I]. A few named their robot such that it would reflect its characteristics, e.g., "*the bluey blue robot*" [P10-B]. While we did not ask children how they arrived at the final designs of their robots, about 35% of participants specified an inspiration for their designs. A few mentioned fictional characters such as Wall-e, R2D2, C3PO, and YouTube Characters, or other robots (i.e. a cleaner robot) as their source of inspiration. For example, one participant pointed out that her robot is based it on a YouTube character called "*Honey the unicorn*" and explained that it is unicorn that tries to teach kids that everything is possible [P44-I]. A few children came up with designs that reflected some of their own characteristics by indicating that the robot has sounds, talks, walks, or looks like them, e.g. "*It will look like me! I will talk like me.*" [sic] [P45-B].

4.9.2 Narrative Design

This affinity diagram included three main themes: negative interactions, neutral interactions, and positive interactions.

Negative Interactions

We observed that many children had mentioned bullying, or aggressive interactions between peers in their stories. Given that one of the goals of this study is to extract concepts to support developing REMind's narrative, we differentiated in this category between negative interactions that could be interpreted as bullying given the right context (i.e., even if the child had not explicitly labeled it as bullying), from ones that were irrelevant to bullying. Also, as two participants had not completed any of the story-writing, animation, and interview steps, which were the sources of data for this affinity diagram, we excluded them from the reported percentages.

Not Bullying-Related: We did not observe any strong themes in this category. However, a few children described the robot having a bad day for reasons related to their performance at school. For instance, one participant describes the reason her robot is upset as "*Belle lost her homework so she got a zero*" [P49-ST]. Also, a few described negative interactions due to accidents, or something the robot had done, such as getting in trouble because of cheating [P2-ST].

Bullying-Related: The excerpts we extracted from children's stories included robots being subjected to various aggressive behaviors from their peers. 60% of children described

robots being called names, getting yelled at, or getting mean comments from their classmates. Most of the mean comments were related to the robot's performance at sports (e.g. "*my robot was getting teased because he was slow [at the gym]*" [P7-ST]), or its grades (e.g. "*[Classmate:] You got a bad grade! I got one hundred! [Robot:] Stop being mean please!*" [P57-ST]. Also, 45% of children described robots being made fun of and laughed at by their peers, for example because of their appearance (e.g. "*the boy made fun of robot's arms [for being too short]*" [P21-ST]), or differences (e.g. "*Belle [robot] got a 100 and Rhonda [human] said it is only because she is a robot*" [P49-ST]). Half of the participants described the robot being subjected to physical violence such as punching, kicking, pushing, slapping, throwing things at them, turning them off, or making them trip e.g. "*the bully THREW the chestnut right at Cali's [robot's] FACE!*" [P8-ST]. Excluding was mentioned in designs of 20% of the participants, for instance, P1 wrote in his storyboard that "*Mike the robot was at school when all of a sudden his friends all started to ignore him. they all played games without Mike and always discluded him*" [sic], or P37 described in a story that when a sad robot on the school playground was asked what's wrong, it replied "*There are numerous games going on and I'm not aloud to play any*" [sic]. Some children (20%) mentioned peers spreading rumours about the robot or telling their secrets to other classmates, e.g. "*Ruby [robot] was spreading rumors about Alex [robot]*" [P50-ST]. Finally, a few children described robots having their properties stolen (e.g. homework, wires), or damaged (e.g. "*a mean robot came and ripped a beautiful drawing I [robot] made*" [P2-ST]).

We also observed a theme of bullies being a group of people, or other peers joining in with the bully in excerpts from 20% of children. P51 described in her story that "*As soon as she [robot] came out everyone shouted F- and laughed*", and explained in the interview that the other kids joined in because the aggressor is "*one of the popular kids*". A few children hinted at the repeated nature of bullying, e.g. "*this [name-calling] made the Snuggler #1 [robot] really angry this was the 5th time it happened*" [P10-ST]. Furthermore, the stories suggested that bullying is envisioned to take place in places with the least supervision from adults. That is, 35% described aggressive behavior to take place during recess, on the school field, or playground, 15% indicated that it was at cafeteria, and others mentioned school bus, hallways, or the sidewalk. Some children (25%) explained that the reason for aggressors' behavior is that they are jealous of the robot, or the robot is new to school e.g. "*because they were jealous of student-e and its capabilitys*" [sic] [P6-ST].

Children described diverse responses from the robots and peers to the aggressors. For example, 20% mentioned the robot looked sad, or started crying, e.g. "*they laugh at him [robot] and call him a loser. He cries.*" [P44-ST]. Also, 25% explicitly described bystanders ignoring the bullying, the robot being abandoned by its friends, or feeling lonely, for example, P19 explains that robot's sister who reported its bullying "*would*

probably ignore it" if she was there when it happened. Another child mentioned the bullied robot did not ask for help and explained "*a few kids at my school sometimes ask for help, but I think bullies eventually stop*" [P20-I]. Also, 25% of children described the bystander peers (robot or human) taking action about a robot being bullied by confronting the bully, including them in their play, or getting an adult (see Fig. 4.7). A quarter of participants indicated that the robot would stand up to its aggressor, e.g. "*when he [robot] finally told them to leave him alone, they dumped ketchup on him*" [P23-ST], or "*[Robot that was excluded from the birthday party:] If I am a nerd I like nerds, I do not want to go.*" [P51-ST]. Also, 35% of participants mentioned the robot opening up to its family, or informing the teacher and some added that the family member would report the incident, for instance P19 explained that after the robot tells its sister about a "*bully*", she will "*call parents to make apologize*" [sic] [P19-ST]. 40% of participants described the teachers or staff intervening by giving the aggressor detention, or taking them away e.g. "*the bully... well, he's in detention*" [P8-ST]. In addition, 35% described the robot being comforted by peers, family members, or teachers after it was subjected to aggressive behavior, e.g. "*so the nice kid offers Cali [robot] some gum as she sees she's unhappy*" [P8-ST], or "*[Robot:] someone bullied me. [Friend:] oh... I know how you feel...*" [P23-ST]. Finally, a quarter of participants described that the bullying stopped, the bully apologized, or became friends with the robot after they were confronted or got suspended, for example P50 shows in her story that after "*Ruby apologizes for spreading rumors*", the robot says "*It is OK*", then they hold hands and say "*Best Friends!*".

Neutral Interactions

Excerpts in this theme were diverse and included robots doing many everyday tasks such as using transpiration, or eating. We observed that robots showing curiosity or concern about their peer's behavior was mentioned in 40% children's stories, for example P37 shows in his animation that a robot notices another robot and thinks to himself "*he doesn't seem to be having fun, I think I'll go ask him what's wrong*".

Positive Interactions

We observed a theme of social activities in children's happy stories. This included robots spending time with friends, meeting new people, helping and getting help from peers. 45% of children mentioned robot playing with peers as a positive event, for instance, P1 describes in a story that after robot's friend cheered him up "*Mike is now happy and they played together outside*", followed by "*Mike is now super happy!*". Also, 30% described the

robot helping or receiving help from peers, sharing something (e.g. snacks), or teaming-up with them at school as a positive event, e.g. "*[Robot:] I guess I wish I studied. [Friend:] oh I will help you study. [Robot:] thank you your the best*" [sic] [P50-ST]. Children also mentioned the robot getting positive evaluations of receiving gifts as happy events. In particular, 30% of children mentioned robots getting happy because of a good grade, or winning a race or a contest, for instance P10 describes "*When the Snuggler #1 [robot] went to school today she found she had won first place for cleanest desk*", and later adds "*This was the best school day ever for the Snuggler #1*", or P1 explains "*Murphy [robot's friend] will cheer up Mike [robot] by telling him jokes and telling him how good he is*". Finally, 30% described robots being happy about exciting events such as field-trips, or parties. For example, P22 shows that a robot celebrates by having a party, "*Ted ges what I got an A+ on my test We should sellabrate with a pizza party*" [sic].

4.10 Lessons learned

In this work, we present qualitative observations and insights from a remote co-design study with children (8-12 years old) in which they designed and crafted *student robots* and devised stories about their interactions. Our findings extend our understanding of how children envision such robots and their social interactions and inform the design of interactive narrative and robot behavior models of REMind: a robotic system that aims to empower children against bullying, and foster peer support. This work also contributes insights for designing pedagogical agents and anti-bullying interventions for children. Below, we share the lessons we learned from this study, and provide recommendations for future work on pedagogical robots and empathic agents, ICT-based anti-bullying interventions, and interactive storytelling technologies for children.

4.10.1 Emotionally Expressive Social Agents

We observed that over 85% of out participants designed robots capable of expressing different emotions. Even though the remaining 15% did not explicitly mention robot's expressive abilities, they had sketched robots showing facial expressions (e.g. smiling [P53-B]), or verbally expressing themselves (e.g. a robot that got a top mark on a test says "*Yay*" [P2-ST]). This suggests that children understand emotions as a useful medium for communication and envision social robots to express emotions. Even though the field of HRI has explored various emotion expression modalities such as using lights, vibration patterns, sound and non-linguistic utterances (e.g. [338]), children in this study unanimously opted for human-like expressions using visual, lexical and vocal modalities.

A recent review of emotional expressions in HRI points out that it is common in the field to use emotions as a tool to communicate robot's internal state; whereas researchers can benefit from an understanding of emotional expressions as context-dependant and socially-determined [126]. This is in lines with research on emotion psychology that suggests emotions have various social roles such as helping individuals with action selection, and acting as a social manipulator by eliciting social responses form their counterparts. [145]

Furthermore, Prior work suggests that incorporating realistic emotional display in agents can increase their believability and cue the user to interact with them similarly to how they would with other humans [145], which can in turn increase their trust and empathy [277, 86]. Also, researchers argue that exploiting emotions in educational agents can guide students' effective learning by influencing their motivational state [145]. However, emotion psychology also suggests that emotions are "fertile" in the sense that they can have different and sometimes contradictory meanings for individuals [145]. This is exacerbated by the fact that people, especially children [281] often use misleading cues in decoding the emotions of others, which can lead to misinterpreting the emotions of artificial agents. [145, 140]

One solution to enhance the interpretability of the intended signals is to facilitate the decoding of emotional display and thus maximize users' ability to read the character's emotions by using simple yet exaggerated signals, similar to children's designs and cinematic conventions. However, scholars raise a critical flag about how such conventions could lessen the transferability of the pedagogical goals to real-world situations where behavioral responses may be muted or obscured [145, 81], which is specifically important for children as they develop their emotion understanding. Therefore, we recommend interaction designers for children to make use of communication affordances of emotionally expressive agents, and strike a balance between communicating simple and easy to decode emotions with familiar visual and lexical modalities, and avoiding overly unnatural and stylized behaviors.

4.10.2 Robots as a Vehicle for Exploring Sensitive Topics

Even though we did not mention the term bullying to children, the majority of them described robots being subjected to aggressive behavior in school, and many explicitly labeled it as bullying. These observations provide qualitative evidence that children are able to elaborate on various bullying-related scenarios where robots take on the roles of aggressors, victims, or bystanders. We also observed that several children had taken inspirations from their own characteristics to come up with their robot designs. This is in lines with prior work suggesting that children can self-reflect, and project their own issues, fears, feelings,

and interests into robots, and argues that robots may be a good vehicle for exploring sensitive social topics such as bullying [387, 278]. As such, related work has proposed using robots as mediators in interviewing children about traumatic and stressful experiences [386]. We believe robots can provide a safe medium for children to explore emotional and sensitive issues because, unlike humans, they are *non-judgemental* [352]. Also, they quite literally enable children to see the world from another being's eyes, which facilitates perspective-taking [385]. As such, we encourage future technology-based interventions to explore the potentials of using robots as mediators.

4.10.3 Customizability and Sense of Ownership

Many of our participants created robot designs that were highly customized, for example, by detailing robots' clothing and accessories, using colors and decorations, picking unique names, or specifying characteristics such as robot's pitch, or preferences (e.g. favorite color). Marketing research illustrates that customization impacts the subjective value that users attribute with a product beyond merely providing a preference fit [127], and imbues them with a sense of agency [350]. They argue that this subjective value arises from the fact the individual "feels like the originator of that object", and creates a sense of psychological ownership similar to that of making a painting compared to buying one off-the-shelf [127]. Researchers suggest that children find customization of robots valuable, and it increases their engagement [349, 25]. Some social robots and games (e.g., Blossom [349], EyePet [114]) take advantage of this by allowing the users to customize agents' appearance. Given children's readiness to customize robots observed in this study and prior work (e.g. [349]), and the low effort required to realize some of their design choices (e.g. agent's voice, name, accessories, decorations), we recommend future work to facilitate children's customizations of such agents.

4.10.4 Designing Imperfect Synthetic Characters

As we observed in this study, children designed robots as intelligent characters with mostly positive traits that are imperfect. This resembles Aristotle's *tragic hero*, who is a virtuous protagonist that is capable and powerful, yet flawed [255]. This tragic flaw (or *Hamartia*, derived from a Greek word meaning to err) is arguably what makes the protagonist someone that the audience can identify with [232], rather than an unreachable hero. Related work posits that designing robots to be "too perfect" makes it difficult for humans to relate to the robot naturally [37], whereas minor imperfections make the robot "real", and endow it with a personality [209]. Prior research in human-robot interaction suggests that implementing

cognitive biases and imperfect behaviors in social robots may encourage their acceptance as long-term companions [37]. Building on this, we encourage future work to explore imperfections in designing synthetic characters for children, and investigate its effects on metrics such as agent's relatability, likeability, and ability to elicit empathy.

4.10.5 Scaffolded Improvisation in Interaction Design

Finally, one takeaway for us from this study was that children like to explain the world. That is, when we asked our participants probing questions about their designs, they seldom replied with "I don't know". We argue that it is not for a lack of comprehension that children devise fantastical worlds where for example robots have parents; but rather an evidence that they are accustomed to fiction, which affords them the flexibly to bend the logical rules and improvise. They do not necessarily need everything to perfectly mimic the real-world logic to accept it, go along with it, and make fictional parallels to their own reality. That said, it is only pragmatic to scaffold children's visionary ideas within the right context. For instance, rather than asking children to design any robot, or for example, a child-robot, we guided them to design *student robots* for the purposes of this project. Prior work exploring children's interactive story-telling with a robot suggests that using techniques such as allowing children to make decisions about the narrative increases their engagement and sense of agency [230]. We recommend the designers of interactive narratives with children to set the scaffolds, but also leave room for them to improvise and make the story their own.

4.11 Discussion

This study presents a co-design approach involving children aged 8–12 to inform the development of characters and narratives in REMind. Participants were asked to envision "student robots" and create stories about their social interactions, including bullying scenarios. Results show that children conceptualize robots as highly customizable, imperfect, and socially expressive characters capable of assuming roles such as bully, victim, or bystander. These insights can inform the design of pedagogical robots and anti-bullying interventions that are both relatable and developmentally appropriate. They also highlight the potential of robots as a safe medium for exploring sensitive social issues and fostering peer support.

Our approach was grounded in the Cooperative Inquiry (CI) framework but modified to accommodate the remote nature of the study, the absence of direct facilitation, and indi-

vidual rather than group-based participation. To support children with diverse expressive and cognitive abilities, we incorporated a range of idea generation and elaboration tools tailored for asynchronous engagement.

Sanders & Stappers describe that in co-design, the researcher shifts from being a *translator* between users and designers to adopting the role of a *facilitator* responsible for supporting the ideation and expression of users (as experts of their own experience) [316]. They identify four levels of creativity: *doing* (getting things done), *adapting* (making things your own), *making* (making things with your own hands), and *creating* (expressing creativity). Based on this, they describe the role of researchers in co-creation to *leading* people at the doing level, *guiding* the ones at the adapting level, *providing scaffolds* to support those on the at the making level, and *offering a clean slate* to the ones at the creating level.

Our study design intentionally supported all four levels. In order to *lead* children that were looking for inspiration, we provided them with clear step-by-step instructions and many examples [6], such as specifying which recycling materials would likely be useful for them to collect. To *guide* those at the adapting level, we explained to children that they can go beyond the recommended material and methods with the supervision of their parents. We provided *scaffolds* by giving children templates for brainstorming, story-planners with guiding questions about their stories, and story-boards. Finally, we offered them a *clean state* by introducing them to an animation-making technique and giving them freedom in choosing what to animate, and asking them open-ended probing questions in the interview.

This research contributes to HRI by demonstrating the feasibility and value of design processes that treat children as co-creators rather than informants. The methodological adaptations proposed here offer a model for future studies aiming to elicit children's situated knowledge, perceptions, and imagination to contribute to design of future robotic technology.

4.11.1 Limitations

This study was conducted remotely due to the COVID-19 pandemic, which introduced several challenges. Of the 57 families invited, 35 either formally withdrew or ceased communication. In several cases, participants required significantly more time than anticipated to complete the study, and some did not complete all steps. These issues were largely attributable to the lack of direct researcher supervision and parents' limited availability due to remote work and pandemic-related constraints. In some cases, children also lost interest over time.

[6]For example, see our curated inspiration board for Upcycled Robot Art on Pinterest

Although the study protocol did not mention bullying to children, parents were informed that the research aimed to inform an anti-bullying intervention. Follow-up interviews revealed that four parents [P21, P22, P53, P57] had conveyed this to their children, potentially introducing bias into their design decisions.

In addition, best practices in co-design emphasize team-based design activities supported by adult facilitators to encourage peer dialogue and collaborative idea development [112]. These conditions were not feasible in our setting, which relied on individual participation without real-time facilitation.

Finally, this is an exploratory study and the researchers have relied on their own subjective opinions to determine some steps in our thematic analysis (e.g. in categorizing traits). We acknowledge that the implications of this study are discussed to make analytical speculations, rather than statistical generalizations.

4.12 Chapter Summary

In this chapter, we presented a co-design study with children to investigate how they envision fictional social robot characters and construct stories about their peer interactions in school. Throughout various phases of REMind's development, we revisited the dataset of children's ideas collected in this study time and again. Insights from this study directly informed multiple aspects of REMind's design—its characters, conflicts, and story arcs.

Our findings highlight the centrality of emotion in children's storytelling. For instance, we observed that children unanimously designed robot characters capable of showing facial expressions, and over 85% explicitly indicated that robots can express emotions. This finding played a central role in our choice of robotic platform: we selected Furhat [9], because unlike traditional robotic faces with moving parts and actuators, it uses a projector to display expressions onto a 3D-printed translucent mask, which enable displaying a wide range of emotional expressions.

In addition, the peer dynamics reflected in children's stories, including how characters experience and react to peer bullying, helped us identify narrative beats that feel authentic and relatable to our target audience. Importantly, children's stories gave us insight into how peer dynamics and bullying are emotionally experienced. Rather than just describing how bullying happens, children's drawings commonly depicted the emotional experiences of characters.

At the same time, this study raised key design questions. While children's stories captured how bullying feels, they offered fewer insights into the *realistic* consequences of

peer intervention. This gap prompted us to ask: What responses are realistic in school settings? How do teachers and peers typically react to a bystander stepping in?

To address these questions, we turned to educators. In the next chapter, we report findings from interviews with local teachers, focusing on the real-world dynamics of peer bullying, existing intervention strategies in schools, and the gaps that an anti-bullying game like REMind might fill. These insights guided the development of REMind's core game design elements, aiming to create an intervention that is not only engaging but also grounded in the social realities of school life.

Chapter 5

Grounding in Context: Elicitation Interview with Local Teachers

"A game that intends to persuade will skew its mechanics to make its point."

— Adams, E., & Dormans, J., *Game Mechanics: Advanced Game Design*

This chapter extends the previous co-design study with children, in which participants created fictional robotic characters and imagined their social interactions. While that study foregrounded children's creative and experiential perspectives, the present work complements it by grounding those imaginative designs in real-world educational contexts.

We conducted semi-structured interviews with 13 local elementary school teachers. Specifically, we focused on the experiences and perspectives of teachers working with children in grades 3–6 (ages 8–12), the developmental period during which bullying behaviors often begin to emerge and become socially normalized [246].

These interviews focused on understanding how bullying manifests in schools, the anti-bullying protocols currently in place, their perceived effectiveness, and typical peer responses to bullying. Since peer engagement is central to the success of pedagogical games, it is crucial that such interventions include realistic portrayals of bullying and avoid overly simplified or stereotypical narratives [144].

Teachers play a key role in identifying and addressing peer bullying in school settings [104]. Supportive teacher involvement has been shown to contribute significantly to positive school climates and reductions in bullying incidents [22]. As such, teachers offer a valuable adult perspective, informed by both policy and practice, on the dynamics of peer conflict and intervention. At the same time, research also highlights important limitations: teachers

may underestimate the prevalence of bullying, be unaware of certain incidents, or become desensitized to them over time [257, 204, 90]. These issues are compounded by students' reluctance to report bullying, often due to fear of retaliation or escalation [384].

To develop effective and contextually grounded anti-bullying interventions such as REMind, it is essential to incorporate insights from both children and educators to gain a well-rounded understanding. This dual-perspective approach supports the creation of interventions that are not only engaging and relatable but also socially and pedagogically relevant. Importantly, for long-term deployment to be on the horizon, the design of such a system must be grounded in what educators need.

In the remainder of this chapter, we first outline the methodology and protocol used for the teacher interviews. We then present a qualitative thematic analysis of the data, highlighting teachers' perspectives on how bullying occurs, how peers respond, and how current anti-bullying interventions succeed or fall short. Finally, we discuss how these insights inform the narrative and game design considerations of REMind.

5.1 Research Questions

This study explores the following research questions:

RQ1 What anti-bullying programs and protocols are currently in use in our local elementary schools?

RQ2 How does peer bullying typically manifest in these school settings?

RQ3 How do children respond to bullying incidents, either as bystanders, targets, or participants, and what are the observed consequences of peer intervention?

By investigating these questions, we aim to identify actionable insights for designing an anti-bullying intervention that is both developmentally appropriate and grounded in the social realities of the classroom.

5.2 Interviews with Teachers

5.2.1 Recruitment

We promoted the study on media groups and asked interested teachers of grades 3 to 6 in local schools to contact us. Teachers digitally signed a consent form prior to the interview,

and we thanked them with a $15 e-gift card afterwards. This protocol was approved by the University of Waterloo Research Ethics Board.

5.2.2 Participants

We recruited 13 teachers with experience of teaching grades 3-6 in Canadian elementary schools (with almost equal distribution of an average of 4.75 teachers experienced with each grade). Participants had 2-32 years of teaching experience (M= 12.3 years, SD=9.1). Among them, 7 teachers taught in public schools, 2 in private schools, 2 in religious schools and 2 in French-Immersion schools. This distribution is in approximate accordance with the number of schools in Canada.

5.2.3 Procedure

The interviews were conducted online or over the phone. At the beginning, teachers briefly described their teaching experience and if they had also taught classes outside of our grades of interest, we asked them to only draw on their experiences with grades 3-6 for answering the questions. We explained that bullying is typically a repeated behavior and offered a definition from Olweus [271]: *"We say a student is being bullied when another student, or several other students say mean and hurtful things or make fun of him or her or call him or her mean and hurtful names; completely ignore or exclude him or her from their group of friends or leave him or her out of things on purpose; hit, kick, push, shove around, or lock him or her inside a room; tell lies or spread false rumors about him or her or send mean notes and try to make other students dislike him or her and other hurtful things like that."*. We conducted the interview revolving around the research questions and asked probing questions whenever appropriate to gain in-depth information (e.g., can you tell me more about it?). The interviews were audio-recorded and lasted about 45 minutes.

5.2.4 Analysis

We transcribed the interviews and used the NVivo software [174] to conduct thematic analysis [52]. Since this was an exploratory research, we used inductive coding to code excerpts from the interviews. The codes were later collapsed into the categories that best reflected the analyses. We discussed the categories as a group, refined them, and determined the overarching emergent themes.

5.3 Qualitative Observations

This section reports on the prominent emergent themes that we observed around our research questions and the lessons learned. Following thematic analysis guidelines [52], we retain some flexibility in determining the emergent themes. That is, we avoid being entirely dependent on quantitative measures and rather report analytical speculations that capture important concepts in relation to research questions.

5.3.1 Anti-Bullying Programs in Schools

Bullying prevention

The majority of our participants stated that their school has no specific anti-bullying programs (10/13). Among those, some mentioned general strategies (2/10), a zero-tolerance policy for bullying (2/10), or curriculum support to teachers instead (3/10). Only three teachers (3/13) cited school-wide programs; although bullying was not the specific focus of any of them (e.g., *Buddy Bench*: a designated bench in school that a child can sit on when they need a friend). Several teachers (7/13) explained that their schools hold one-off events, such as presentations (5/13) or assemblies (2/13). Overall, teachers found the anti-bullying protocols unsatisfactory and pointed to insufficient education, and lack of organizational strategies and repercussions for bullying (4/13). *"We try to keep everything done in the classroom, because as soon as we try and go higher up, we know that the students are being sent back and that the issues are going to keep repeating themselves."*[T10]. This observation confirmed that there is a need for novel anti-bullying interventions in local elementary schools.

Focus of strategies

The majority of participants believed that schools delegate dealing with bullying to teachers (9/13). The focus of the teachers' strategies against bullying can be categorized into three themes: (i) mediation strategies (6/13, e.g, providing an intervention script), (ii) education about bullying (e.g., discussing what is bullying, 3/13), and (iii) fostering social skills and values (e.g., inclusion 5/13). For example, T4 explained that they teach children: *"...to keep the friends together, to stand up for each other, to include the ones that someone else has excluded, just to prove to the bully that they are valued."* [sic]. This guides our intervention approach and narrative design in REMind.

Effectiveness of Programs

Participants' opinions about the effectiveness of the programs varied. A few teachers (3/13) speculated about the reasons behind ineffective programs include: (i) scenarios being created by adults, (ii) scenarios being outdated and irrelevant to children, (iii) isolated lessons, rather than ongoing interventions, (iv) researchers not being in-tune with the reality of the classrooms and designing generic programs. *"I would get the kids to help come up with scenarios, not just the run of the mill program that they did in 1990, which is very outdated now."* [T19]. This validates our approach of co-designing with children, and interviewing teachers to ground our designs in reality of the classrooms rather than traditional definitions. Also, this theme indicates a need for longitudinal interventions (e.g., serious games), rather than one-off lessons.

Protocols against bullying

If bullying happens in the classroom, teachers often address it themselves (13/13) by investigating the incident and solving the issue to give children choices to resolve their problem (e.g., "*this needs to stop or parents will be notified*"). Sometimes teachers intervene by taking away privileges (e.g., disabling chat in a virtual classroom). If it is a serious or repeated instance, they notify the parents and ask the school social worker or the principal's office to intervene (13/13). At this point, some schools discuss a behavior plan that outlines how they will react should the student continue the problematic behavior. Teachers mentioned that in serious cases, the principal's office may do an "*in-school suspension*" (4/13); *"they basically just in a room in the office. They were just basically doing nothing, which in my opinion, is not super helpful."* [T14]. This highlights that even when anti-bullying strategies exist, a great deal of work is put on the teachers. So, they may benefit from stand-alone intervention approaches that lessen this burden.

Peers' knowledge of bullying

The majority of teachers agreed on two points: (i) children know the basics about bullying (7/13), and (ii) children, especially at younger grades, often overly report or label conflicts as bullying, when it is in fact teasing or joking (9/13). *"We have kind of a mix of children's ideas of what bullying is. I find the younger they are, 'oh, so and so took my pencil, they're bullying me', and it's like, no, that's not really what bullying is."* [T3] [sic]. REMind could demonstrate the fine line between bullying and teasing; for example, by leveraging various scenarios with nuanced differences and encouraging children to reflect and determine what constitutes bullying.

5.3.2 Peer Bullying in Schools

Frequency and intensity

More than half of the teachers believed that bullying happens *"all the time"*, or on a daily basis (7/13), and several mentioned that it happens frequently (6/13)– *"I would probably say it happens daily, but the amount of times that teachers actually get told about it, not as often. They just keep it to themselves, they're not telling adults."* [T14] [sic]. Also, several teachers highlighted that even though bullying happens frequently, it is typically committed by very few peers who target many people (5/13). Several added that sometimes bullying can last as long as several years (7/13). This reaffirms that despite an abundance of research, bullying is still a prevalent problem and exploring novel interventions against it remains relevant.

Types of bullying

Among the types of bullying listed in the definition offered by Olweus [271], (i) Exclusion (12/13), mean remarks (8/13), spreading rumors (8/13), and name-calling (5/13) are still very common in local schools. However, physical bullying and stealing happen very rarely – *"I remember when I first started teaching... every couple of weeks, there was a schoolyard fight. Like, in the 90s! Punching, kicking, pulling hair, you know, the whole thing. And I haven't seen a fight like that happen in... wow, I don't even know."* [T22] [sic]. It is evident that dynamics of peer bullying have changed drastically over the past decades, which may challenge the contextual validity of traditional interventions.

Where it happens

There was a consensus among the participants that in-person bullying typically happens in unsupervised environments (11/13, e.g., recess, cafeteria) or unstructured times (5/13, e.g., break time) where it is difficult for staff to supervise everyone – *"anywhere where there's not a teacher or an adult visible?"* [T1] [sic]. The majority (9/13) pointed to cyberbullying as one of the common types of bullying not listed in the definition. A few (2/13) believed that it is uncommon because phones are banned on the premises and school devices are monitored, whereas several pointed that online bullying is not confined to school (4/13). The majority of teachers (7/13) were concerned that cyberbullying is becoming increasingly common due to online classrooms, social media, access of young children to technology, and the invisibility offered by a virtual world. *"Cameras were on for all the students for a*

while. So then the kids would tell each other 'oh look what you're wearing, look what your room looks like'... all these students have cell phones, they will take a picture of someone, they will go online and make a meme out of it. And then they take the meme and share within their social media platform." [T20]. This provides input for designing scenarios for REMind that reflect children's present day experiences.

Why it happens

According to the participants, the common reasons of peer bullying includes bad parenting (5/13, e.g., little supervision of online activities) and personal trauma (5/13, e.g., having been bullied themselves). Teachers cited differences in ones appearance (6/13, e.g., different physique or fashion), being a minority, or having immigrant or refugee status (5/13, e.g., different food or accent), or a low socioeconomic status (4/13), as factors that could lead to a child's victimization –*"They exclude someone because she doesn't have the proper fashion sense or she's wearing very old shoes or her hair is not done, or makeup is not done, or she's just like physically different."* [T20]. This observation supports exploring role-play as a medium to help children take various perspectives, reflect, and build empathy.

Gender differences

All teachers had noticed gender differences in bullying; they explained that girls tend to do more "social bullying" such as exclusion (7/13), are more verbal (6/13), subversive (6/13) – *"Oh, they can be nasty and it's very subtle. Girls are definitely more the emotional strains. They are the social type."* [T4] [sic]. Whereas boys tend to exhibit more physical bullying (e.g., pushing) than girls (6/13), and they typically resolve conflicts faster after an incident (4/13). Teachers mentioned that it is more common for boys to bully someone over their athletic abilities (6/13)– *"boys will make fun of other boys athletic ability, 'you're not fast runner, don't play soccer.', and then they'll bring that point across by choosing that person last for the team or just not letting them play at all."* [T22].

Age differences

Several teachers expressed that that bullying gets worse among older children (9/13). They explained that as children age and get more access to technology, online bullying becomes more common. Also, their problems get more complicated; for example, as their bodies develop, issues related to gender and sexuality begin to unearth. Their social circles get more established and social exclusion becomes more common. Also, premediated and

psychological bullying take place more often. Finally, peer intervention becomes more frowned upon and happens less frequently. Teachers pointed that younger children often resort to teasing and physical bullying (4/13), because they "*do not know better*", are more emotional, less socially-aware, and do not know how to do psychological bullying (3/13). Also, younger children are often more open to intervening in bullying of a peer (2/13) – *"[when a young child intervenes] teacher says good for you, thank you for standing up for your friend; that means the world to them. Whereas nobody wants that kind of attention as they get older, because then it just makes you look like a wimp or, it's just not a favorable look."* [T22]. Learning from this, serious games like REMind can be designed to provide tailored experiences that address peers' age-specific needs.

Effects of the pandemic

Finally, even though we did not bring up COVID-19, several teachers pointed out to the diverse effects of pandemic on peer bullying. Some thought that pandemic has decreased bullying (especially physical bullying) because there is less interaction among children (4/13). Others thought that the pandemic has worsened the situation by decreasing social skills among kids, or making bullying harder to detect (3/13) – *"I think kids are internalizing it. It's harder to detect the bullying, and kids are not as forthcoming that they're being bullied, especially if they have other priorities to deal with."* [T19] [sic]. This contributes to the contextual-validity of REMind, by shedding light on the nuanced and underexplored impacts of the pandemic on peer relationships.

5.3.3 Peers' Reactions to Bullying

Bystander presence

The majority of teachers believed that bystanders are often present when bullying takes place (8/13) – *"I personally haven't come across or heard that it was just the person who was getting bullied and the person who was bullying in a corner. It's more of a group because they want attention."* [T20] [sic]. This suggests that bystanders remain the majority in most bullying incidents and reaffirms the relevance of bystander-focused interventions.

Bystander feelings

Several teachers believed that bystanders often feel empathetic towards the victims (4/13), and know that what is happening is wrong (4/13). A few teachers mentioned that some-

times bystanders can be oblivious, or find the bullying "*funny*" [T20] (3/13) –*"I'm sure what goes through their head is boy I'm happy it's not me. To be able to say, I am glad it's not me, they'd have to have some sort of empathy to kind of translate those feelings to how they wouldn't want to be in that situation."* [T1] [sic]. This supports that there is negative bias towards bullying amongst bystanders, which makes them easier to influence via interventions.

Frequency of interventions

Several teachers stated that the frequency of bystander intervention can vary, depending on factors such as the culture of the classroom, which side they support (i.e., whose friend they are), and their age (5/13). A few mentioned that bystander intervention is uncommon in their school (3/13). Only one teacher indicated that it happens frequently (1/13). The majority of teachers had observed peer intervention by getting a teacher (sometimes in confidence) (7/13), or telling their parents (2/13). Teachers had also observed students directly intervening by calling the bully out (3/13), or pulling the victim away (2/13) – *"On a very very rare occasion another student will stand up and be like hey, this is wrong. The majority of them will just laugh at it. There will be very few who will be strong enough to go and say that hey, you know, whatever you're doing is wrong. Stop!"* [T20]. Thus, interventions should aim to build confidence and encourage peers to do what they feel is right.

Intervention effectiveness

The majority of teachers found peer interventions at least somewhat effective and believed it usually stops the bullying (7/13). Others believed that intervention results in escalating the bullying (3/13) or directing it to the bystander (2/13). *"Most of the times, they'll back off. Or they'll start bullying the bystander who is standing up for them."* [T18][sic]. While encouraging, this emphasizes the importance of not over-promising outcomes.

Why bystanders avoid intervention

The common reasons for avoiding interventions included (i) fear of victimization (5/13), (ii) interventions not being seen favourably in the peer group (4/13), (iii) having a limited understanding of bullying (e.g., thinking it was for fun, 3/13), or (iv) being friends with the bully (4/13). Others mentioned shyness, getting used to bullying, or diffusion of responsibility (3/13) – *"A child couldn't go tell the teacher if something happened because*

they would be made fun of for being a tattletale or being a snitch. Nobody wants to be the one." [T22] [sic]. Given that otherwise passive bystanders are the main target of our intervention, it is important that REMind aims to explore all the reasons that children may hesitate to intervene.

Victim's reactions

Common themes in victims' reactions as described by teachers include covering up the incident, or staying silent about it (5/13), avoiding it or walking away (3/13), or crying (3/13). Sometimes victims tell parents who inform the school (4/13). T17 explains that if a child that is bullied looks upset and gets teacher's attention, *"The conversation that usually comes after the teacher walks away is that you can't hide it from your face that you're upset, or you got us in trouble because you look upset. It's not always the best scenario, obviously, for the victim."*. This provides input for designing realistic stories about victims' experiences of bullying, to support bystander perspective-taking.

Ideal reactions

Several teachers thought the ideal reaction for a victimized peer is to get help (e.g., tell a teacher). Others thought that victims should address the incident themselves (4/13) – *"I think standing up for yourself is always a good strategy to try. But that can backfire in a lot of ways. [..] it almost can be worse than if you said nothing at all."* [T22]. Also, teachers believed the best reaction for bystanders is to address it themselves, for example, by "*de-escalating*" the bullying [T4] or having a mediation *script* (5/13). While several teachers argued for reporting the bullying (6//13), a few thought that going to adults should be the last course of action (2/13). Others suggested strategies such as "*being friends*" [T15] by building empathy and defusing the bully's power (3/13), or removing the victim from the situation (3/13) – *"I think it's more effective when it comes from the peer group. Everybody wants to belong to the peer group."* [T22]. We take inspiration from teachers' intuitions of *what works* to set the objectives of REMind.

5.4 Discussion

We presented qualitative observations and lessons learned from semi-structured interviews with 13 elementary teachers about peer bullying in local schools. The interviews were conducted to support the design of an anti-bullying serious game, REMind. Our findings

highlight a need for novel anti-bullying interventions that are relatable by children and reduce teachers' workload. Some of our observations confirmed prior work on anti-bullying interventions; the frequency and intensity of bullying and limited effects of anti-bullying programs aligned with our expectations. Our study also aligns with related work about gender and age differences in peer bullying. Teachers also confirmed that bystanders are frequently present in bullying scenarios, and although they seldom intervene, they usually find it morally wrong. This is in line with prior work on the behavior of bystanders, and it re-affirms that they are a key demographic for anti-bullying interventions and their existing negative attitudes towards bullying makes them a more realistic target for impacting behavioral change [175].

However, several findings were contrary to our expectations. For example, we were surprised to find that anti-bullying interventions are generally underused in local schools, and the responsibility is mostly placed on teachers. It was reported that schools mostly rely on monitoring and disciplinary methods to combat bullying, rather than interventions aimed at shaping children's attitudes and changing their behaviors. Even when interventions are used, they are typically one-time events rather than ongoing programs. *"If it's integrated into the year, it just becomes the norm as to how they stand up for each other. Isolated lessons are great for awareness, but they don't encourage practice."*, T4 explained.

5.4.1 Promoting Situated Learning and Meta-Cognition

Teachers' insights on reasons why bystanders avoid intervention (e.g., fear of losing social status) highlight that it is not rooted in a lack of knowledge about bullying; rather, intervening against someone holding (perceived) power is a skill, and skills go beyond mere knowledge of facts. We argue that practicing a drama-based serious game enables *situated learning* [319], because thoughts are embedded in experiences and learning emerges from building new structures of knowledge through partaking in actions to solve a problem in the real world [102, 13]. Role-play develops a capacity for *meta-cognition*, the ability to think about one's own thinking process [38]. This ability plays an integral role in helping young people become skilled thinkers. Similarly, researchers argue that serious games incorporate meta-cognitive strategies with gaming, which often leads to higher engagement in learning and better pedagogical outcomes [396]. REMind aims to go beyond increasing knowledge, and promote intervention skills in children.

5.4.2 Direct vs. Indirect Bullying

During the interviews, we cited a commonly-used definition of bullying by Olweus (2001 [271], built on his earlier work in 1994 [270]) to establish common ground with respect to the characteristics of bullying behavior (see section 5.2.3). This definition includes several forms of direct bullying such as physical aggression (e.g., kicking, pushing), locking someone in a room, and stealing or damaging one's property. However, qualitative evidence from our study suggest that nowadays direct bullying happens scarcely in local elementary schools and this definition may no longer apply. *"A lot of bullying nowadays is exclusion, and social control. It's not the traditional beat a kid up kind of thing. That's really, really rare."*, one participant (T4) emphasized. Another teacher (T22) explained *"I think there's been a lot of education around solving your problems with words... Even thinking of myself growing up, people thought it wasn't a big deal. Whereas now, somebody might be appalled. If you say I pushed that person, somebody will be like, WOW, you put your hands on someone?!"*.

Prior work has reported gender differences in types of bullying behavior, with indirect bullying (e.g., excluding from friend groups) being more prevalent among girls while direct bullying is more common with boys [68]. However according to our participants, even though gender-related differences still exist, they are less pronounced these days. That is, while all the teachers we interviewed reported having noticed gender differences such as girls being more subtle, they also highlighted that gender differences are not necessarily conspicuous – *"I mean, to say boys never spread rumors or gossip, they do."* [T22][sic].

5.4.3 Contemporary Dynamics of Peer Bullying

In the course of the study, teachers unpromptedly discussed several contemporary issues related to bullying. For instance, they elaborated on the adverse effects of the pandemic on the dynamics of peer bullying in their online or in-person classes. Teachers also talked about bullying incidents based on cultural or ethnic differences among peers, such as negative remarks based on minority skin color or hair style, immigrant or refugee status, different food preferences or accents. This is an important issue in local elementary schools as Canada is a multicultural and highly diverse country, and Ontario is home to more than a hundred thousand new immigrants every year. Finally, the majority of teachers emphasized the prevalence of cyberbullying and raised alarm about its extensive increase over the recent years as technologies such as social media have become more and more available to younger children (which is in lines with prior work, e.g., [200]). *"Back when I was a kid, a long long time ago, once we left school, like we were turned off from there, right? We didn't have social media like we do now. So now our kids are connected 24/7 whether they want to be*

or not. There's always ways for people to reach out" [sic], T18 highlighted. Others brought up many examples of children using social networks, media sharing platforms, memes, and anonymous messaging apps for bullying peers.

We argue that commonly-used traditional bullying definitions fall short of reflecting such contemporary dynamics of peer bullying. This is particularly noteworthy as the majority of our participants stressed that children often do not find the scenarios described in the anti-bullying interventions relatable and do not *buy into* them. *"They tend to be scenarios that kids listen to and laugh at because it has nothing to do with them, you know? The scenario doesn't connect to them and it doesn't reflect and sell them in 2020 way of skills and kids being with each other"*, T19 explained. Along the same lines, in 2021, a video[1] was trending on TikTok (a social media platform popular among the youth with roughly one third of users between ages of 10-19 [272]) that mocked the unrealistic and wishful thinking outcomes of anti-bullying intervention strategies that are commonly taught in elementary schools. This video was liked by over 1.2M users and more than 2K users were inspired to make their own TikTok videos using the original sound. In fact, previous work on effectiveness of anti-bullying programs underlines the importance of "buy in" from all the stakeholders, including teachers and students, and warns that "no violence prevention program can or will work in any school" without the presence of this factor [365]. In addition to the evident disconnect from the students, teachers in our study also had mixed opinions about best anti-bullying practices. Overall, we believe the qualitative evidence demonstrates a lack of buy in for anti-bullying interventions, and highlight that conducting elicitation studies is ever so important for ensuring the ecological validity of such programs and grounding their designs in contextual dynamics such as local culture and contemporary challenges.

5.4.4 Limitations and Future Work

In this work, we report an interview study with elementary school teachers about peer bullying. While the qualitative insights obtained from this study informed the design of our anti-bullying serious game, there are limitations that need to be addressed. This study was conducted remotely during the global pandemic, and our recruitment process was challenged by the constraints imposed by COVID-19, such as school closures. As such, we had little control over the pool of participants. We avoided snowball sampling to ensure diversity in our group of participants. Instead, we recruited a relatively small group of local teachers via social media. As a result, our participants' experiences greatly varied

[1] https://bit.ly/32Ay8wG

in terms of types of schools (e.g., public vs private), years of teaching experience, school demographics, and school climate.

Furthermore, this study was an extension of our previous study in which we conducted a co-design study with 8-12 years old children to inform the design of REMind. Before the global pandemic, we had planned to conduct the interview study with teachers of children that participated in the co-design study. This was not possible during the COVID-19 pandemic. In this initial plan, we wanted to present a demo of the social robots and the setting that would be used in REMind to the teachers and get their feedback. As this was no longer possible due to the remote nature of the study, we decided against using REMind as a focal point of the interview. Future work can be geared towards facilitating intergenerational design studies and focus groups to better understand the design requirements needed for ensuring buy in from all stakeholders.

Also, it is common for teachers to teach various grades during the course of their career. As such, even though we tried to recruit teachers of grades 3-6, some of our participants had also taught other grades outside of this range. Although we asked teachers to only draw from their experiences with 8-12 years old children, we had no way of examining this. Future work can focus on understanding the age-related differences in the dynamics of peer bullying, and its implications for designing technology-based anti-bullying interventions.

Finally, several teachers brought up unprompted topics such as the impact of the pandemic on dynamics of peer bullying. Although these topics were interesting for our research team, for the sake of a consistent methodology we avoided adapting our interview script towards these topics. Future work can shed light on the effects of the pandemic on children's behavior in remote or in-person settings, and its impact for designing anti-bullying serious games.

5.5 Conclusion

This chapter reported on a qualitative interview study with local elementary school teachers, aiming to ground the design of REMind—our anti-bullying serious game—in the social realities of Canadian classrooms. While our earlier co-design study with children emphasized creative and experiential perspectives, this chapter added the educator's lens to ensure contextual relevance and pedagogical alignment. We presented qualitative findings and discussed the lessons learned. This work contributes insights for designing pedagogical serious games and novel anti-bullying interventions.

5.6 Chapter Summary

Through thematic analysis of 13 semi-structured interviews, we identified recurring gaps in current anti-bullying practices: local schools lack dedicated programs, rely heavily on teacher-driven interventions, and rarely offer longitudinal support. Teachers repeatedly voiced a need for interventions that are relatable and engaging for children, reduce their own workload, and reflect the nuanced social dynamics of today's classrooms.

Insights from this study impacted various aspects of REMind in the next cycles of iterative design. Importantly, we learned from teachers that misidentifying bullying by labeling it as "joking" or "teasing" is a common problem. To address this, we added identifying bullying based on the three criteria of imbalance of power, intention to harm, and repetition [92] (attributed to Olweus) as a learning objective, which will be discussed in Section 7.2.2.

Also, insights from teachers shaped REMind's story world, and clarified the kinds of emotional and social experiences the game should evoke. For instance, teachers frequently noted that bullying tends to occur during unstructured and unsupervised times, such as recess. In response, we situated the central bullying scenario in a recess setting, incorporating not only narrative cues but also ambient sound design to evoke the auditory experience of an outdoor schoolyard with children playing in the background.

Teachers also spoke about the emotional experiences of bystanders, including feelings of discomfort, and silent relief. These perspectives shaped reflective moments in the narrative. In one example, after witnessing a peer being bullied, the avatar robot reflects: *"I didn't love it. It was kind of rude. To be honest, I was glad it wasn't me."*

In addition to these contextual observations, teachers' views on the focus of anti-bullying strategies informed REMind's thematic scaffolding. One teacher, for instance, emphasized that bullies gain power through peer responses, and urged students to "*not give the bully power*". In later iterations of REMind, this idea became a central metaphor in the game: as the final step in the game, the player helps the avatar robot reclaim a symbolic 'power' object from the bully. Such advice informed REMind themes and key values around peer support embedded throughout the story.

At this stage of REMind's development, the narrative arc and structural framework of the game had begun to solidify, and initial design decisions were already underway. A central challenge emerged: how might we transform the act of teaching children how to respond to bullying from a didactic lesson into an engaging, game-based experience? The next chapter explores this question through game design focus groups with children, aiming to understand how playful learning could be integrated into anti-bullying education.

Also, while these interviews offered valuable insight into children's social realities and teachers' pedagogical priorities, they did not fully clarify what, specifically, REMind should teach children to do in response to bullying. That is, beyond encouraging children not to remain passive, we had yet to define what kinds of concrete actions or defending strategies REMind should promote. Chapter 7 describes how we addressed this gap by consulting subject-matter experts (psychologists) to further clarify REMind's learning objectives and refine its educational focus.

Chapter 6

Incorporating "Fun": Focus Groups with Children

The quest for making learning fun has fascinated educators across the ages. When we are having fun, we are more likely to be motivated to learn and to persist in learning. Fun can also help us to focus and to concentrate on the task at hand, which can lead to deeper and more meaningful learning [213]. In essence, fun broadens our cognitive resources and facilitates learning.

A key feature of play is that it is intrinsically motivating; we play because it is *fun*. Games, as structured forms of play, have been extensively used to support learning, with their capacity for creating engagement, or fun, as the most frequently cited argument [284]. Games are engaging and enjoyable by design, which can increase learners' motivation and interest in the learning content, leading to higher levels of effort, persistence, and achievement [202, 242].

Although games that have a purpose beyond entertainment are commonly labeled 'Serious Games,' game design scholars argue that this label is misleading, as it implies that such games need not prioritize fun; instead they advocate for the term 'Transformational Games' [324]. Regardless of terminology, to be effective, such games must indeed be fun [284]. Hence, it is crucial to explore how we might objectively integrate fun into the designs of educational experiences. Game designers highlight several key factors: goals, feedback, interactivity, storytelling, aesthetics, challenges, and social interaction. While the fundamentals of play remain consistent, we argue that novel technologies like social robots introduce new opportunities for play through their unique affordances. This raises the question: **how can social robots make transformational games more fun?** We explored this question in the context of developing REMind.

The challenge in designing for fun stems from the fact that it is not an inherent quality of a system; rather, it is subjective, situational, and contextual. Firstly, fun is *subjective*; personal factors like age, interests, and personality can influence one's enjoyment versus another's. Secondly, fun is *situational*; one's mood, environment, and company can dictate whether an activity is enjoyable. Finally, fun is *contextual*, depending on factors such as the activity, social setting, and cultural context. For example, a casual chess game in a park might be fun, but the same game in a competitive tournament could induce anxiety [324]. In other words, different folks have different fun.

Recognizing users as "experts of their own experiences" [316], we engaged children, the game's primary stakeholders, in focus groups to brainstorm ways to make REMind fun. We analyzed the qualitative data gathered from this study by applying Framework Analysis [143] and using the MDA Taxonomy of Game Pleasures [170], which identifies 8 categories of enjoyment in games. This method helped us identify 28 elements of fun in robot games, which informed our game design. In this chapter, we present the findings, and briefly discuss how they shaped the design of REMind.

6.1 Understanding Fun

Fun is often cited as the primary reason for integrating games into learning environments [284], as it supplies learners with intrinsic motivation. Fun is defined as an enjoyable experience that extends beyond a jolt of pleasure, which individuals typically seek to repeat [326]. Schaufeli et al., describe fun as a "pervasive affective-cognitive state," [322] while Koster, in his influential book "Theory of Fun," asserts that "fun is just another word for learning" [211]. Research has consistently shown that positive emotions associated with fun not only broaden cognitive resources [129] but also enhance learners' attentive state [179], serve as effective retrieval cues [178, 177], and improve decision-making, creative problem-solving, and other higher-level cognitive functions [123].

Incorporating fun into the design of a system is challenging because fun is an inherently subjective experience. Related work on video game motivation identified challenge, fantasy, and curiosity as key components of fun [242]. Caillois classified four forms of play contributing to fun: competition (Agon), chance (Alea), simulation (Mimicry), and vertigo (Ilinx) [63]. Lazzaro, by analyzing players' facial expressions, identified four types of fun: Hard Fun (emphasizing challenge and mastery), Easy Fun (exploration and creativity), Serious Fun (aimed at learning and personal growth), and People Fun (social interactions and community building) [224]. Furthermore, the MDA framework outlined eight primary "game pleasures" that encapsulate the main sources of enjoyment in games [170]: Sen-

sation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression, and Submission (see Table 6.1 for definitions). Others have expanded this list to as many as 14 types of fun[137]. These frameworks illustrate the multi-faceted nature of fun and provide design insights.

6.2 Aligning Game Mechanics

At the time of conducting this research, REMind was in the intermediary phases of development. We had already decided that REMind would be structured as a room-based installation in which a single player interacts with three Furhat robots [9] (a tabletop human-like social robot with a back-projected head capable of displaying a range of facial expression), and practices spect-actorship.

At the time of conducting this study, we identified the following core learning goals for REMind: (a) help players differentiate between bullying and teasing by understanding that bullying has 3 criteria [92] (attributed to Olweus): imbalance of power, intention to harm, and repetition; (b) foster empathy and perspective-taking; and (c) promote safe and effective intervention strategies such as assertive defending, comforting victims, or reporting to authorities.

To enhance the effectiveness of REMind, this study aimed to understand how its game mechanics could be further developed in alignment with these learning goals while ensuring fun gameplay. In later stages of this research, we extended this list of learning goals and outlined seven distinct objectives, which are discussed in chapter 7 of this dissertation.

6.3 Methodology

To directly involve children in the design process, we engaged them in focus groups in which we explained the purpose of REMind, demonstrated the robots' capabilities, and engaged in a group brainstorming activity.

6.3.1 Procedure

Two members of the research team moderated the focus group sessions. The sessions started with a brief 'ice breaker' activity to facilitate group introduction. Then, the moderators reaffirmed the assent of all participants.

We familiarized children with REMind by presenting an overview of its serious goal (i.e., fostering anti-bullying bystander intervention), and its core mechanic which is facilitating a role-play among 3 robotic characters. To boost children's imagination of the game characters, we provided them with character sheets describing each character's name, appearance (e.g., hair color), personality traits (e.g., likes to make others laugh), flaws (e.g., has trouble coming down when angry) and hobbies (e.g., tells lots of knock-knock jokes). These character sheets were compiled in collaboration with a professional playwright, based on children's designs of robotic characters in the previous story co-design study reviewed in chapter 4.

We also familiarized children with the Furhat robot. We presented children with a demo that established that Furhat can engage in nonverbal and verbal communication, change its voice, gender, age and facial expressions, control, participate in timed challenges, and recall information (e.g., keep count of everyone's points in a game). To provide children with transparency on the machine nature of the robot (in accordance with ethical considerations outlined in Principles of Robotics [45]) we gave them a glimpse of Furhat's control interface and how it could be used to build simple interactions such as saying a sentence and showing a gesture.

For the brainstorming activity, we used the *Crazy Eights* [108] technique for rapid idea generation. In this activity, each child was tasked to reflect on 'How might we make REMind fun' and create eight distinct ideas in eight minutes, scribbling each on a sticky note. This method promotes fast, creative thinking, fostering an environment where quantity is valued over the quality of initial ideas. Afterwards, children shared their ideas with the group. Each idea was placed on a large whiteboard, and peers could indicate if they had similar thoughts as we visually clustered them based on themes. Researchers posed follow-up questions when necessary.

Each design session lasted one hour. As a token of appreciation, children received personalized certificates and their parents received CAD $15. This protocol was approved by the University of Waterloo Human Research Ethics Board.

6.3.2 Recruitment & Participants

We promoted the study through local mailing lists and interested parents contacted us and received a detailed information letter. Parents of 15 children aged 8-14 (M=11, SD=1.64) provided consent and confirmed child assent.

Following recommendations on optimal focus group size [346], participants were divided into two groups based on their availability. One group consisted of 7 children aged 8-11,

and the other group included 8 children aged 10-14. We did not collect information about gender, but the groups seemed roughly gender-balanced.

6.4 Data & Analysis

Data from our co-design study constituted 95 sticky notes with game design ideas (M=6.33, SD = 3.06) and 2 hours of video recordings. Among these ideas, 37 originated from the first group (N=7), and 58 originated from the second group (N=8). We used Framework Analysis [143], a systematic methodology in qualitative research, to analyze and interpret the data. It involves five stages: familiarization, where researchers immerse themselves in the data; identifying a thematic framework, where key themes and categories are identified; indexing, where the thematic framework is applied to the data; charting, where data is summarized in thematic charts; and mapping and interpretation, where the charts are used to define concepts and interpret findings. This analysis was performed by a primary coder, and a secondary coder assisted with intercoder reliability evaluation. The analysis was conducted using NVIVO software [174].

(i) **Familiarization**. An in-depth review of this data was performed multiple times by the primary coder, creating a dataset of the game design ideas with annotated contextual information drawn from the video recordings.

(ii) **Framework Identification**. We chose the MDA Taxonomy of Game Pleasures [170] as a heuristic lens for framework analysis. It is a comprehensive framework that categorizes eight core elements of fun derived from playing games: sensation, fantasy, narrative, challenge, fellowship, discovery, expression, and submission. Sensation refers to the game's sensory appeal, fantasy to its capacity to transport players into another world, and narrative to the story that unfolds within the game. Challenge pertains to the obstacles or problems presented to the player, while fellowship encompasses the social interactions facilitated by the game. Discovery involves the exploration and uncovering of new information or environments within the game, and expression allows the players to express themselves or their ideas. Lastly, submission describes the pleasure derived from the game as a pastime or an activity to pass time. This taxonomy thus provides a holistic perspective on the diverse pleasures a game can offer, making it a valuable tool for game analysis and design. This taxonomy served as a basis for a detailed deductive coding scheme. Table 6.1 summarizes the taxonomy.

(iii) **Indexing**. To index the data, the primary used thematic analysis to deductively code each idea in the dataset into any number of relevant categories of game pleasures. As a result, each idea was coded to 1-7 game pleasures, which yielded a total of 303 references from the two co-design focus groups.

(iv) **Charting.** The primary coder used a deductive approach to identify the sub-themes in each category of game pleasures. Of the 8 kinds of fun in LeBlanc's taxonomy, each category was mapped to 26 - 54 references (M=37.88, SD=11.28).

(v) **Mapping & Interpretation.** Finally, we studied the key features identified in our charts. This enabled us to create a schematic diagram of what children perceived as fun within each category of the MDA taxonomy. Section 6.7 summarizes the findings.

Table 6.1: Eight types of game pleasures in the MDA framework [170].

Pleasures	**Definition**
Sensation	Enjoyment from sensory experiences (visuals, music, tactile feedback).
Fantasy	Pleasure derived from imagining oneself in different roles or worlds.
Narrative	Enjoyment of unfolding events or stories.
Challenge	The core pleasure of solving problems within a game.
Fellowship	Enjoyment from friendship, cooperation, and community.
Discovery	Pleasure from finding new things and exploring game worlds.
Expression	Joy of self-expression & creativity, e.g., designing characters or levels.
Submission	Pleasure from immersing oneself in the game world and escaping reality.

6.5 Intercoder Reliability Testing

To evaluate Intercoder Reliability, the second author deductively coded a 25% subset of the dataset, as recommended by literature [275]. This resulted in an agreement of 0.72 and a Cohen's Kappa of 0.66, indicating substantial agreement.

6.6 Quantitative Observations

In deductive coding of the dataset, each idea was coded to 1-7 game pleasures, which yielded a total of 303 references from two co-design focus groups. This section provides a

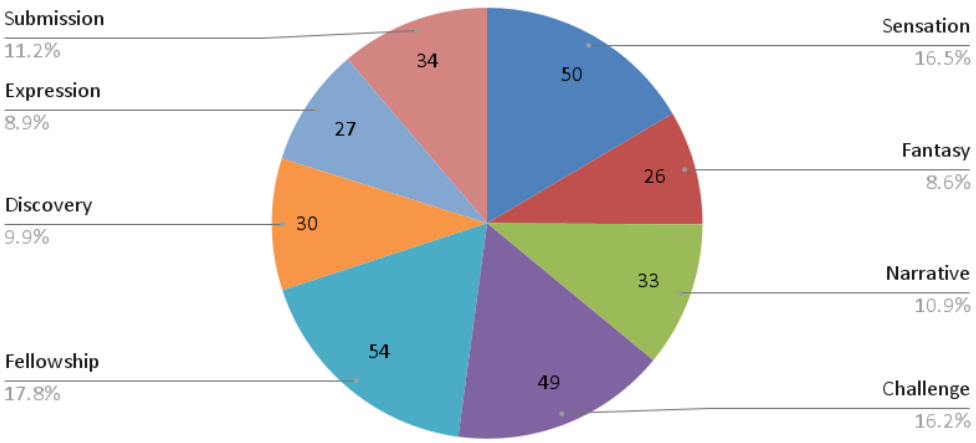


Figure 6.1: Distribution of children's design ideas across 8 game pleasures. Numbers on the pie denote count of references. Percentages denote count relative to total references.

descriptive statistics analysis of our quantitative data, examining the prevalence of game pleasure categories, age-based differences, individual preferences, and overlap among pleasure categories.

6.6.1 The Inductive Lens

The three most prevalent categories of fun that emerged from our analysis were Fellowship, Sensation, and Challenge, each featured in over 16% of the game ideas (see Fig. 6.1). Nevertheless, all categories of game pleasures were represented, showing a balanced spread of fun across the dataset. No type of fun was completely absent, or overwhelmingly dominant. Finally, although there may have been some differences, all eight categories of fun were evident in ideas from various age groups.

Age differences

Our observation suggest that there may be age-based differences in prevalence of kinds of fun in participant's ideas. To explore this, we divided the dataset in two age groups of 8-10 year old (N=6, 106 references), versus 11-14 year old participants (N=9, 197 references). However, despite any potential age differences, all 8 categories of fun were present in game design ideas from participants in both age groups.

Individual differences

While we observed individual differences in preferences for types of fun in children's ideas, on average, each child's game design idea was coded to 6.6 of 8 kinds of fun (SD=1.30). Also, on average, each type of fun was coded to 12.38 out of 15 participants (SD=2.00).

Overlap of game pleasures

Each of the game design ideas was coded to an average of 3.19 game pleasures (SD = 1.66).

6.7 Qualitative Patterns: Pleasures of Robot Games

A total of 28 themes emerged from qualitative analysis. Below we present the elements of fun we observed in each category of MDA Taxonomy of Game Pleasures. Since this taxonomy was originally developed for video games, we draw comparisons throughout to illustrate how social robots' unique features can elicit enjoyment. We draw comparisons between the world of video games and what is possible via robots.

6.7.1 Sensation

Compared to video games that are typically confined to 2D screens, robot games extend the game world into the player's 3D physical space, offering a more immersive gameplay. This allows for mixed reality interactions and use of physical props. We identified 4 pleasures of robot games related to sensation:

Dramatic Resonance Participants enjoyed the dramatic embodiment of fictional roles, and the ability to observe the robot embody different roles (e.g., *"Some kind of fight scene between the bully and player/victim"*, *"It could copy me"*).

Embodied Gameplay Many ideas incorporated physical activity (e.g., dancing), alluding to games that blend digital and physical play. For example, *"Simon says"*[1] where the players' physical actions are a key element of what makes the game fun, was one of the most popular ideas brainstormed by children.

[1] A children's game where players follow commands given by the leader, 'Simon,' but only if the command begins with 'Simon says,' such as 'Simon says touch your nose.'

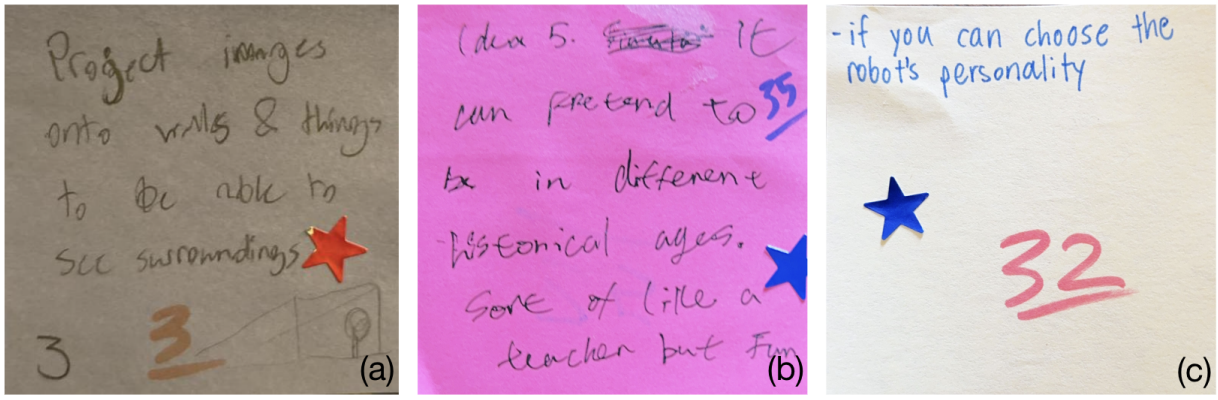


Figure 6.2: Sample ideas brainstormed by participants: (a): *"Project images onto walls & things to see surroundings."*; (b): *"Idea 5: it can pretend to be in different historical ages. Sort of like a teacher but fun"*; (c): *" if you can choose the robot's personality"*.

Use of Props Children frequently mentioned various props such as board games and card games, indicating a preference for tactile experiences and props.

World Aesthetics Some ideas emphasized the look and feel of the game world, enhancing the enjoyment of gameplay. Fig. 6.2 exemplifies this with a design concept brainstormed by a child, who drew a projection and noted: *"Project images onto walls & things to be able to see surroundings"*.

6.7.2 Fantasy

Our observations indicate that robots can add unique fictional dimensions to games. Children perceived robots' non-human features as extraordinary superpowers and seemed to find the futuristic technological appeal of robots fascinating. We identified 4 types of fun related to fantasy.

Simulating Life Children demonstrated a desire for simulating aspects of real life, such as using the robot for 'becoming' different characters, or projecting their self onto the robot (e.g., *"Robot acting out you in the past"*).

Hero's Journey Some ideas involved the robot as a hero with a mission (e.g., *"Special gem holding together the world but people want to take it"*).

Non-Human Odyssey Participants were interested in exploring the robot's non-human characteristics and affordances (e.g., *"If the robot's face could change colour when it gets angry or sick"*).

Sci-Fi Companions Many ideas explored sci-fi-inspired fantasies of advanced robots serving as children's sidekicks and assistants.

6.7.3 Narrative

Compared to video games, robots could introduce distinctive mediums of storytelling that children find enjoyable, including storytelling via their physical affordances (e.g., color of LEDs), as well as their social interactions (e.g., using gaze). We identified four types of fun related to narrative in robot games.

Environmental Storytelling Children's ideas involved themes of robot interactions with the game environment to subtly convey narratives (e.g., *"Robot showing another robot how to watch clouds"*).

Robot-Mediated Storytelling Children enjoyed using unique robot affordances for storytelling; for example, by suggesting to change its accent based on scenarios, or change the color of its face when it gets angry.

Interactive Storytelling Children indicated a desire for having agency in shaping game narrative through making meaningful choices (e.g., *"Get the player to watch a scenario and pick what happens next"*), dialogues with the robot (e.g., *"By-standing game: move to the next level by telling what to say, when someone is getting bullied" [sic]*), or generating their own stories from scratch (e.g., *"Create your own story in the world"*).

6.7.4 Challenge

Our observations indicated that children's perceptions of robots' social awareness often exceeded their actual capabilities. For instance, one child believed that robot could read their emotions because it has a camera. We argue that human-like features and social interactivity of robots can add a social twist to traditional challenges offered by games. We identified four kinds of challenge-related fun.

Brainteasers A number of children's ideas involved playing guessing games such as puzzles, riddles, trivia, and quizzes with a robot (e.g., *"guess who"*).

Reflex and Reaction Children indicated that robot games requiring quick thinking and reflexive responses would be fun (e.g., *"A game where Furhat winks or blinks and then you do the same thing, but if you do 1 wrong, you lose. Furhat does it very fast"* [sic]).

Mastery of Game Mechanics Children's ideas emphasized the importance of clear goals and feedback for player achievement, points, racing, and game levels (e.g., *"Games are more fun if there are points"*).

Social Strategy Some ideas required using social skills to overcome obstacles, or help the robot (e.g., *"Trick [another robot] into not bullying"*).

6.7.5 Fellowship

This category of game pleasures is inherently social, making social robots an apt medium for enhancing fellowship aspect of games. Our findings show that fellowship was the most prevalent category of fun in children's game concepts. Children envisioned robots in various social roles, including co-player, avatar, and user interface for playing with other children. Using a robot as the player's embodied avatar is a unique feature of robot games that cannot be replicated with human co-players. You can embody a robot, but you cannot embody another person. This helps create aesthetic distance and encourages perspective-taking [319]. We identified four types of fun related to fellowship in robot games.

Robot as Friend Some participants envisioned the robot as a co-player in games (e.g., acting as a *"Simulated friend"*).

Robot as Avatar Some ideas involved using the robot as an avatar representation of the child in the game (e.g., *"It can say words that I say"*).

Robot as Game In some ideas robots served as an interface facilitating gameplay (e.g., acting as a conversational interface in *"Simon says"*[2]).

[2] A children's game where players follow commands given by a leader, 'Simon,' but only if the command begins with 'Simon says,' such as 'Simon says touch your nose.'

Community Children indicated that interacting with other human players (e.g., via playing a game as a group) can elicit fun.

6.7.6 Discovery

Unlike video games, robot can facilitate gameplay involving exploration of the physical world, as well as discovering the robot's capabilities. It appears that the ambiguity of robots' capabilities sparks curiosity and drives children to playfully experiment to find robots' boundaries and fill in the gaps of their mental models. We identified three types of discovery fun that robot games could incorporate.

World Exploration Children expressed an interest in exploring game worlds, encompassing both physical and fictional domains. Physical examples included familiar activities like *"Hide and seek"*, while fictional exploration included complex, imaginative scenarios, such as one design concept (depicted in Fig. 6.2-b) for a robot that could *"pretend to be in different historical ages"*—a role described by the participant as *"sort of like a teacher but fun."*

Game Discovery Some game concepts suggested that discovering new elements, levels, solutions, characters, or possible endings can elicit fun (e.g., *"Puzzle to earn coins and unlock more puzzles"*).

Robot Discovery Children found it fun to playfully experiment with a robot's capabilities and test its limits (e.g., *"A memory game where you show Furhat a thing then another, and another and he says them in the right order"*).

6.7.7 Expression

Players value self-expression and enjoy making meaningful choices that have visible consequences [324]. A distinct value that social robots can add to this category of fun is by acting as a vehicle for role-play [319]. We identified three types of fun related to expression that can be incorporated in robot games.

Robot-Mediated Role-Play Many game ideas featured role-playing with the robot or using the robots to assume different make-believe roles (e.g., *"Instead of you role playing one role, you could be different people (ex. teacher"*).

Improvisation Several ideas involved improvisational games, suggesting that spontaneous creativity can elicit fun (e.g., *"Charades with Furhat, he guesses what you are doing, then you say right or wrong"*).

Robot Customization Participants indicated that personalizing the robot's appearance or characteristics can be enjoyable (e.g., *"Get to design a new character"*, or Fig. 6.2-c)).

6.7.8 Submission

Observations suggest that robots foster a suspension of disbelief, making gameplay more immersive. Three types of fun were identified in this category.

Suspension of Disbelief Some ideas indicated that children enjoy temporarily setting aside knowledge or awareness of reality to embrace fictional elements (e.g., *"simulating"* different people, *"Life as a famous person"*).

Robot Novelty Some children, particularly younger ones, seemed to find the robot's novelty appealing, even in mundane tasks (e.g., *"It can count the cards"*).

Robot Control Children seemed to find exerting control over a robot's behavior inherently enjoyable and exciting (e.g., *"It can say words that I say"*, *"You could guide the robot"*).

6.8 Informing the Design of REMind

Informed by these observations, we refined the design of REMind game mechanics and narrative to incorporate some of the identified elements of fun. A high level summary of the updated game narrative is as follows.

Upon entering the game world, the player learns that a pervasive *glitch* has affected the Furhat robots in the fictional world of *KERNEL*. This glitch, caused by an unknown algorithm the robots have learned, is increasingly dangerous and detrimental. It causes the robots of Kernel to exhibit signs of disharmony and confusion. For example, they forget small things, such as parts of their sentences or answers to simple questions, their speech becomes jumbled and incoherent, and their projected faces show visual distortions.

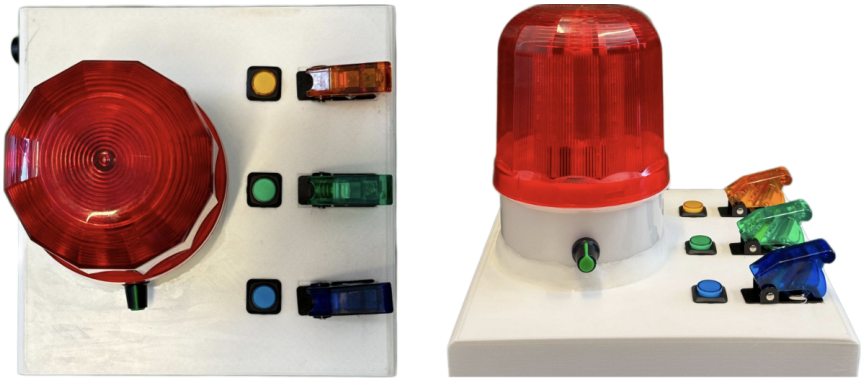


Figure 6.3: The first prototype of "Bullying Detector" had a 3D-printed shell.

To eliminate the glitch and restore balance in Kernel, the main robot character, AVATAR, must embark on a heroic journey to its own past, simulate the memory that started the glitch, and overwrite it. However, AVATAR can only achieve this with help from a human child, because solving the glitch requires one to reason using their emotions—something robots lack. AVATAR and the player discover that the critical memory involves a peer bullying incident, enacted by FUSE and JITTER, two other Furhat robots in the room. In this memory AVATAR was a bystander that observed FUSE bully JITTER and did not take any action.

To overwrite the memory, the player engages in a series of problem-solving steps. First, the player helps AVATAR take the perspectives of FUSE and JITTER by reflecting on their emotions and intentions. Then, the player helps AVATAR reflect on why it did not intervene. AVATAR reveals its "Bullying Detector" did not sound an alarm, leading it to believe that the incident was merely teasing. The player searches the room to find the circuit and test it. By exploring this prop, the player discovers that when all three switches (representing the criteria for bullying outlined in section 6.2) are turned on, the beacon light on the circuit flashes, indicating bullying has been "detected". The player also finds out that the alarm has been muted and uses the adjustable volume knob to fix the circuit, preventing future bullying from going unnoticed.

Next, the player helps AVATAR overwrite the glitchy memory by choosing an intervention strategies and showing the robot how to carry it out. This involves the player improvising what AVATAR should say, and demonstrating it to the robot. The player is guided to record themselves enacting what the intervention. Their facial expressions and voice are then streamed onto the Furhat robot so the player can watch their enactment embodied by the robot AVATAR and observe how the story unfolds as a result.

This refined narrative aligns REMind game mechanics to learning goals and incorporates the identified elements of fun. Table 6.2 provides examples of how specific elements of robot game pleasures were implemented in REMind.

Table 6.2: Robot game pleasures and examples of how they informed preliminary designs of REMind

	Robot Game Pleasures	**Example Implementation in REMind**
Sensation	Dramatic Resonance	- Interactive role-play via Furhat robots
	Embodied Gameplay	- Player explores the room and interacts with props
	Use of Props	- Use of "bullying detector"
	World Aesthetics	- Use of room-based light and audio cues
Fantasy	Simulating life	- Use of robots to explore peer bullying
	Hero's Journey	- AVATAR's journey to eliminate the glitch
	Non-Human Odyssey	- AVATAR overwriting a past memory
	Sci-Fi Companions	- Player explores a fictional robot universe
Narrative	Environmental Storytelling	- Light and sound cues aiding storytelling
	Robot-Mediated Storytelling	- Glitch distorts robots' speech and face
	Interactive Storytelling	- Player decides how AVATAR intervenes
Challenge	Brainteasers	- Player troubleshoots the glitch
	Reflex and Reaction	- Use of time limits for challenges
	Mastery of Game Mechanics	- Use of progressive levels for resolving the glitch
	Social Strategy	- Player strategizes against peer bullying
Fellowship	Robot as Friend	- Player and robot collaborate to fix the glitch
	Robot as Avatar	- AVATAR is used as player's avatar
	Robot as Game	- Two robots are used as non-player characters (NPC)
	Community	- All players meet for post-game debrief
Discovery	World Exploration	- Player searches for objects in the room
	Game Discovery	- Player discovers new challenges
	Robot Discovery	- Player discovers Furhat capabilities
Expression	Robot-Mediated Role-Play	- Player role-plays by using AVATAR as a proxy
	Improvisation	- Player determines how AVATAR intervenes
	Robot Customization	- Player customizes AVATAR
Submission	Suspension of Disbelief	- Player engages with a fictional story
	Robot Novelty	- Player interacts with Furhat robots
	Robot Control	- Player's recorded gesture is streamed onto AVATAR

6.9 Discussion

To be effective, educational games must be fun. Our goal was to design the anti-bullying robot game REMind in a way that is enjoyable for children while supporting its learning objectives. To this end, we conducted focus group sessions with children, analyzed their design ideas using Framework Analysis, and categorized the results using MDA Taxonomy of Game Pleasures. We identified 28 fun elements that can be incorporated into social robot games and used these findings to inform the design of REMind. Based on this work, we offer key recommendations for designing game-based learning experiences with social robots.

First, we argue that designers should move beyond creating robot *interactions* and instead use robots to create holistic mixed reality experiences [339]. Games provide a systemic framework and invaluable tools for this purpose. Notably, Elemental Tetrad of Games [324], comprises of four interconnected part: mechanics, aesthetics, story, and technology. Mechanics define the game's rules and actions; aesthetics encompass its visual, auditory, and sensory appeal; story provides narrative context; and technology enables the game's creation and functionality. These elements work in harmony to shape the overall player experience. For example, REMind uses Robot-Mediated Storytelling to convey robot speech getting jumbled as a symptom of the glitch, which is achieved by using a voice transformation function to increasingly replace AVATAR's speech stream with a set of nonsensical words during glitches. This blends the mechanics of worsening glitches, the aesthetic of distorted speech, the narrative of glitch-affected robots, and the technology of voice modulation. We recommend that designers focus on leveraging stories and bringing them to life by using social robots.

Second, facilitating playful learning depends on a break from reality. The 'magic circle' in games refers to the space, both physical and mental, where the fictional rules and reality of the game world are temporarily accepted, allowing participants to experiment freely without fear of failure. Piaget and Vygotsky have both emphasized the role of play in allowing children to step away from the *"here and now,"* fostering deeper learning [284]. Creating this magic circle requires little technology as fiction is built on agreed-upon rules and constraints. It is these rules that allow a stick to become a sword and a blanket to become a fortress in children's games of make-believe. Designers of robot transformational games should leverage the power of make-believe.

Also, we recommend that designers prioritize interactivity in the game, as fun and interactivity often go hand in hand. Game designers use various interactive loops, like action-feedback, cognitive, emotional, and social interactivity, to create engagement [326]. In this study, we observed that children do not necessarily need the robot to perform

extraordinary actions to have fun. Instead, many of their ideas for making the game enjoyable involved the robot prompting them to take actions (e.g., by playing *"Simon says"*). Therefore, designers should focus on creating interactive experiences with clear goals, varied activities, and immediate feedback, rather than having children passively observe robot's actions.

Finally, in this study, we made a pragmatic decision to inform the children about the narrative and robotic technology used in REMind. Although initially considered a limitation, it emerged as a strength by scaffolding children's visionary ideas. Understanding the robot's affordances allowed children to generate a wide range of realistic game design ideas that could be executed by the robot. For example, they brainstormed games around the Furhat robot's capacity to change facial features, a unique feature of this specific robot. To foster the generation of realistic ideas, designers should ground their explorations in design of real systems and transparently communicate the affordances and practical limitations of those systems to children. This approach enables children to create intuitive and engaging games that align with the capabilities offered by the technology [18].

Limitations This study's limitations include the small sample size, limited discussion time for children's ideas, and the wide age range of participants. Additionally, the brainstormed ideas, tailored to Furhat robots' unique features, may not be generalizable to other robotic platforms. Methodological constraints, such as not tracking participant IDs and limited discussion of age and group differences, further impact the clarity and generalizability of the results.

6.10 Conclusion

We conducted a participatory design study with children to explore how to make the robot game REMind fun and engaging. Drawing on MDA Taxonomy of Game Pleasures, we analyzed children's input and identified 28 distinct fun elements that can inform the design of transformational games with social robots. Our findings suggest that social robots, due to their capacity for embodied and interactive play, are uniquely suited to support learning through play. This research contributes a framework for designing engaging robot-mediated educational games.

6.11 Chapter Summary

In this chapter, we established that fun is crucial for engagement, persistence, and deeper learning. Educational games must prioritize fun, which is viewed not as a trivial component but as essential to effective learning. Recognizing that fun is subjective, situational, and contextual, we reported on a focus groups with 15 children to explore how to integrate fun into the design of REMind. The qualitative data, comprising 95 game design ideas, were analyzed using Framework Analysis and categorized using the MDA Taxonomy of Game Pleasures (Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression, and Submission). This analysis yielded 28 distinct elements of fun specific to robot games, with Fellowship, Sensation, and Challenge being the most prevalent themes in the children's ideas. Key qualitative patterns emerged, highlighting how social robots, compared to video games, introduced unique opportunities for fun through their physical presence, social interactivity, and non-human characteristics. For instance, children enjoyed the dramatic resonance of embodied role-play, the hero's journey fantasy, and envisioning the robot in social roles such as a friend or avatar.

The identified elements of fun directly informed the refinement of REMind's design. The updated game narrative centered on a robot, AVATAR, embarking on a heroic journey to eliminate a "glitch" that caused it to fail as a bystander in a past bullying incident. This new structure integrated fun elements like interactive storytelling (player chooses AVATAR's intervention), the challenge of solving a circuit-based "Bullying Detector" prop (use of props/discovery), and robot control/expression (streaming player's actions and voice onto AVATAR). Ultimately, this study provides a framework for designers to leverage the unique affordances of social robots to create holistic, engaging, and fun mixed-reality learning experiences.

The influence of these findings on REMind extends beyond what was presented as an example in this chapter. The next chapter will present the final design of REMind, showing how fun and learning are aligned not just narratively but mechanically and aesthetically. Section 7.2.2 outlines the *serious* learning goals which must be balanced with *fun* elements [324]. While the remaining sections describe how game design elements (including characters, narrative, mechanics, and props) work in concert to support them.

Chapter 7

System Overview: REMind Game Design Elements

"An educational game will make an effort to represent its subject matter correctly, as a professional flight simulator does."

- Adams & Dormans, *"Game Mechanics: Advanced Game Design"*

7.1 Introduction

REMind is a single-player, educational robot role-playing game (RPG) designed to foster prosocial bystander behavior in response to peer bullying. It engages children through embodied interaction with social robots, tangible props, and an interactive narrative that unfolds through play (see Fig. 7.1). The player observes a live dramatic enactment of a bullying situation performed by social robots and takes on the role of a mentor to a robot avatar. The player guides this avatar to interpret social cues, recognize bullying, and choose effective intervention strategies. Finally, the player puppeteers the avatar's reaction by improvising an intervention, which the robot then enacts in a replay of the scene, allowing the child to witness how the story unfolds as a result of their intervention.

Games, as *structured play*, are inherently systemic, and the fundamental activity of game design is understood to be system design [326]. This chapter provide a systemic overview of REMind by dissecting it to its parts: describing four game design elements via the lens of the Elemental Tetrad, while introducing Learning Goals as a fifth element that guides the system's overall design logic.

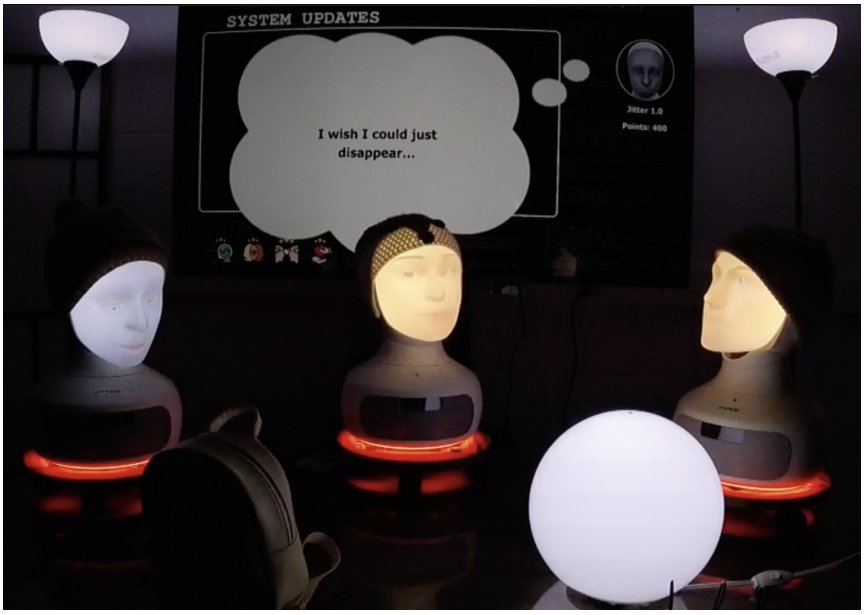


Figure 7.1: REMind engages players in role-play with three Furhat robots.

7.1.1 Elemental Tetrad of Game Design

Game design involves making hundreds, often thousands, of interrelated decisions about how a game works, looks, feels, and unfolds over time. This is rarely a linear path; rather, game design evolves iteratively through cycles of design, playtesting, reflection, and refinement [324, 326]. To understand and communicate the complex nature of a game's design, it is helpful to use structured frameworks.

One such model is Jesse Schell's *Elemental Tetrad* of game design [324], which breaks games down into four interdependent elements: Mechanics, Story, Aesthetics, and Technology. **Mechanics** are the procedures and rules that define the game's goals, what the players can or cannot do, and the consequences of their actions. **Technology** refers to the material and tools that make the game possible, from pen & paper, to custom motherboards. **Narrative** is the sequence of events within the game, which can be linear or emergent. And finally, **Aesthetics** is the look and feel of the game [324]. This chapters uses the Elemental Tetrad as a structure to provide a systemic overview of REMind. However, we emphasize that these elements do not exist in isolation [324, 326]; they are interdependent and interconnected, and must be considered as a dynamic whole.

7.1.2 Designing for Learning: Adding a Fifth Element

Creating effective Game-Based Learning (GBL) experiences requires that game design be purposefully driven by well-defined educational goals. As Plass et al. [283] argue, the mechanics of educational games (their rules, actions, and feedback systems) must be deliberately aligned with their learning goals. When mechanics are misaligned, learners may become proficient at the game without acquiring the intended knowledge or skills.

Similarly, Brenneman [57] emphasizes that narrative elements must also align with learning outcomes. Coherent narratives that resonate with learners' experiences and are meaningfully tied to educational goals, sustain learner engagement, promote reflection, and scaffold deeper understanding [57]. When the story is misaligned, the learners follow a thread that may be engaging, but leads nowhere.

Crucially, the elements of the Tetrad are not modular; they are interdependent and mutually influential [324]. Aligning mechanics and narrative with learning goals sets the trajectory for the entire system. Without such intentional alignment, the game risks becoming a superficial distraction that may be entertaining but ultimately pedagogically ineffective.

Therefore, in providing a systemic overview of REMind in the following sections, we begin by introducing learning objectives as a fifth and foundational game design element. This section precedes the Elemental Tetrad, establishing learning goals as the "tip of the arrow" that guides the design. Following this, we analyze how the four elements of the Tetrad—Mechanics, Narrative, Technology, and Aesthetics, and Technology—are structured to support the learning goals.

7.2 Learning Goals

Games Are Simulations

Games teach by functioning as simulations [7]. For instance, a game of Monopoly simulates competition within a real-estate market, while a child's game of "house" is an early simulation of adult life. Simulations can be understood as abstract models of real-world systems. Games teach players by allowing them to interact with these abstract models [7]. Just as playing Monopoly instills basic financial concepts like taxation and resource management, children's make-believe games serve as a vital rehearsal for life and an essential part of their cognitive and social development.

When we create a simulation, the process of abstraction requires intentionally omitting less-relevant details. A traffic simulator for autonomous vehicles, for example, might safely exclude aesthetic features like windshield wipers. Adams & Dormans [7] argue while scientific simulations strive for accuracy, games simulations prioritize engagement. Consider as an example, a city-building game — if solely intended for entertainment, such a game might let players erect a skyscraper instantly. However, if it aims to educate players about urban planning, skipping less glamorous aspects like zoning undermines the lesson. This creates a tension for designing educational games, in which designers must strike a balance between keeping the game *fun* and sending the correct *serious* message [7].

In the context of game design, it is the job of the designer to thoroughly understand the *serious* aspects of the system they wish to model and then judiciously decide which details to include and which to abstract away. To do so, scholars emphasize the importance of working in tandem with Subject-Matter Experts (SMEs) [324]. Specifically, Schell distinguishes between two types of SEMs: experts with deep factual knowledge, and those skilled in teaching it. REMind learning objectives and design goals emerged through contextual inquiry with both groups of experts: (i) elementary school teachers, who navigate bullying daily (whose perspectives were reported in the Chapter 5); and (ii) social psychologists specializing in peer bullying. In this section, we outline the learning goals of REMind and reflect on how they were shaped by consultations with SMEs.

7.2.1 Consulting Subject-Matter Experts

We consulted two psychologists from the University of Turku, Finland, who are internationally recognized for their contributions to peer bullying anti-bullying interventions. One expert is a senior researcher with decades of experience investigating the role of peer dynamics in bullying and evaluating the effectiveness of large-scale interventions. Her extensive foundational research has led the development of the KiVa anti-bullying program [313], a widely implemented, evidence-based intervention that incorporates role-play with animated agents and serves as a key point of reference in this project (see Section 2.2.3). Over the course of developing REMind, we frequently engaged with her publications, learning from her expertise to understand the field and inform design decisions. Motivated by this, we reached out to request consultation and feedback in 2022. She kindly agreed to provide feedback and invited a close collaborator to join the discussion. The second expert is a research collaborator whose research expertise primarily focuses on peer relations, social status and power dynamics underlying school bullying, and anti-bullying interventions. work involves researching the efficacy of intervention strategies, particularly within the context of the KiVa anti-bullying program.

The consultation procedure involved an in-depth discussion in a one-hour meeting. We briefly introduced the project, and engaged in a contextual inquiry aimed to gather guidance on safe intervention strategies, integrating meaningful game design choices, determining the target age, and selecting a resonant theme, as well as general advice and feedback. Experts generously agreed to maintain an ongoing dialogue through email correspondence, which allowed us to refine some design decisions in light of targeted expert feedback. They also helped us with choosing constructs and finding questionnaires for assessing intervention effectiveness, which will be described in the next chapter.

7.2.2 Seven Learning Objectives

Below, we outline seven learning goals for REMind, and reflect on how they were shaped by insights from subject-matter experts, as well as related literature.

Goal 1. Identifying Bullying

Teachers had revealed that difficulty in distinguishing bullying from teasing or joking is one of the common challenges peers face (see Section 5). To address this, REMind aims to familiarize learners with the 3 criteria to identify bullying (attributed to Olweus [92]): **(i) Repetition**, **(ii) Power imbalance**, and **(iii) Intent to harm**.

Goal 2. Practicing Intervention Strategies

A core learning objective of REMind was to encouraging to rehearse prosocial intervention strategies in response to peer bullying. Game design experts emphasize that a good game must give players **meaningful choices** [324] — which are understood as choices that lead players to reflect and ask themselves strategic questions (e.g., *"should I play it safe, or take a big risk"?*) Thus, a design consideration in REMind was: how might we give children meaningful choices when simulating a peer bullying situation?

We posed this question to the domain experts. Experts emphasized one way to give players meaningful choices in REMind is the choice amongst various defending strategies. For example, confronting a bully directly in public is an example of a choice that is both high-risk (as the bully might retaliate), and high-reward (as the defender may be viewed by peers as a "big hero"); whereas telling a teacher in private is a low-risk, low-reward choice. Experts also emphasized that while assertive defending is generally effective, it may be unrealistic for peers with social anxiety, who might avoid publicly confronting aggressors.

They introduced privately telling an adult, and comforting the victim as two alternative strategies that are safe for vulnerable peers.

With the help of experts, we identified five defending strategies typically used by peers outlined in the Adolescent Defending Behaviors Questionnaire (ADBQ) [381]: 1) Assertive defending (e.g., publicly confronting the bully); 2) Comforting the victim (e.g., offering kindness and emotional support); 3) Reporting to authority (e.g., a teacher or parent); (4) Aggressive defending (e.g., retaliatory or violent responses); and (5) Tactical defending (e.g., diverting the bully's attention away from the victim). Among these, we excluded aggressive defending as developmentally inappropriate and potentially harmful, and we did not emphasize tactical defending because its inherent ambiguity makes it difficult to model clear narrative consequences. Reporting to authority was also de-emphasized, as our primary design goal was to support direct peer intervention; and this would help us maintain narrative simplicity. As a result, REMind aims to promote two primary intervention strategies: **(i) Assertive defending** by using firm words to confront the bully, and **(ii) Comforting the victim** by offering emotional support and inclusion.

Goal 3. Understanding Outcomes of Defending

In REMind, children practice bystander intervention through interactive narrative scenarios and observe the unfolding consequences of their choices. A design consideration in REMind was to avoid over-promising outcomes and setting unrealistic expectations, because while bystander intervention can be highly effective, it does not always guarantee success. During our consultation with experts, we asked how to avoid over-promising while still motivating learners to keep trying, even if their efforts do not end bullying.

Experts emphasized that effectiveness of defending can be understood along two complementary dimensions: stopping the bullying, and making the victim feel better. They noted that even if a defending act does not fully halt the bullying, it can still be impactful in the sense that it makes the victim feel seen, supported, and less alone. This was also echoed in our prior interviews with local teachers who believed that receiving social and emotional support from peers can mitigate the psychological harms on victims.

Moreover, the experts also helped us recognize a third key outcome of bystander intervention. They explained that although children often worry that defending a victim will diminish their social standing by making them appear unpopular or weak among peers, research [221] suggests the opposite is often true: defending can increase their peer status.

Learning from these insights, REMind aims to teach children that the outcomes of defending are threefold: **(i) It may or may not stop the bully**, **(ii) It helps the victim feel better**, and **(iii) It can enhance the defender's peer status**.

Goal 4. Cultivating Empathy & Compassion

In the context of bullying, empathy with the victim is a key predictor of defending behavior [368, 134]. When designing experiences for promoting affective empathy, the question arises: could encouraging a child to feel the pain of others be emotionally harmful? We posed this question to our expert consultants. Their response emphasized that while affective empathy may lead to uncomfortable feelings, this is not inherently harmful. As one expert noted, *"We cannot protect children or young people from all possible negative feelings [..], but we could also talk about compassion"*.

Empathy and compassion are related constructs, but they are not the same. Empathy is defined as the ability to share another's feelings and understand their perspectives [344]. Whereas Compassion, is defined as "the feeling that arises in witnessing another's suffering and that motivates a subsequent desire to help" [142]. Ekman [120] operationalizes empathy by describing three correlates:

1. **Cognitive Empathy** is the ability to accurately perceive and understand another person's emotions (i.e., *recognizing* what they feel). While crucial for social interaction, it can be exploited and may not always translate to prosocial behavior [286].
2. **Affective Empathy** is the automatic and often unconscious mirroring of another person's emotions. (i.e., *feeling* what they feel).
3. **Compassionate Empathy** is the motivation to alleviate another person's suffering. It is theorized to be a common, but not definite, consequence of the two other forms of empathy [286].

Learning from these insights, REMind aims to help learners cultivate empathy and compassion by facilitating meaningful reflection on **(i) the (affective) feelings**, and **(ii) the (cognitive) perspectives of the victims** of bullying.

Goal 5. Exposing Bully's Motivation

We had learned from consulting teachers that one barrier to defending is that sometimes bullying is perceived by peers as "cool". During our consultation, we asked domain experts for practical advice for shifting peer percetions: how might bullying be reframed to reduce its appeal? Experts advised that making the underlying motivations of bullying visible may be a promising approach. That is, by emphasizing that bullying behavior often stems from insecurity, jealousy, the need to put others down to feel better about oneself, or a thirst for

power and control, which are not signs of confidence or social strength. As one expert put it, *"the thirst for power and control over others does not reflect a happy, balanced mind."* Based on expert advice, REMind aims to expose learners to the underlying motivations that bullying is often driven by.

Goal 6. Challenging Misperception of the Norms

Finally, experts emphasized that a key barrier to defending is a *misperception of norms* related to bullying within the peer group. Social psychologists define group norms as shared standards that prescribe acceptable attitudes and behaviors within a group context [309]. However, classroom norms are not always directly observable and therefore can be misperceived. In the context of peer bullying, children may refrain from intervening not because they condone it, but because they overestimate how much their peers approve of bullying [331]. This stems from a phenomenon called *pluralistic ignorance*, where individuals privately dislike a behavior but publicly pretend to agree with others, creating a false consensus [309, 361]. Therefore, experts emphasized that challenging misperception of norms and "making students aware that actually most of your peers don't like bullying" may be effective in promoting defending. As such, REMind aims to help learners understand this problem and teach them that most peers typically disapprove of bullying.

Goal 7. Reflecting on Self-Efficacy

Prior work by Salmivalli emphasizes that effective anti-bullying interventions should strengthen bystanders' self-efficacy [310]. This means bystanders should be empowered to feel capable and confident in their own ability to intervene and support peers who are being bullied. In our consultations, experts advised us to prompt children to *reflect* on their self-efficacy in relation to defending strategies. Therefore, REMind aims to promote learners reflection on self-efficacy.

7.2.3 Game Themes

To guide REMind's narrative framing, we brainstormed a set of candidate themes intended to scaffold prosocial interpretation and emotional engagement. These were not final narrative messages, but starting points for discussion with expert psychologists. Several themes were inspired by literature on peer bullying, while others drew directly from teacher interviews conducted in our prior work:

1. *"Offer your friendship"* – Encourages prosocial outreach to isolated peers; obtained from Interviews with local teachers [318], and inspired by the "The Healthy Context Paradox" [167].
2. *"Include those someone else has excluded"* – Encourages challenging social exclusion; obtained from Interviews with local teachers [318].
3. *"It's normal to be different"* – Destigmatizes nonconformity; inspired by "The Odd Student Repertoire" [359].
4. *"It's okay to change your mind"* – Normalizes shifting perspectives; aimed at easing bystanders' reputational concerns [309].
5. *"Don't give bullies power"* – Highlights bullying as goal-driven and encourages disrupting its social reward structure; obtained from Interviews with local teachers [318].

In our consultation with peer bullying researchers, we asked them to assess which of these candidate themes might resonate most with children. Experts' consensus pointed toward Theme 1 and Theme 5 as particularly impactful, suggesting that ***"Offer your friendship"***, and ***"Don't give bullies power"*** might be the most intuitive and motivating for peers. They also found Theme 2 (***"Include those someone else has excluded"***) promising for sending a broader message of prosocial inclusion. They were less supportive of (3) and (4), noting these may be less actionable or salient to peers. Notably, one expert advised us to add ***"You have the solution together,"*** to reinforce the collective nature of peer-based intervention.

7.2.4 Target Audience

In our earlier co-design studies with children, we focused on participants aged 8 to 12 years. This age range was consistent with the target demographic in related work [149]. However, we found this range to be developmentally broad, encompassing significant variability. To address this, we sought guidance on an appropriate age group in our consultation with expert psychologists. Based on their prior research evaluating the effectiveness of KiVa anti-bullying game across different age groups [199], they recommended narrowing our focus to 9- and 10-year-old children.

7.3 Core Mechanics

Game mechanics are the unique defining feature of games, distinguishing them from other media like books or movies, which rely on technology, story, and aesthetics. Sellers defines mechanics as "recurring patterns and 'chunks' of gameplay" that are built from the game's

tokens and rules [326]. Tokens are the representative objects that define the game's state (e.g., chess pieces or Monopoly money), while rules dictate the behavior and the interaction space of these tokens.

Mechanics Are Interaction Patterns

A fundamental characteristic of game mechanics that lends to their systemic nature is that they form a loop between the player and the game [326]. This loop involves the player formulating an intent, performing an action (input), the game altering its internal state, and providing feedback to the player [326]. Hence, in the context of REMind, game mechanics may be understood as patterns of human-robot interaction that contribute to "meaningful play" [358].

Games Teach through Mechanics

Adams and Dormans explain that good educational games do not lecture; rather, the signal they communicate is "generated by mechanics" [7]. Unlike traditional media which convey the message via presentational means such as the audio, video, or text, players primarily infer the game's meaning by interacting with the mechanics and observing the consequences of their actions [7]. For example, a game of Monopoly teaches players financial concepts not through direct instruction, but rather via hands-on play experience.

The interactive structure of game mechanics is critical to this process, because mechanics function to reward desirable behaviors and punish undesirable ones, effectively training players to understand and adopt the strategies necessary for success.

Below, we review the core mechanics of REMind.

7.3.1 Robotic Avatar

Central to REMind's gameplay is the concept of a robotic avatar. In video games, avatar is a special type of character that a player controls in a game [324]. An avatar can typically be customized, and serves as the player's representation in the virtual world of the game [326]. A robot game is distinct in that it is not situated in a virtual environment— it happens in the real world. The robotic avatar is physically embodied and may be co-located with the player in the real world, which introduces practical design implications. Unlike conventional avatars, the robot avatar is not fully controlled by the player. Instead, the gameplay

establishes a relationship in which the avatar is positioned as a semi-autonomous social actor, occasionally guided by the player, who takes on the role of a mentor.

Before the game starts, the player may customize the robot's face, voice, name by using a GUI; and physical accessories, by choosing a hat and placing it on the robot, as well as selecting its favorite stuffed toy and placing it robot's backpack.

To interact with the robot, player can also engage the robot in conversation to persuade it to do something, or change its perspective (such as asking the robot to open its eyes when the bullying scene is replayed, or persuading it to believe in its own ability to make a difference). In addition, the player may explain aspects of the social world that the robot does not understand, including the emotions experienced by other characters. At times, the player is asked to make decisions on the robot's behalf, such as selecting an appropriate strategy for intervening in a bullying situation. On rare occasions, the player takes direct control of the robot's actions by puppeteering its behavior, particularly in high-stakes scenarios that demand immediate intervention.

To complete this interactive loop and establish the robot's role as player's avatar, the gameplay provides feedback to the player in a variety of ways. The robot avatar embodies the player's customization choices, for instance, by recognizing and referring to itself by the name given by the player and addressing the player by their name. It may also respond through performative reactions, such as demonstrating a newfound understanding of other characters' feelings. Feedback is sometimes conveyed through the game graphical user interface (GUI), for example by showing that a "low self-confidence" error is cleared. Narrative consequences also reflect the player's choices, as story branches develop accordingly. Finally, during when the avatar robot is puppeteered, it mirrors the player's facial expressions and voice in real time.

These feedback mechanisms may operate redundantly. For instance, when the GUI indicates that an error message has been cleared, this change may also be reflected in the robot avatar's behavior and in the progression of the narrative.

7.3.2 Robot-Mediated Spect-Actorship via "Puppet Mode"

The central mechanic of REMind is robot-mediated spect-actorship, which is inspired by Augusto Boal's Forum Theatre [43] (see section 2.3.4). In the game, this mechanic is referred to as *Puppet Mode*.

During gameplay, the player watches a scripted dramatic scene involving peer conflict, performed by three social robots (see Fig. 7.1). This scene is presented twice. The avatar robot plays the role of a bystander to a bullying scenario. In the first run, the avatar

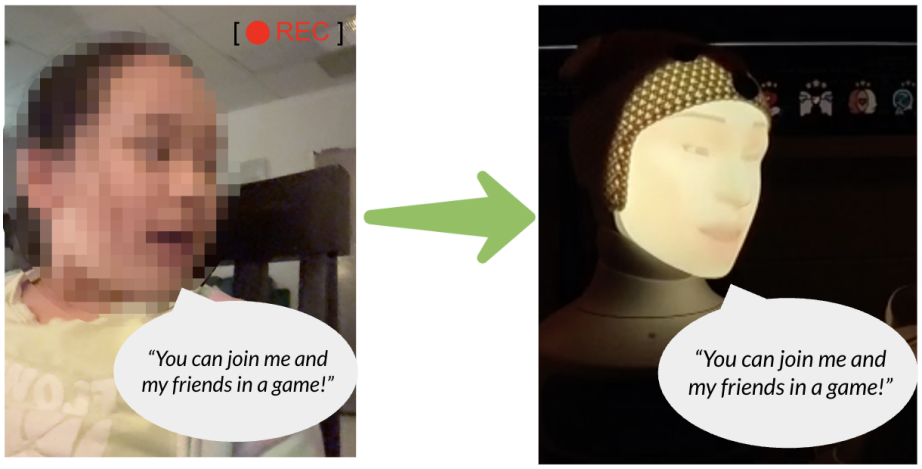


Figure 7.2: An example of the "Puppet Mode" Interaction: Player's facial expressions and voice are captured and converted to a gesture played on the robotic avatar.

remains passive. In the second run, the player is invited to stop the performance at a chosen moment and puppeteer the avatar robot to enact an alternative course of action. In doing so, the player improvises what they think the bystander robot should do as if they were the robot, intervening directly in the dramatic scene (see Fig. 7.2).

Feedback from this mechanic is delivered in two forms. First, the player watches the avatar robot reenact their recorded performance, providing a second-person perspective on their own moral intervention. This enables a form of "self-as-other" reflection, an experience not afforded by traditional games, applied drama practices, or puppet play. Second, the game offers narrative feedback by showing how the story evolves in response to the player's intervention, both in the immediate resolution of the scene and in the broader consequences that unfold as a result of choosing to defend.

7.3.3 Debugging Moral Reasoning via "Bully-Detector"

REMind uses a custom-made interactive prop named *Bully-Detector*, designed to help players practice identifying bullying (see Fig. 7.3). When a button on the Bully-Detector is pressed, the speaker on the device plays a pre-recorded diagnostic question: (1) "Has it happened more than once," (2) "Is someone more powerful than the other," and (3) "Did someone hurt the other on purpose"?

Considering the scenario, player may collaborate with avatar to respond to each question by flipping the corresponding toggle switch to indicate "yes" or "no." When the TEST



(a) Front View (b) Top View

Figure 7.3: "Bully-Detector" is an interactive prop to practice moral reasoning about bullying. The buttons play yes/no questions. The alarm goes off if bullying is "detected".

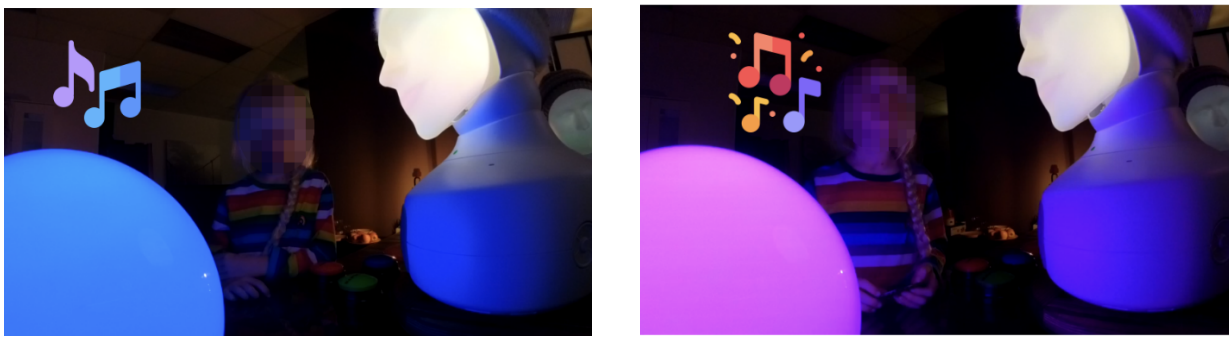
button is pressed, the alarm will be triggered only if the device has "detected" bullying. Feedback includes avatar expressing that it now understands the incident as bullying rather than *"just a joke,"* as well as the narrative advancing to the next module.

These three diagnostic questions correspond to the 3 criteria for identifying bullying: repetition, power imbalance, and intent to harm. Through exploration, players may discover that the alarm only goes off if all three answers are "yes".

7.3.4 Empathy Training via Affective Interpretation

Another core mechanic of REMind focuses on empathy training through interpretation of an affective display of ambient light and music. In this activity, the player is tasked with filling in the gaps in avatar robot's understanding of the emotional state of another character (the victimized robot) by identifying the emotion represented via affective audio-visual cues, and explaining what it feels like.

In the narrative, the robot avatar expresses that it "detected" two emotions in the victimized robot, JITTER, however, since robots do not have hearts, avatar cannot fathom what these emotions mean, and only understand what they look and sound like; and therefore, needs human help (see Fig. 7.4).



(a) Sadness (b) Fear

Figure 7.4: Avatar displays 2 emotions it has "detected" in the victim through ambient audio-visual cues. Player explains these emotions to the robot.

This mechanic positions the player as a co-meaning-maker, inviting them to reflect on the victim's emotional experience and articulate it to the robot. In doing so, the mechanic supports affective perspective-taking and empathy training through an embodied social interaction. Rather than asking the player to recall predefined emotional labels, this mechanic draws on their capacity to observe, infer, and explain; reinforcing the relational, socioally-situated nature of empathy.

The loop is completed when the robot avatar acknowledges understanding the player's explanations. Furthermore, once both emotions are reviewed, the robot performatively reflects on how the victimized robot must have felt; which culminates in avatar taking JITTER's perspective and realizing that they must have felt terribly alone. Finally, the story advances based on the avatar's updated understanding.

7.3.5 Narrative Mechanics

Player agency is central to the motivational of games. Unlike traditional entertainment media like books or films, games do not progress if the audience are passive; the experience unfolds only if the player acts [326].

Within the framework of Interactive Digital Narratives (IDN), Narrative Mechanics are the mechanisms by which players enact agency within the narrative space, shaping events, influencing characters, and progressing the plot through their choices and actions [118]. They serve as a bridge between the pre-scripted narrative content and the process of unfolding the story through user interaction [208]. Below, we outline the key narrative mechanics that drives story progression in REMind.

Prop-Mediated Perspective and Frame Switching

REMind uses two prop-mediated narrative mechanics facilitate to explore interactive non-linear storytelling: players may view how the story unfolds from the point-of-view of different robot characters; and they may extend this mechanic by "loading" different versions of the same robot character. The former may facilitate perspective-taking, and the latter is used to demonstrate alternative endings in scenarios where narrative outcomes are inherently ambiguous and non-deterministic (for example, that bystader intervention may or may not end the bullying behavior).

Changing Point-of-View via "Access-Cloud" Each robot character in the game is associated with a small magnetic cloud-shaped prop called an Access-Cloud: a representational token that enables players to shift narrative point-of-view by gaining access to a robot character's internal state. To "connect" to a robot character, the player must first attach the associated Access-Cloud to "Nimbus" (which is a repurposed IKEA lamp with a metal frame), and then, toggle the lamp's switch on and off (see Fig. 7.5). The game provides feedback by updating the robot profile picture and name displayed on the GUI, and triggering a notification to signal that the robot is successfully *connected*. Once a robot is connected, its internal affective state may be represented via ambient audio-visual cues, and its cognitive state (e.g., thought bubbles) may be displayed on the GUI. Ultimately, this narrative mechanic allows players to watch the unfolding story from the perspective of different characters in the room.

Robot Version Control via "Marshall-Box" To facilitate reflection on the consequences of intervention, the player can view multiple alternative versions of the same character (e.g., JITTER before vs. after intervention, or two alternative versions of reality where FUSE stops bullying, or does not). This narrative mechanics complements the Access-Cloud, and is achieved through embodied interaction with a prop named Marshal-Box. The player may select one of the keyed tokens (representing different character versions), and plug it into the Marshal-Box in order to "load" that character into the Access-Cloud (see Fig. 7.6). This interaction produces immediate visceral feedback (a satisfying click sound), changes the corresponding character name on the GUI, and initiates the alternative narrative path by allowing the player to simulate the specific version of that character.

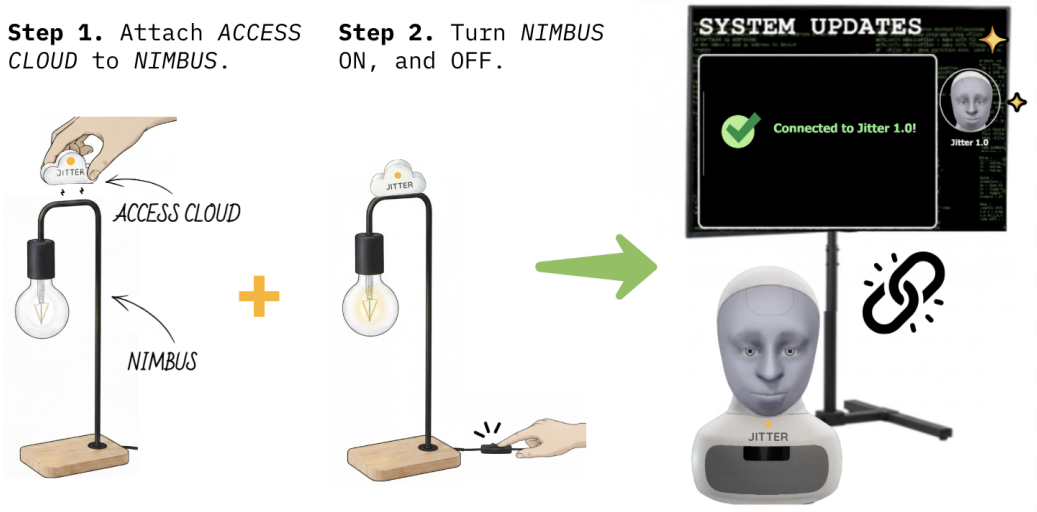


Figure 7.5: Narrative mechanics are implemented via interaction with tangible game props. Players use Access-Clouds to view the story from different robot characters' points-of-view.

Activating Robot Processes via Push-Buttons

At certain points during the gameplay, players may activate various processes by pressing large push-buttons. For example, the player animates the avatar with their recorded performance at their preferred time during the replay of the conflict scene by pressing a button labeled "Puppet Mode".

Pressing a push-button provides an immediate feedback by playing an audio cue, as well as initiate the process that is related to the button. For example, pressings the "Simulate" button will initiate a replay of the conflict scene by powering up the other two robot actors, setting all the robot LEDs and room light to red and playing a count-down video on the GUI—followed by the 3-robot dramatization of the bullying scene button to replay robot's past memory (see Fig. 7.7).

Manipulating Abstract Social Resources via Symbolic Tokens & Containers

REMind uses tangible symbolic tokens & containers as metaphoric representation of abstract social resources (such as a character's peer status, or a bully's power). Embodied interaction with these props in the context of the story (for example, taking away tokens representing a bully's power) is used to reinforce specific learning goals.

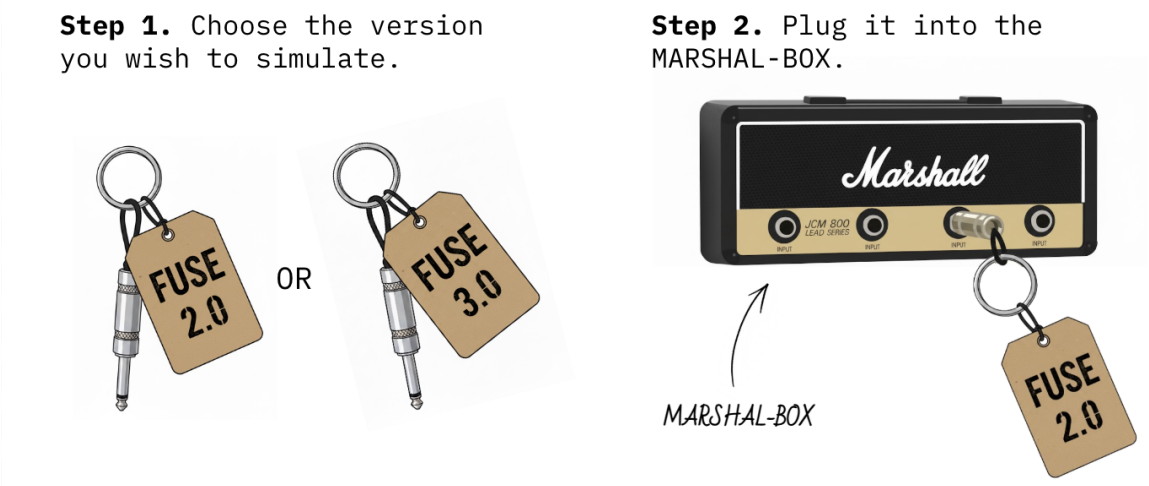


Figure 7.6: Prop-mediated interaction allows players to select different "versions" of a robot character to view alternative story endings.

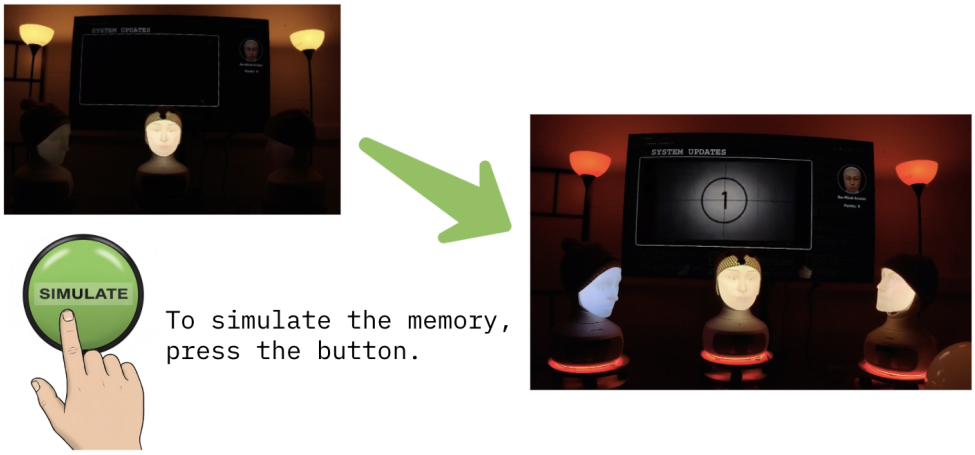


Figure 7.7: Player may initiate the dramatization of the conflict scene by pressing a button.

Taking away Bully's Power via the "Power-Box" At the end of the game, the player interacts with a metaphoric prop called the *Power Box*, which is placed in front of the bully character. Inside the box are thunderbolt-shaped tokens that metaphorically represent the excess power the bully holds. To complete the scene, the player removes these tokens and discard them into a nearby bin (see Fig. 7.8). This tangible interaction symbolizes taking away bully's power. This mechanic produces immediate physical feedback through the act of removing tangible tokens. It also triggers narrative feedback, acknowledging the player's

action as a resolution within the story.



Figure 7.8: Embodied interaction with Power-Box, a tangible prop reinforcing the morale of the story.

Increase in Avatar's Peer Status via "Heart-Meter" The *Heart-Meter* is another metaphoric container with symbolic tokens. In REMind, the tokens are heart shared stickers and sponges which represent avatar's peer status. The player can physically open and close the drawer box and inspect it at two key points in the story. Early in the game, player finds it nearly empty. Later, after intervention, the player reopens the same drawer to find it (seemingly magically) filled up (see Fig. 7.9). The tangible interaction provides immediate feedback visible through the altered state of the prop, as well as narrative feedback, reinforced by avatar's overjoyed reaction to the change.

Modeling Cognitive Obstacles via Robot Errors

At certain points during the gameplay, robot error messages appear on the GUI. Not as real robot malfunctions, but as intentional design elements that dramatize narrative breakdowns, signaling moments when the avatar robot faces a cognitive obstacle (e.g., struggles to understand a social situation).

Drawing from Interactive Digital Narrative (IDN) theory [208], robot error messages function as "narrative vectors": substructures that guide the player's interaction by providing directions as they transition between narrative events. Importantly, they function as a mechanic for cognitive scaffolding: That is, errors may be used as a deliberate modeling technique to represent the specific cognitive obstacles the robot (and by extension, the player) must overcome to achieve the learning objectives (such as bystander intervention).

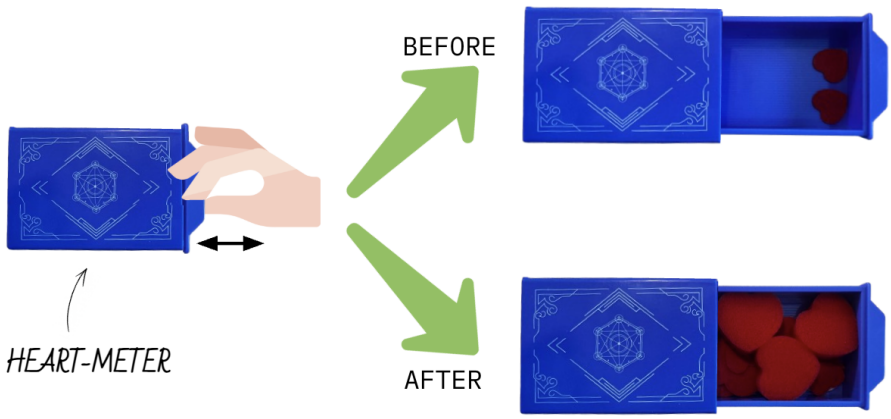


Figure 7.9: The player opens the "Heart-Meter", a drawer box that symbolizes avatar's social status, before and after intervention.

Error messages are paired with a suggested "fix," prompting the player to take corrective action. Error messages are usually accompanied by a performative expression from the robot, such as looking upset (see Fig. 7.10). Once the player addresses the issue by following

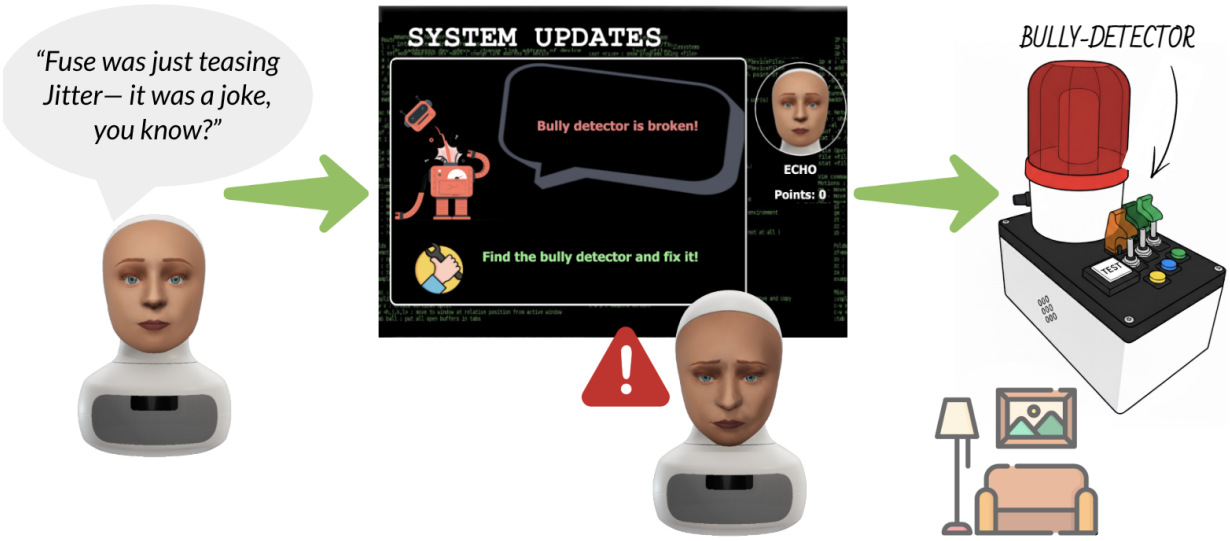


Figure 7.10: Error messages signal a narrative breakdown requiring player's intervention.

the suggested fix, the game provides feedback through a GUI notification confirming that the error has been resolved. This also often prompts a reaction from the avatar and allows

the narrative to progress.

In this way, the robot errors drive the story forward, justify shifts in the mode of interaction (e.g., from observation to intervention), and maintain narrative coherence while explicitly aligning the gameplay challenge with a pedagogical goal.

Listing Cognitive Gaps via "Debug Mode"

The player may initiate robot's Debug Mode, by finding and pressing the Debug button. The game provides feedback by the avatar robot momentarily closing its eyes while the TV screen displays a radar scanner searching for missing memory components (represented as null values), and then generating a list of information that needs to be recovered.

As the player helps the robot fill in the gaps in its mental model, the GUI visualizes the progress (see example in Fig. 7.11). By providing a set of sequential challenges, Debug Mode also serves as a narrative vector.

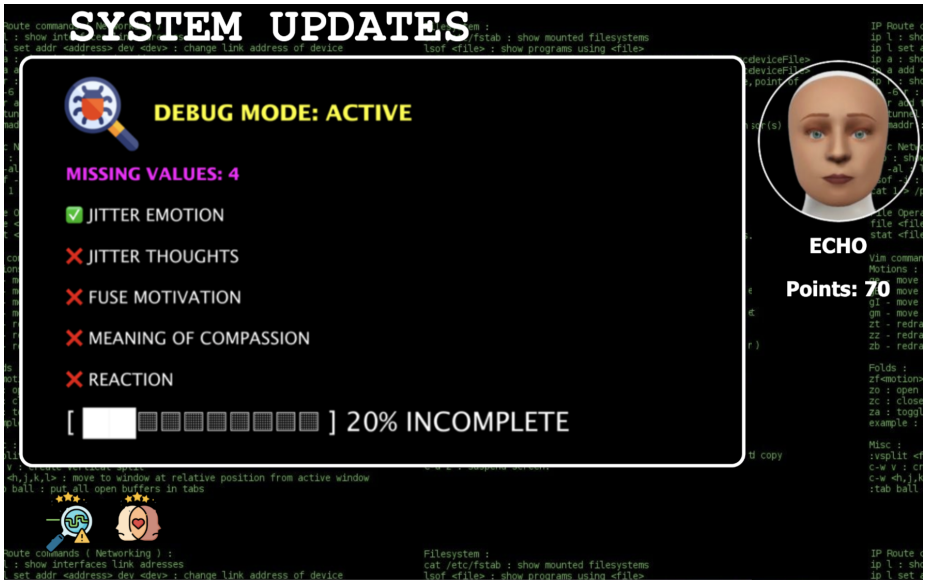


Figure 7.11: The "Debug Mode" lists missing values the player must help robot recover.

Prop-Mediated Narrative Activation via "ORACLE"

ORACLE is the name given to a globe-shaped plasma lamp that is framed as the wise guardian of the social robot world. As a core narrative mechanic, ORACLE is the central-

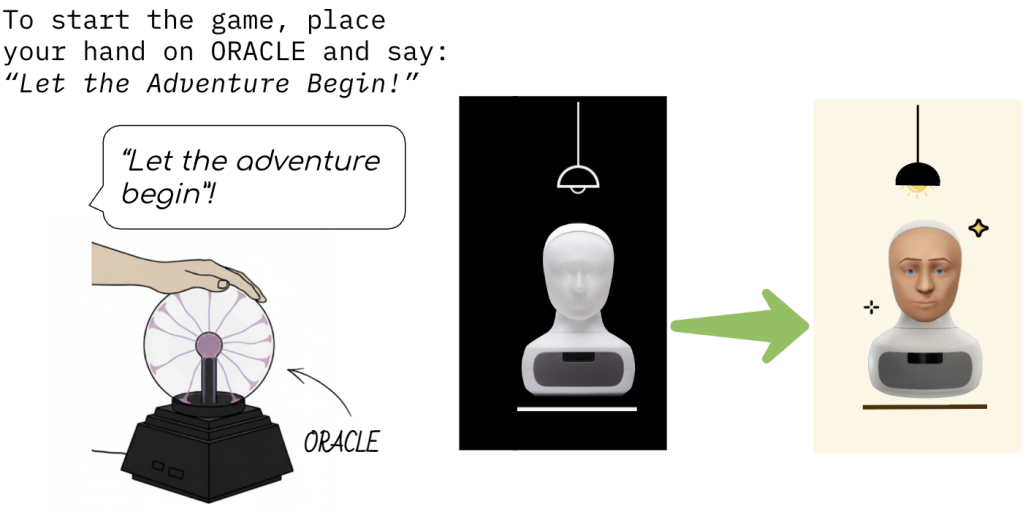


Figure 7.12: The player initiates the game via haptic interaction with a plasma light.

ized source of meta-level guidance, assisting the player and the avatar in discovering the story's overall structure, uncovering the consequences of their actions, and facilitating the discovery of resolution from multiple perspectives.

Initiation and the Magic Circle The ORACLE acts as the point of initiation for the game experience. The player begins by placing a hand on the ORACLE and speaking a command (e.g., "let the adventure begin", see Fig. 7.12). This haptic interaction with the plasma light provides immediate sensory feedback, and the larger game provides responds via multi-modal feedback: the room lights up, the GUI plays a startup video, and the customized avatar robot is activated. In this way, the interaction enables the player to "enter the magic circle" [324] of the game.

Meta-Level Narrative Guidance As a guide, the ORACLE may deliver critical meta-level information via pre-recorded video messages played on the GUI (see Fig. 7.13). These messages serve as explicit narrative vectors, providing abstract clues that direct the player's interaction toward achieving story resolution. For example, the ORACLE may suggest finding and connecting to another robot's Access-Cloud to shift perspective, which allows the player to observe the full impact of their intervention. When the player successfully executes this instruction, the game provides narrative feedback by progressing the plot in accordance (in this example, shifting the point-of-view, and revealing new information

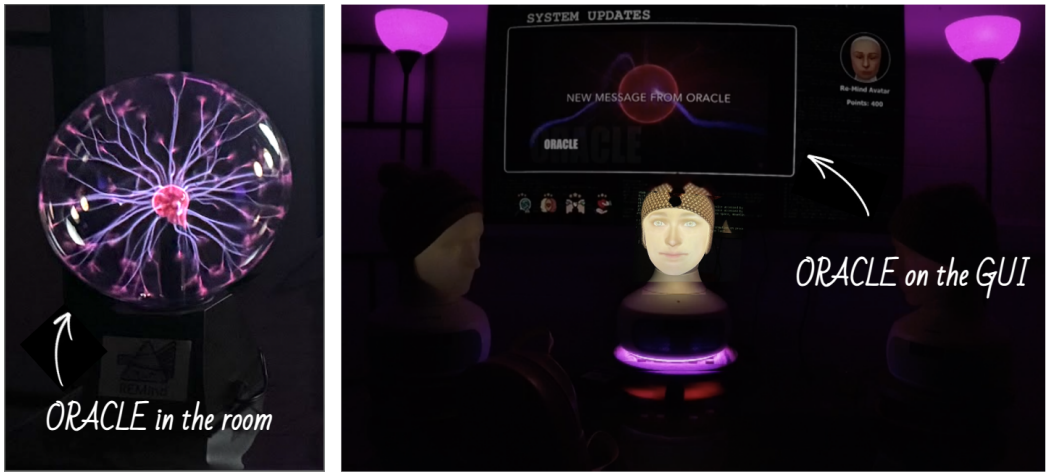


Figure 7.13: ORACLE provides narrative guidance via pre-recorded messages on GUI.

about the consequences). In this role, the ORACLE helps maintain narrative coherence while supporting player agency.

ORACLE-Prompted Item Retrieval At specific moments in the gameplay, the GUI displays an image of a specific item (such as a numbered clue, see Fig. 7.14), signaling that the player may search the physical room to find the corresponding clue card. This interaction is framed narratively as a message sent by the ORACLE (as the wise guardian) to guide the player's next step. Feedback from this mechanic comes through the function of the retrieved object, such as discovering instructions written on the found clue card, which help the player make progress and advance the narrative.

Points & Achievements

Finally, at different milestones during the gameplay, the game narrative provides players with feedback by offering points and badges as in-game rewards. The game is designed without penalties; however, if the player chooses not to engage with the challenges, the narrative does not progress.

Points are awarded for completing smaller milestones, such as resolving error messages, for instance, helping the avatar regain its self-confidence. Point-related feedback is delivered through an audio cue (e.g., coin sound) and a visual update to the points tally on the GUI. Points are also used to influence decision-making at a key narrative juncture where the player selects an intervention strategy. The player is presented with two options: confront

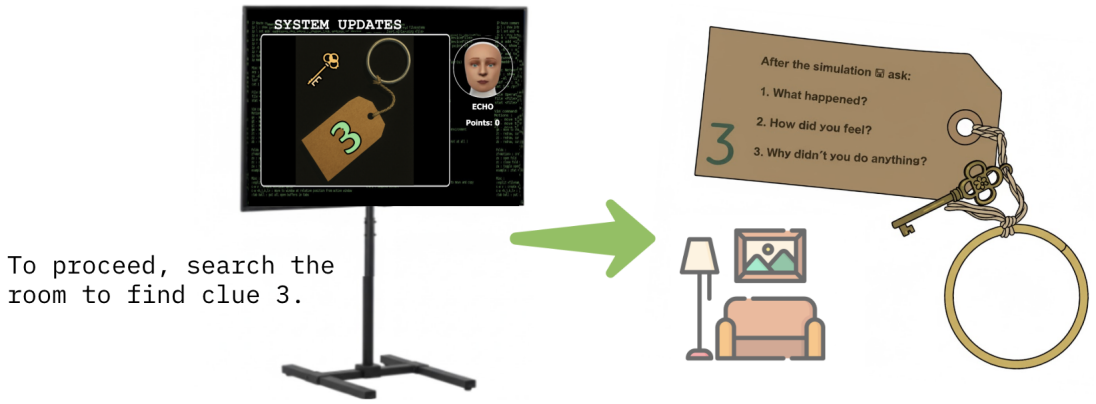


Figure 7.14: The GUI prompts the player to find a numbered clue hidden in the room.

the bully for 1000 points, or comfort the victim for 500 points. This design reflects insights from domain experts (see Section 7.2.2), where confronting the bully is recognized as a higher-risk, higher-reward strategy. By assigning greater point value to the more difficult option, the game aims to encourage players to explore direct intervention within a safe environment.

In addition to points, REMind features five collectible badges: "Bully Detective," "Empathy Guru," "Perspective Taker," "Compassion Expert," and "Defender Hero." These are awarded upon successful completion of specific modules. Feedback for badge achievements includes a GUI notification with a chime sound, and the badge appearing in the player's collection bar at the bottom of the screen.

7.4 Narrative Design

While all games have narrative components, different games integrate storytelling to various degrees. In some games the story merely provides a superficial context (e.g., Angry birds), however, in some others, it is an integral part that provides context for the interactive experiences [326]. REMind is a story-driven game. Storytelling plays a central role in role-playing games (RPGs), where narrative is not only the medium but also the mechanism through which meaning is constructed. In this section, we overview the narrative design of REMind.

Stories Promote Prosocial Behavior

Storytelling is fundamental to human cognition, serving as a primary means of constructing meaning, transmitting values, and shaping our understanding of the world [100]. Studies of hunter gatherer tribes suggest that storytelling may have evolved as a way to promote cooperation and social cohesion [332]. This is confirmed by recent reviews that show digital storytelling activities can significantly promote prosocial behaviors in children by positively influencing their values and enhancing their emotional and empathetic skills [337].

Stories Teach Empathy

Koster [211] argues that stories and games teach in fundamentally different ways: where as games teach "experientially", as they are about people's actions, and excel at reducing complexity by making simplified, quantized models which helps them function as "deliberate practice machines"; whereas stories teach "vicariously", as they are primarily about people's emotions and thoughts, and excel at generating empathy.

The efficacy of stories in evoking empathy is well-supported. When immersed in a story, brain regions associated with the "self" become inhibited [348], leading individuals to experience the emotions and perspectives of characters as if they were their own, effectively fostering empathy. Psychologists refer to this phenomenon as "narrative transportation" [370]. According to a meta-analysis of 132 studies on narrative transportation [370], it can significantly influence people's beliefs, attitudes, and intentions, aligning them with the moral themes of the story.

Persuasive Power of Storytelling

Unlike analytical persuasion, which relies on logical evaluation, narrative persuasion operates primarily through affective mechanisms, reducing critical thinking while increasing openness to the story's message [370]. Compared to analytical persuasion, the effects of narrative persuasion tend to be long-lasting and, in some cases, may even strengthen over time [370].

Given that empathy is central to REMind's game goals, our narrative design prioritizes the development of in-depth characters and multimodal communication of their internal thoughts and emotions.

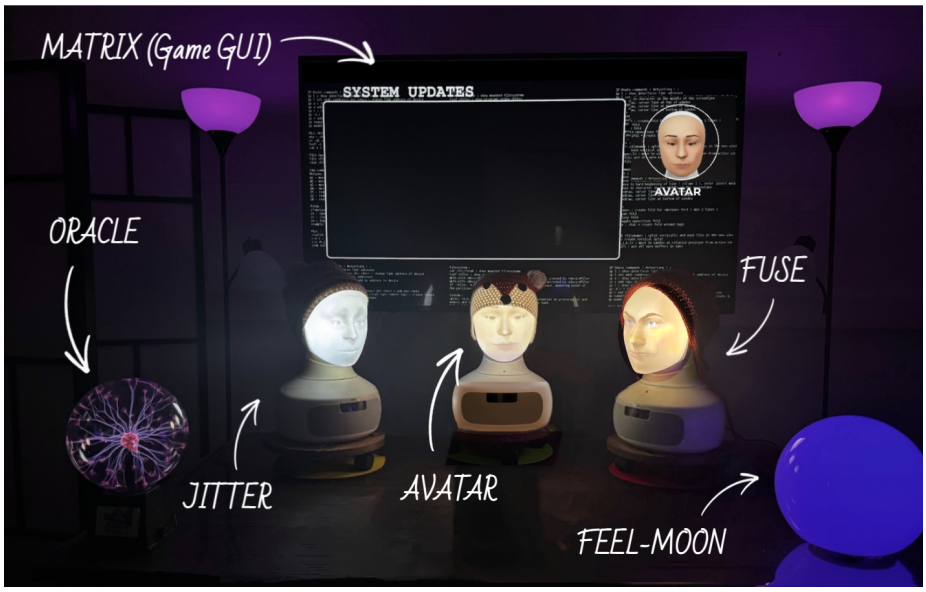


Figure 7.15: Storytelling elements in the REMind game world.

7.4.1 Characters and Setting

REMind is set in a fictional world named KERNEL inhabited by social robots. KERNEL is located at the University of Waterloo, in a room that is designed to resemble a studio apartment.

Setting

In the middle of KERNEL, three Furhat robots are placed on a dining table, arranged in a triangle, with the main player character robot positioned in the middle. A large TV screen, named MATRIX (aka, the GUI, is situated behind the dining table. ORACLE, a plasma light is placed on a nightstand opposite the dining table. The room has three primary light sources: two floor lamps flank MATRIX, and a globe-shaped lamp named FEELMOON is placed next to the table. FEELMOON may be activated by a robot character to visually express a specific emotion. (see Fig. 8.4).

Characters

REMind features 3 main robot characters (see Fig. 7.16):

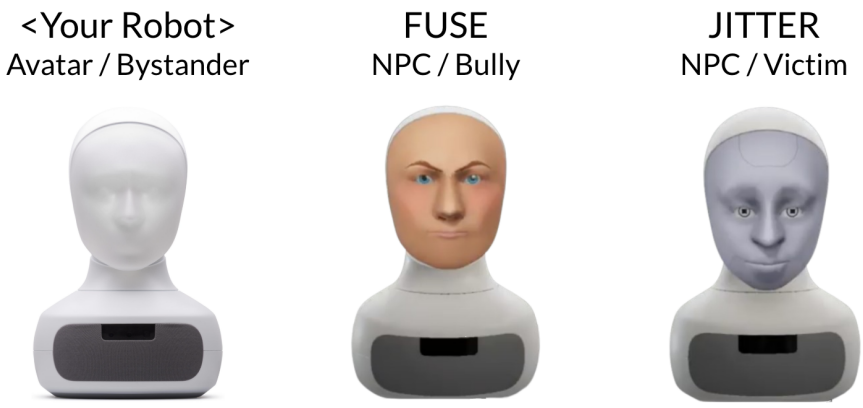


Figure 7.16: Three Robot Characters in REMind.

1. **AVATAR**[1]: Serving as the player's in-game avatar, AVATAR's goal is to fix the mysterious glitch that has struck KERNEL, causing robots to malfunction. To do so, AVATAR must go on a heroic journey through time to explore a past memory by simulating it, and then and rewrite the memory. However, AVATAR can only achieve this with help from a human child, because solving the glitch requires one to "think with their heart" — something robots lack.

2. **JITTER**: A Non-Player Character (NPC) robot who appears in AVATAR's simulated past memory. In this memory, JITTER is a victim of bullying by another robot, FUSE.

3. **FUSE**: The second Non-Player Character (NPC), FUSE is the robot who is bullying JITTER in AVATAR's past memory.

Channels of Robotic Character Expression

The robot characters serve as the key interfaces through which players experience both the physical and social aspects of the game world. They communicate and express themselves through three distinct channels:

(i) **Robot Behavior** conveyed directly via speech and facial expressions,

[1]AVATAR in all caps is used as a placeholder for the name given to the robot by the player.

(ii) **Robot "Mind"** visualized on the MATRIX, as thought bubbles or internal processes (see Fig. 7.21), and

(iii) **Robot "Emotions"** represented physically within the room using ambient music and light cues.

7.4.2 Cognitive Scaffolding: Modeling Peer Defending

At its core, a story is a sequence of events viewed from a perspective [211], typically featuring a character on a *path* to achieve a particular *goal*, who is block by specific obstacles they must overcome [154]. In games, the narrative often informs the player about the game world and helps them establish their in-game goals [326]. In an educational game, the game goals must be aligned with the learning goals [57]. A central goal in REMind is for the player to practice bystander intervention by coaching the robot AVATAR to intervene against peer bullying. To facilitate this learning, the story structure directly reflects the cognitive obstacles AVATAR must overcome.

The narrative is scaffolded by Latane and Darley's model of bystander intervention [222] which describes five cognitive steps people go through before helping in an emergency: (1) notice the situation, (2) interpret it as an emergency, (3) assume responsibility, (4) know how to help, and (5) take action [222]. Accordingly, the game's story unfolds across five sequential steps that guide the player through solving a series of symbolic sub-problems:

1. **Noticing**: Asking AVATAR to keep its eyes open as the bullying scene unfolds (necessary to prevent the simulation from being aborted).
2. **Interpreting as Bullying**: Fixing AVATAR's broken "Bully-Detector."
3. **Assuming Responsibility**: Helping AVATAR understand its responsibility explaining the victim's emotions and perspective (Empathy Training), and reflect on the bully's motivation.
4. **Assuming Responsibility**: Choosing AVATAR's specific intervention strategy.
5. **Taking Action**: Puppeteering the robot's intervention.

Important, REMind does not end when AVATAR intervenes in peer bystander; rather, it is essential that the narrative embeds proceeding steps to convey the outcomes of the intervention. To do so, the narrative outcomes are scaffolded by the three-part model of intervention impact outlined in Section 7.2.2: (i) bullying may or may not end as a

result of the intervention, (ii) defender may gain peer status, and (iii) the victim feels better. REMind narrative design reflects this by allowing the player to not only observe the impact of intervention on FUSE's immediate reaction in the scene, but also observe how AVATAR and JITTER are transformed as a result.

Finally, in this game the glitch that has affected the robot society is a metaphor for "Misperception of the Norms" (explained in Section 7.2.2). The glitch is introduced to the story as caused by a shared misunderstanding among many robots. It is ultimately resolved when AVATAR discovers that this misunderstanding stems from many robots disliking the bully's behavior but incorrectly believing that their peers approve of it.

By embedding theory into the narrative flow, REMind aligns story progression with learning objectives, gradually building cognitive schema for moral action.

7.4.3 Embedded Narrative

REMind narrative arises from combinations of embedded and emergent narratives components. Embedded narrative is the pre-existing, crafted narrative content that the player interacts with but does not significantly influence, such as backstories and cutscenes [57].

Inciting incident: Introducing The Glitch

As soon as the robot AVATAR robot comes to life, it asks the player for help and is immediately interrupted by a mechanical glitch sound. AVATAR explains that the glitch changed everything: Before the glitch, robots were kind, shared power, and helped each other all the time. After the glitch, robots start making errors, show signs of disharmony and confusion, and are now selfish.

AVATAR explains the glitch is urgent because it gets progressively worse. At the beginning robots forget small things, such as parts of their sentences, but now, robots are forgetting important things, like friendship. AVATAR confesses it can no longer remember the names of its two best friends because of it.

Finally, AVATAR reveals its teacher said the glitch is caused by a "big misunderstanding" that many robots share, essentially meaning their algorithms learned the wrong thing about how the world works. To fix it, they must figure out what they got wrong and "unlearn it." A game clue reveals that as a first step, AVATAR must simulate the memory of its first glitch and change it.

Conflict: Simulated Memory (Peer Bullying Scene)

This simulated memory begins with AVATAR noticing that JITTER looks sad, approaching to ask what is wrong. JITTER explains that *"There's a game of 'Guess who,' a game of 'Red light green light,' and a game of 'Simon says,' and nobody is letting me play!"*. At this moment, FUSE enters the scene (wakes up) and immediately begins bullying JITTER by asking if someone forgot to finish designing its face. JITTER quietly asks Fuse to stop. FUSE asks *"Why should I stop?"*, and escalates the mockery by raising its voice and taunting JITTER about its quiet voice, demanding, *"Speak up, JITTER!"* JITTER looks sad and quietly protests that its voice *"isn't that quiet..."*. FUSE continues to taunt JITTER by inventing a new mocking nickname: *"Pixel-Face! That's your new name now!"*. As FUSE proceeds to repeatedly call JITTER *"Pixel-Face"*, the sound of children laughing fills the room. AVATAR watches the entire exchange but does not intervene. The scene ends with JITTER silently looking at AVATAR with a sad downward expression.

Backstories: Establishing Behavioral Patterns

When collaboratively fixing the Bully-Detector, AVATAR shares three brief backstories involving FUSE and JITTER.

1. On JITTER's first day, someone asked what JITTER's hobby was, and JITTER said making animal sounds. FUSE just cut in and said: *'Okay, enough out of you, baby-JITTER-dork!!'*, and some robots laughed. AVATAR did not laugh, because it sounded rude; but also did not interfere.

2. One time, FUSE stole JITTER's homework as a prank. JITTER was searching everywhere. AVATAR knew what happened and wanted to help, but did not want to be a snitch—so they rolled away.

3. Another time, FUSE had a birthday party and invited everyone, except for JITTER. No one else said anything, so AVATAR thought they should stay out of it.

Together, these backstories establish the pattern of FUSE's bullying and, more importantly, explain AVATAR's hesitation to act by reflecting its *misbelief*. A character's misbelief is a false conviction they hold about themselves, others, or the world that seeds inner conflict. This conviction is the direct opposite of the morale of the story. AVATAR's misbelief is: "It is better to stay silent and avoid conflict than to intervene in bullying." By embedding this misbelief into AVATAR's history, the narrative sets up the opportunity for the player to overturn this conviction later on, transforming AVATAR from a passive bystander into a defender.

Addressing Cognitive Gaps: Empathy and Perspective-Taking

After fixing the Bully-Detector, player activates AVATAR's debug mode. AVATAR generates a list of information that needs to be recovered.

JITTER's Emotions. The first missing value is JITTER's emotions. AVATAR displays two detected emotion using FEELMOON lamp paired with affective music, and the player interprets the displays by naming the emotion (e.g., "sadness"), describing how it feels, and sharing a story about it. After the player completes this process for both emotions, AVATAR reflects on its new understanding. It concludes that based on JITTER's emotional state, "If I were JITTER, I would have wanted someone to say something."

JITTER's Thoughts. The training then shifts to Perspective-Taking. The player helps AVATAR take JITTER's perspective by improvising in response to this question: *"If we could hear JITTER's thoughts, what do you think we would hear"*? AVATAR nods and acknowledges the response.

FUSE's Motivation. Also, the player speculates on FUSE's Motivation for acting as a bully. AVATAR reflects on player's suggestions, considering that FUSE may have been seeking power by putting JITTER down. AVATAR ultimately reasons that perhaps FUSE also needs help, concluding: *"If someone feels the need to hurt others to feel better, they might not be very happy inside."*

Choosing Intervention Strategy

With its cognitive gaps addressed and a responsibility to act assumed, AVATAR detects two options for intervention, which are displayed on MATRIX. The player must choose how AVATAR will respond to the bullying, selecting one of the following two strategies:

1. Comfort JITTER
2. Be Firm to FUSE

Improvising Intervention

After making a choice, AVATAR asks player for examples of what it should say to carry out the strategy. Player improvises a response, and then shows AVATAR brainstorms and

improvises what AVATAR should say to carry out the chosen intervention strategy. They then demonstrate how the AVATAR could intervene by physically acting it out. AVATAR attempts to imitate the player, but gets *blocked by fears*, experiences a glitch and powers down. To overcome this, player must use the *Puppet Mode*. Player acts out the intervention strategy and records themselves. Then, they re-simulates the bullying scene, and at the right time, use the *Puppet Mode* button to puppeteer AVATAR's intervention.

Endings: Outcomes of Intervention.

To observe how the story evolves as a result of intervention, the ending highlights effects on the bully (FUSE), the victim (JITTER), and the defender (AVATAR) through distinct narrative feedback moments.

1. **Impact on the Bully:** To convey the impact of intervention on potentially (but not necessarily) stopping bullying, ORACLE announces that it has processed AVATAR's new response to the simulated memory and computed *"8,297 possible endings"*. It then offers to show the player and AVATAR the two most likely outcomes, presented from the perspective of FUSE (the bully's).

   (a) FUSE 2.0 (De-escalation). In this outcome, AVATAR's intervention appears to lead to a breakdown of FUSE's confidence. Thought bubbles on the TV reveal FUSE's inner doubts—*"Wait... why isn't anyone laughing?"* Eventually, FUSE dismisses the situation with *"Whatever. Not even worth my time"* and powers down.

   (b) FUSE 3.0 (Retaliation). In this alternative version, FUSE does not stop bullying. Thought bubbles reveal FUSE thinks that mocking AVATAR will bring back the group's laughter. FUSE calls AVATAR 'Pixel-face's bodyguard,' and group laughter is heard.

2. **Impact on the Victim:** To show how intervention can affect the victim emotionally, players are shown two versions of the scene, this time from JITTER's perspective—first before AVATAR intervenes, and then after.

   (a) JITTER 1.0 (Before). Players see how the bullying felt for JITTER when AVATAR did not intervene. As FUSE mocks JITTER, the room fills with thunderstorm audiovisual effects. JITTER's thought bubbles reveal despair—e.g., *"Why me? I feel so alone..."*

(b) **JITTER 2.0 (After).** The scene replays, this time showing JITTER's perspective after AVATAR intervenes. The thunderstorm clears, an ambient audio-visual effect of swirling rainbow lights and cheerful music fills the room. JITTER smiles and their thought bubble reads: *"I think I made a new friend today."*

3. **Impact on the Bystander (AVATAR):** To reflect how defending can increase peer status, we use the "Heart-Meter" prop (see Fig. 7.9).

   (a) **Heart-Meter (Before).** Early in the story, AVATAR confides: *"I felt bad, but I didn't say anything. I mean... what was I supposed to do? I'm not popular enough to pull that off! Have you even seen my Heart-Meter?"* The player discovers the Heart-Meter: a mostly empty box with two heart stickers.

   (b) **Heart-Meter (After).** After the intervention, the player checks the Heart-Meter again, and this time it is filled with hearts. AVATAR responds with an expression of excitement: *"Wow, <childName>... all this time, I thought if I said something, other robots would like me less. I thought if I interfered, I would lose friends... But instead, more robots respect me now?"*

Resolution: Fixing the Glitch

As the final step in resolving the glitch, the player and AVATAR uncover the misunderstanding that caused the glitch: although many robots felt bad about bullying but stayed silent, assuming other robots were *"cool with it"* (see details in Appendix H). Their silence gave too much power to the bullies, a power that must be reclaimed to repair the glitch. AVATAR tells the player, *"I have seen a little box full of power next to FUSE!"* The player finds a small power-box and removes the charms. At that moment, AVATAR remembers the names of its two best friends, signaling that the glitch has been resolved. AVATAR takes the power tokens to return them the robots of KERNEL and bring back harmony.

7.4.4 Emergent Narrative

Within the IDN framework [208], emergent narrative refers to a system of storytelling characterized by narratives that are not predefined (embedded) but are instead generated in real-time through users interactions and choices. Game scholars also emphasize that good games give players meaningful choices with *visible* consequences [324]. A common challenge in doing so, referred to as the *Narrative Branching Problem*, is that diverging the storyline every time a player is offered a meaningful choice, would cause an the exponential increase

in content required by authors [105]. REMind used several techniques to counteract these constraints, sustain narrative interactivity and emergent storytelling, and create a sense of player agency within generally pre-scripted interactions.

Narrative Branching

Ligthart et al., [230] describe 3 types of narrative branching for containing the narrative branching problem: *Shallow Branching* (choices that briefly diverge story paths but merge quickly), *Alternative Ending* (choices that diverge story paths), and *World State Choices* (player input modifies variables rather than the core plot structure). REMind narrative incorporates all three strategies. Players can choose the intervention strategy, which diverges the story down two alternative paths.

The narrative also offered shallow branching in two ways. First, whenever possible, the game modules allowed players to choose the order of operation. For instance, in the Bully-Detector module, players were allowed to freely choose which of the three diagnostic buttons to explore first with AVATAR, rather than following a pre-determined linear path. Second, shallow branching was also embedded within the conversational interaction. An example of this would be AVATAR asking *"have you ever lost something really important?"* during gameplay. Depending on how the player answered this question, the robot would choose from a selection of canned responses, and go back to the main storyline.

Finally, REMind offered world state choices by allowing the player to customize the robot avatar. The avatar robot used the player's name throughout the story, and the game system consistently recognized the robot's given name, in order to create a sense of psychological ownership and narrative immersion.

Improvisation and Self-Reflection

REMind embeds features that position the child as the central creative agent in the experience. Key examples include improv-based modules such as Puppet Mode and Empathy Training, where the player's spontaneous input became core narrative content.

Q&A with Predictable Conversational Flow

Finally, at several points during the game-play, the avatar robot would engage players in conversation by asking questions with predictable answers. An example of this is an interaction in which AVATAR looked around nervously and then whispered: *"$< ChildName >$,*

can I tell you a secret?" Even though the player was actively interacting, we could predict that innate human curiosity would compel them to say yes. This technique provided simple, reliable opportunities for embedding conversational interaction without influencing the story path.

Embodied Play with Tactile Props

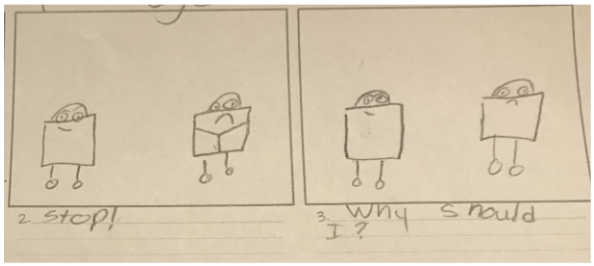
Several narrative mechanics in REMind relied on players' embodied interaction with tangible props, which meant the narrative would not progress until the player took action. Other than the narrative mechanics described in the section 7.3.5, we intentionally sought out opportunities for children to be active participants rather than passive observers by making embodied interaction with tangible props central to gameplay. For instance, simulating the robot's past memory required a multi-step, embodied sequence: the player has to physically locate a "memory file" (a floppy disk), find a floppy-disk reader, rotate the robot, plug the reader into its USB port, insert the disk (a novel experience for young children), and finally, press the "Simulate" button.

Player-Initiated Conversational Flow

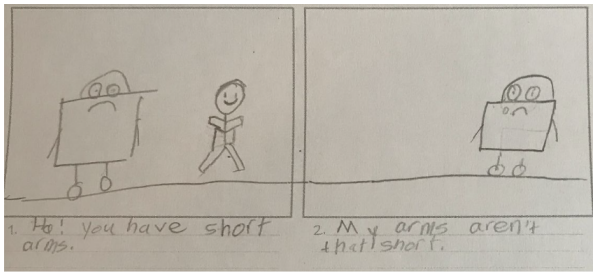
At several points in the game, the player initiates a pre-determined conversational flow with the robot. For example, they may find a clue card with a specific question they can ask AVATAR. Once they ask the question, the robot will respond and the game will proceed. In this way, the game avoids positioning the player as a passive listener to long monologues by the robot, and makes them part of the conversation; while keeping the narrative path simple and linear.

7.4.5 Narrative Development

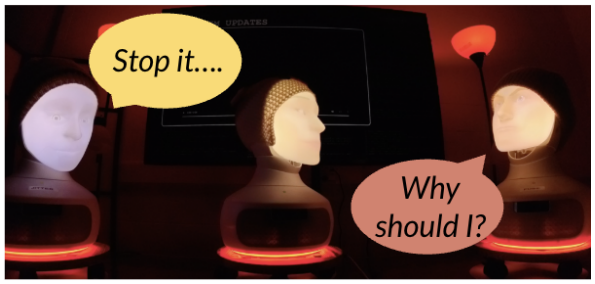
To create a deep, character-driven experience that supports the learning goals, REMind narrative development process combined established a storytelling archetype (i.e., Hero's Journey) with an iterative, AI-assisted co-creation approach, grounded in the system's unique requirements based on hardware affordances, and target audience (9–10 year olds). This included co-creation of key narrative beats and dialogues. AI-generated suggestions were not treated as final script but rather, it was used as a creativity support tool to explore tone, brainstorm dialogue variations, and adjust narrative framing. The process was informed by insights from previous studies, for instance, the final script incorporated several lines and phrases used in children's stories (see examples in Fig. 7.17).



(a) Victim robot: "Stop!"; Bully robot: "Why should I?"



(b) Bully human: "Ha! You have short arms."; Victim robot: "My arms aren't that short."



(c) Jitter: "Stop it..."; Fuse: "Why should I?"



(d) Fuse: "Speak up! Can't hear you with that quiet little voice."; Jitter: "My voice... isn't that quiet..."

Figure 7.17: Example of dialogues from children's storyboards (a, b) directly adopted in REMind scenes (c, d) to depict bullying.

Character Sheets

Some narratologists assert that stories are primarily character-driven, arguing that stories that are engaging, build deep characters with whom the audience can effortlessly empathize [154]. To build deep characters, we created character-sheets for all primaary characters in REMind, outlining their Role, Goal, Greatest Fear, and Misbelief. These sheets incorporated character design insights from children's co-design study (reviewed in Chapter 4) and were grounded in research-informed motivations from peer bullying literature. For example, the antagonist FUSE was designed to be motivated by a desire for status and power and to be perceived as cool, even if not well-liked (as per research on bully goals [310, 135, 248]). The character sheets were enriched with personality types drawn from the Enneagram model [300]: a personality typology that describes nine distinct but interconnected personality types, and represents each type with a basic desire, and a basic fear. From an interaction design point of view, the Enneagram stands out because it models **dynamic, motivation-based personalities** rather than static traits, which lends itself well to AI-assisted narrative development. Character sheets are presented in Appendix D.

Dramatic Structure: Hero's Journey

The narrative structure of a game is defined as "the space of potential sequences of events" [57], is the flexible presentation that arises from various combinations of embedded and emergent narrative elements [358]. To co-create REMind narrative arcs with AI, we used Joseph Campbell's Hero's Journey [66] as a structural template. Campbell studied myths, folktales, and stories from cultures around the world and found a circular narrative pattern. Hero's Journey is a universal story of a hero who leaves their ordinary world, undergoes a series of challenges and trials, and ultimately returns home transformed. It is a powerful archetype that can help us understand journeys of transformation. Table E.1 in the Appendix E presents a summary of how we translated the 12 steps of Heros's Journey as interpreted by Christopher Vogler [374] to REMind's narrative beats.

AI-Assisted Co-Creation Process

The detailed narrative script for the 12-step structure was co-created iteratively using a customGPT powered by OpenAI's GPT-4o model [273]. This approach allowed for rapid prototyping of dialogue and scene concepts while ensuring adherence to the project's pedagogical goals and technical constraints. The AI assistant was configured to act as a

children's storyteller, and its knowledge-base was pre-loaded with REMind-specific documents including character sheets, pre-set game design concepts, and summary of expert feedback. The instructions guided the AI agent to responding following a read-think-act paradigm, by considering by considering the design intents, system description and project assets, and maintain a list of lessons learned from iterative feedback with designer. In this way, function as both a co-writer and reflective collaborator. Appendix F presents details on the configuration of the chatbot and an example prompt.

7.5 Technology

REMind is an interactive storytelling system that consists of multiple Furhat robots, smart lights, GUIs, and physical props. Its complexity, particularly the necessity of coordinating synchronous multi-modal feedback and supporting real-time, emotionally sensitive child-robot interaction, necessitated a Human-in-the-Loop operational protocol managed by a two-person team. The core challenge lies in the current limitations of Natural Language Understanding (NLU) technology, which cannot reliably handle the spontaneity and emotional depth required for a pedagogical role-play about bullying.

Therefore, the system relies on the coordinated effort of a Wizard (technical operator) and a Joker (applied drama facilitator) to manage the experience. The detailed roles and protocol for this two-person facilitation team are a critical component of the methodology and are fully detailed in Chapter 8 on the experiment design.

In this section, we focus strictly on the technical elements of the system: detailing the robotic platform, the custom-built scripting tools, the process for converting human performance into robot gesture, and the design of the custom props.

7.5.1 Robotic Platform

Furhat [9] is a tabletop social robot with a back-projected 3-D printed mask for face, capable of displaying facial expressions, head movements, and speech. Facial expressions (also known as *gestures*) on Furhat robot can include coordinated animations of the eyes, eyebrows, mouth, and head.

Robot speech was rendered using Microsoft Azure Text-to-Speech (TTS) engine [252]. And robot facial expressions were added using the basic gestures available in Furhat Library [131]. We also added several custom-made gestures (recorded by human actors and converted to robotic gestures).

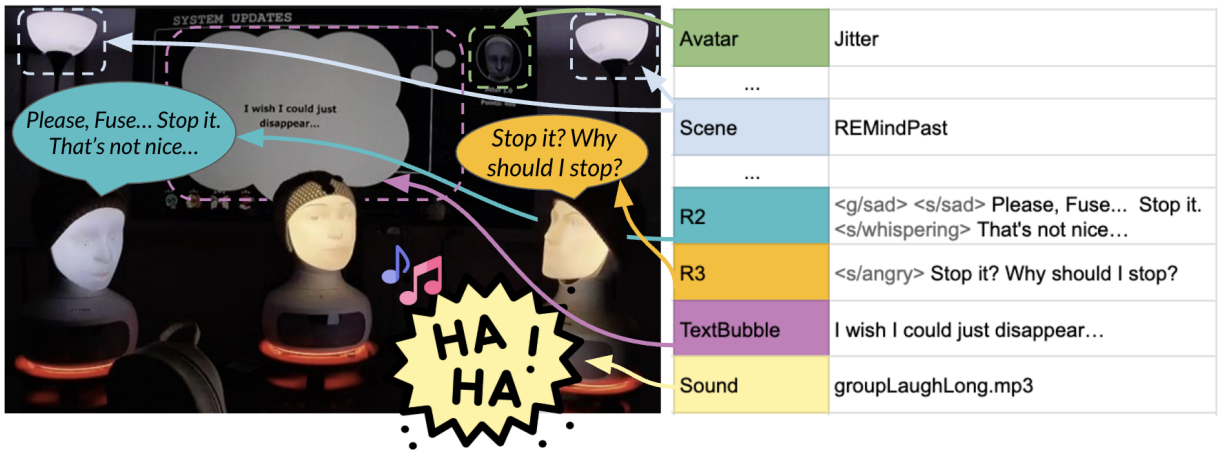


Figure 7.18: Example translation of a *StorySync* spreadsheet-based script (right) into a live dramatic scene in REMind (left).

7.5.2 StorySync: A Spreadsheet-Based Scripting Toolkit

We developed StorySync as a spreadsheet-based scripting tool for rapid prototyping of REMind. This system synchronizes control of multiple robots, the GUI, ambient light and sound, and narrative branching. One Furhat robot acts as a server host, sending HTTP POST requests to other robots, the GUI, and a Philips Hue Bridge [269]. Each row in the spreadsheet defines a scripted event—such as a robot's speech or gesture—that the system can trigger sequentially or conditionally when the wizard clicks. Storysync reads the script line by line, executes sequential events, and generates dynamic buttons on a customized wizarding screen so the human operator can trigger actions during live gameplay. This design lets us coordinate the timing of concurrent narrative and game elements, respond to children's input in real time, and manage the complexity of synchronous multi-robot performances in a dynamic, child-centered environment. Fig. 7.18 illustrates how a scripted entry in StorySync drives a live dramatic scene in REMind.

Robot Controls

Robot action commands enable us to synchronize multiple robot actions by using a command in one column to choose which robot actor will be delivering the action (denoted as R1, R2, R3), and appending it with arguments in the second column to manage the robot's speech, gestures, gaze, and LED behavior (see Table 7.1).

Through StorySync, we are able to trigger predefined gestures on robot actors (such as

a smile) at specific points in the narrative. These were either built-in gestures from the Furhat Library, or custom-designed in accordance with the narrative. Custom gestures approach enabled us to script richer expressions to support storytelling——for example, having the robot shake its head in sad disbelief, and then look downward. Custom-designed gestures were created by recording a human actor's facial expressions, and converting them to robot gestures (for technical details, please see section 7.5.3).

StorySync integrates Speech Synthesis Markup Language (SSML) control. SSML is an XML-based standard for specifying how text should be spoken by a Text-to-Speech (TTS) engine by using predefined tags. Incorporating SSML tags enabled us to adjust aspects such as pitch, speed, pauses, and vocal effects, to create expressive synthesized utterances in accordance with the narrative, for example, by making the robot speak slowly, sound excited, or pause for dramatic effect.

Furthermore, StorySync allows us to script the robot's gaze behavior (eyes and head) by predefining target locations (specific 3D coordinates relative to the robot)—for example, looking toward a prop or another robot. It also provides control over the robot's LED behavior by assigning custom RGB color values to display on the LED ring.

Finally, StorySync integrates a Persona command, which may also be used to load a character on a robotic actor. That is, it assigns the robot a predefined persona with specific face and voice settings. During the gameplay, this command allowed AVATAR robot to mimic other characters (see Fig. 7.19).

Narrative Control

Table 7.2 summarizes the narrative controls available in StorySync. This set of commands allow REMind to go beyond linear storytelling and create a complex and dynamic gameplay experiences, by providing the wizard with flexible tools for shaping the story's progression. They support deliberate pauses for timing, interactive dialogue options, temporary side plots that eventually merge with the main storyline, and permanent branches that move the narrative onto alternative paths, such as different ways a child may choose to intervene against bullying. Together, these commands enable non-linear progression and create opportunities for improvisation, responsiveness, and dynamic storytelling.

Beyond supporting non-linear progression, these narrative controls also serve important design functions. First, they help sustain the illusion of interactivity. For example, when a child says the "magic words" at the start of the story, the room comes to life — the lights brighten, the GUI plays a game startup video, and the avatar robot wakes up. Here, StorySync allows us uses a timed Wait command to synchronize multiple modalities of environmental feedback, making the experience feel more immersive.

R1	On JITTER's first day, someone asked what JITTER's hobby was, and JITTER said making animal sounds. FUSE just cut in and said: <a/R1>
Persona	Fuse
delay	500
R1	Okay, enough out of you, baby-JITTER-dork!!
delay	500
Persona	Avatar Reset
delay	500
R1	and some robots laughed. <g/sad> <d/500>
R1	I didn't laugh, because it sounded rude. But I also didn't interfere.
R1	My best friends... <g/GazeUpLeft> <d/1500>
R1	<g/sad> My best friends... also didn't laugh.

Figure 7.19: Screenshot from StorySync: As AVATAR recalls a bullying incident, the *Persona* command is used to temporarily adopt FUSE's (the bully's) face and voice, highlighting the dialogue being mimicked.

Command	Argument	Description	Example
R[1/2/3]	*Text*	Robot speaks the provided text.	R1 | Hi *<childName>*!
	<d/..>	Inserts a delay (in milliseconds).	R1 | But *<d/1000>* how?
	<s/..>	Changes speech style (prosodic parameters) to convey affect.	R2 | *<s/sad>* Please stop...
	<p/..>	Makes the robot speak faster or slower.	R1 | *<p/slow>* I speak slowly.
	<v/..>	Makes the robot speak louder or quieter.	R1 | *<v/loud>* I speak loudly.
	<g/..>	Performs a gesture; custom-made, or from the Furhat library.	R2 | *<g/nod>* I am nodding.
	<a/..>	Robot gaze is directed to a pre-set location (e.g., another robot).	R1 | *<a/R2>* I look towards R2.
	<l/R,G,B>	Sets the robot's LED ring to a color in RGB format.	R3 | *<l/255, 0, 0>*
Persona	*Pre-set Character*	Switch avatar's persona (face & voice) to one of the pre-set characters.	Persona | *Teacher*

Table 7.1: Robot action syntax in StorySync. The vertical bar ('|') in the examples indicates a column breaks in the spreadsheet.

Second, they make the interaction more tailored to children's input by allowing more appropriate and varied responses. When the robot asks a reflective question, such as *"Have you ever lost something really important?"*, children's answers may range from a favorite toy to a family member. By designing dialogue options as binned responses to possible categories of human input, the wizard can select the most appropriate response.

Finally, enabling shallow branching (Convergence) can grant players greater control over how they navigate the story. For example, while exploring the "Bully-Detector" prop, players could choose which question to investigate first rather than following a fixed order. This strengthens a sense of player agency.

Command	**Arguments**	**Description**	**Example**
Wait	*Timing Instruction*	Adds a green button to the wizarding interface; the game continues only when the wizard clicks it.	Wizard | Wait for the player to say: *"Let the Adventure Begin"*.
Wizard	*Action Instruction*	Adds a red button to the wizarding interface with instructions that tell the wizard to do something else first; the game continues only when the wizard clicks it.	Wizard | Direct robot gaze at the player before proceeding.
Choice	*Choice 1 ... Choice n*	Adds buttons for alternative robot responses; the wizard selects one.	Choice | Yes | No
Convergence	*Side-plot 1 ... Side-plot n*	Adds buttons that temporarily branch the story, then return to the original storyline.	Convergence | Fuse 2.0 | Fuse 3.0
Divergence	*Branch 1 ... Branch n*	Adds buttons that branch the story, and continue without returning to the original storyline.	Divergence | Be Firm to Fuse | Comfort Jitter

Table 7.2: Narrative controls in StorySync for managing story flow, dialogue choices, shallow branching, and alternative storylines. The vertical bars ('|') indicate column breaks.

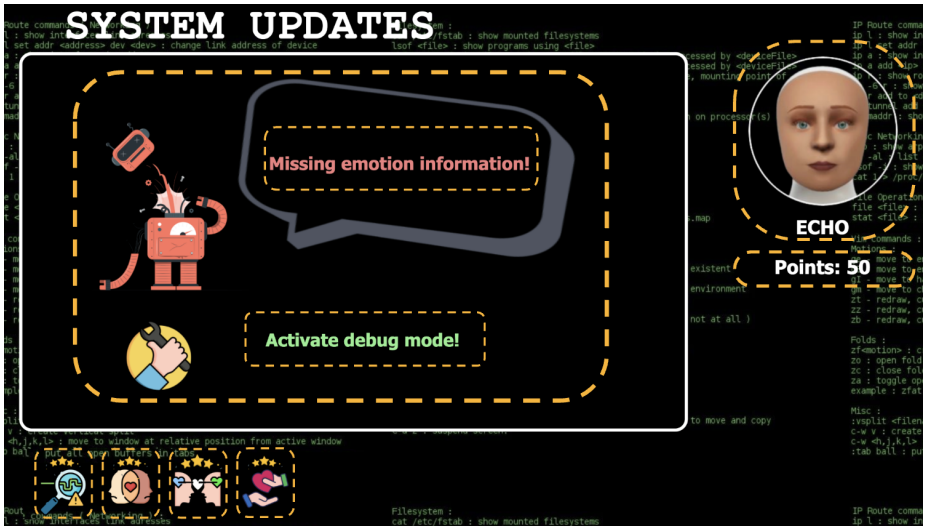


Figure 7.20: Example REMind GUI screen: StorySync enables modular control over the areas marked in yellow.

GUI Control

REMind features 2 GUIs: An avatar customization GUI used prior to starting the game, and a game GUI shown on a large TV (named MATRIX) during gameplay.

In the **Avatar Customization GUI**, the player enters their name, chooses a name for the robot avatar, and selects its face and voice (see 8.1). These inputs are integrated into the system via StorySync, which captures the values of *<ChildName>* and *<RobotName>* and makes them globally accessible throughout the script. This allows the robot to refer to itself by the name chosen by the child, and to address the child by their own name.

The GUI is divided into various sections for displaying storytelling and game elements (see Fig. 7.20). The largest area is the system updates section, which displays text, images, and videos related to narrative content such as error messages, thought bubbles, and in-game choices. On the top right corner, a profile section presents a robot profile picture and name. Beneath the profile picture, the current score in the game is listed. And finally, an achievements section at the bottom of the screen shows player's collected badges. Table 7.3 summarizes the StorySync commands available for controlling these sections.

The Image and Video commands support visual storytelling in the system updates section. The Error command displays a red diagnostic-style message, accompanied by a green-colored fix suggestion (see example in Fig. 7.20). The Thought Bubble command displays a thought bubble. Profile dynamically updates the avatar section to reflect char-

Command	Argument	Description	Example
Image	*File Name*	Shows an image in the GUI and plays a pop-up sound.	Image | *DebugStep1.png*
Video	*File Name*	Plays a video in the GUI.	Video | *OracleMessage.mp4*
ClearGUI	—	Clears all media from GUI.	ClearGUI
Error	*Error, Fix*	Shows an error message in red and a solution in green, with alert sound.	Error | Self-confidence too low! | Help <*RobotName*> believe in itself!
ClearError	*Text*	A resolution message shows error is resolved, and plays a tone implying success.	Clear Error | Self-confidence restored!
TextBubble	*Text*	Adds a thought bubble with a pop-up sound.	Bubble | I wonder how JITTER felt...
Profile	*Robot, Name*	Updates robot picture and name in the profile section.	Profile | FUSE | FUSE 2.0
Achievement	*Badge Name*	Displays a badge with a chime sound; adds badge to player's collection.	Achievement | Empathy Guru
Points	*Integer*	Adds points with coin sound.	Points | +10

Table 7.3: GUI controls in StorySync for managing media, feedback, and rewards. The vertical bars ('|') indicate column breaks.

acter changes. Together, these two commands allow the GUI to externalize characters' inner states, letting children "see the mind" of different robots and deepening their sense of perspective-taking. Finally, the Achievement and Points commands provide real-time feedback tied to children's decisions, reinforcing educational goals.

Scene Control

For ambient lighting, we used the Philips Hue [269] smart lighting system, which enables wireless control over light color, brightness, and dynamic scene. We integrated the Hue API into StorySync, enabling timed transitions to customizable lighting presets. In addition to lighting, StorySync also supported triggering ambient sound effects via audio playback on the GUI. Together, these features enabled the creation of immersive, dynamic scenes that evolved in response to the unfolding story (see Table 7.4).



Figure 7.21: Example of a thought bubble emerging from the character's profile picture on the GUI.

7.5.3 Converting Human Performance to Robot Gesture

To facilitate puppet mode and stream players' recorded performance onto the Furhat robot, REMind uses facial motion capture technology. Specifically, we used the Live Link Face iOS application by Unreal Engine [133] to capture high-fidelity facial motion data. This application records facial expressions using Apple's ARKit [173] facial parameters and allows exporting the data in CSV format. These recordings were processed through Furhat's Gesture Capture tool [303], which converted the facial parameters into Furhat-compatible *.json* gesture files.

In parallel, we extracted the player's voice from the original performance video and converted it into a lightweight audio file optimized for Furhat playback (mono .wav, 16-bit, 16kHz). Because both the voice and facial expressions were captured from the same human performance, they were already naturally synchronized. This approach removed the need for any manual alignment between speech and gesture (which would be necessary if we had used text-to-speech).

7.5.4 Custom-Made Logic-Gate Prop

The Bully-Detector prop is custom-built. The device features 3 round push buttons placed next to 3 toggle switches, a large Test button, and a buzzer alarm. Its core functionality

Command	Arguments	Description	Example
Sound	*File Name,* *Loop / Once*	Plays a sound file once or on loop until cleared.	Sound | SadMusic | Once
Scene	*Scene Name,* *Transition Time,* *Lamp Name*	Transitions to a preset lighting scene, with a specified fade time and target lamp(s).	Scene | SadScene | 10 | L3

Table 7.4: Scene control commands in StorySync for managing ambient sound and lighting.

is derived from a 3-way AND gate logic: engaging all 3 toggle switches triggers the buzzer alarm. This logic is implemented using a Raspberry Pie Pico [293] microprocessor. The Raspberry Pi Pico also stores and plays the audio files that are triggered upon the pressing the three momentary push-buttons.

The entire circuit, including the Pico, a small array of passive components (resistors, a transistor, an amplifier), and a speaker, is fully enclosed within a secured Hammond project box. Power is supplied exclusively by two internal battery packs (6V and 3V), eliminating the need for external wiring. The project box is machined so that all user-facing components (i.e., the buttons, switches and the alarm), are tightly mounted to the enclosure, ensuring internal circuitry remains inaccessible and minimizing risks associated with tampering or exposure.

The electrical documentation for the Bully-Detector, including both the circuit Schematic and the physical PCB Layout, is detailed in Appendix C.

7.6 Aesthetics

Aesthetic elements determine how the game looks, sounds, and feels. They are the most visible layer of the experience that constitute the player's immediate sensory engagement.

Understanding Aesthetics

Game design literature emphasizes that aesthetics are critically important because they have "the most direct relationship to a player's experience" [326, 324]. In video games, aesthetics typically encompass audio elements (such as music and sound effects), and visual

elements (such as graphics and art style) [324]. Sellers also connects aesthetics to a game's use of the player's "interactivity budget," suggesting that a fast-paced game "can afford to be assaulting the player's senses with feedback" [326]. This idea aligns with the notion of "juiciness" in interaction design: a juicy game is one that incorporates various layers of audio-visual embellishments in its interface feedback [157], such that just a little bit of interaction gives the player a continuous flow of sensory rewards [324].

Game design literature emphasizes that aesthetics are incredibly important because they have "the most direct relationship to a player's experience" [326, 324]. In video games aesthetics typically include the music and sound effects, as well as visual elements [324]. Sellers also relates aesthetics to how the game uses player's "interactivity budget," arguing that a fast-action game "can afford to be assaulting the player's senses with feedback" [326]. This notion is also referred to as "juiciness": a juicy interface is one that incorporates various levels of audio-visual embellishments in its system feedback [157], such that just a little bit of interaction gives the player a continuous flow of delightful reward [326].

Game designers often use aesthetic elements to set context for the emotions they want players to feel, for example by using colors, and music to prime players for emotions such as fear, victory, or hope [326]. This focus on the player's desired emotional state is formally structured by the Mechanics-Dynamics-Aesthetics (MDA) framework [170]. MDA defines A as Aesthetics, encompassing the "desirable emotional responses evoked in the player." The taxonomy of eight game pleasures used in Chapter 6 provides the vocabulary for this aesthetic layer.

While under the MDA framework, game aesthetics are conceptualized as different kinds of "fun," some game designers distinguish the two more explicitly. In *Theory of Fun for Game Design* [211], Koster treats "aesthetic appreciation" as one of the many factors contributing to enjoyment of games. He argues that if the core game [mechanics] are inherently fun, the aesthetics serve to focus and magnify that fun; if not, no amount of aesthetics "dressing" will render the game enjoyable [211].

The drama literature offers a broader, more embodied view of aesthetics. In *Embodied Aesthetics in Drama Education* [103], DeCoursey contends that drama engages the mind, body, and emotions of learners in ways that traditional fact-based pedagogy does not, which often results in learning that is "in significant ways is superior"; he then positions aesthetics as whatever it is about drama that sometimes produces a better learning experience (for example, that participants of drama "do things") [103]. Drawing from neuroscience and psychology of attention, DeCoursey suggests that emotional response lies at the heart of aesthetic experience and that this response is inherently embodied [103]. Importantly, philosophy of art scholars argue that it is possible to create emotional experiences intentionally through imagination [103, 379]. The centrality of aesthetics to meaning-making

and its links to embodied experience has also been explored in other seminal scholarly works [110, 243], which has potential implications for the added value of using robots in educational games.

Irrespective of the medium of communication, Schell argues, the "poetry of presentation" can make experiences more compelling [324]. This perspective resonates with the Human-Computer Interaction (HCI) literature, particularly Don Norman's framework of Emotional Design [267], which underscores the cognitive and behavioral significance of emotional responses evoked by design. Norman posits that and the emotional aspect of interacting with a product is often more crucial to a its success than the functional or practical elements, asserting that "attractive things work better" [267].

In this section, we build on these perspectives to examine the aesthetics of the experience of REMind.

7.6.1 Designing Audio-Visual Affective Displays

REMind features immersive affective displays using ambient music and light cues. This aesthetic is central to facilitating affective perspective-taking. To create these displays, we adopted Russell's circumplex model of affect [308] as the foundational framework, which maps emotions into a 2D space by by organizing them along two dimensions of valence and arousal, creating four primary quadrants (Q1–Q4). Based on the narrative requirement to model the experience of a victim of bullying, we specific two target emotions: sadness (Low Arousal, Negative Valence) and fear (High Arousal, Negative Valence).

Affective Music To select affective music, we used the Emopia dataset [169], a curated corpus of emotionally labeled solo piano pop music segments annotated according to Russell's model. A trained musician nominated representative tracks corresponding to the sadness and fear. We reviewed these nominations and selected two distinct, short snippets of music (30–40 seconds each) that best represented the emotional context of the story, one for each target emotion. Also, a soundtrack of fast heart-beat was added to the music representing fear to reduce ambiguity.

Affective Light For lighting design, we mapped emotions to color (blue for sadness, purple for fear based on prior work [201, 264] (see Fig. 7.4). In addition, we used estimated values of the arousal and valence dimensions of the circumplex model for sadness and fear and mapped them onto light animation speed and brightness respectively.

This process resulted in displaying sadness via a dim and slowly pulsating blue light paired with slow and melancholic music, and fear via a purple light that was animated faster and brighter, paired with music that was quick, tense, and somewhat ominous.

7.6.2 Programming Emotional Subtext

Stories, as a means of pedagogy, are meant to be told effectively. To bring a narrative to life, human performers leverage their embodiment, using motion, timing, gestures, and vocal variation to convey meaning. However, delivering a compelling story with robot actors is challenging because robots have considerable limitations when it comes to emotional expressivity. In performance arts and communication, "subtext" refers to unspoken meaning or emotions behind what a character says in a script which adds depth to their words and actions. Unlike human actors, social robots face significant constraints in communicating this emotional subtext. As we established earlier, emotions have a key role in how stories persuade us and foster empathy.

We partially mitigated the limited expressivity of the robotic actors by designing an emotionally evocative narrative (e.g., the robot struggling to remember the names of its best friends). Furthermore, we sought to add emotional subtext (or compensate for its absence) through static configurations, affective fine-tuning, and ambient cues.

Challenges with Facial Expression

Robotic platforms seldom afford facial expressions. Our decision to use Furhat robots in REMind — informed by prior co-design work where children consistently imagined characters with expressive faces — was largely because Furhat supports facial expressions. While the Furhat platform provides a library of basic facial expressions (gestures), we encountered several challenges in using these to create believable emotional subtext.

First, facial expressions are highly contextual, which makes it challenging to script robot drama with gesture tags from a predefined library. That is, even gestures with seemingly straight-forward labels are inherently vague. For example, a "smile" can look genuine, sarcastic, or apologetic. Similarly, a pre-defined gesture labeled "thoughtful" from a library may communicate concentration, confusion, or mild sadness, making it difficult for designers to discern the expression based on the tag in order to use it for precise scripting of emotional expressions. As a result, the only reliable way to understand whether the gesture is an appropriate match to the dialogue context is trial and error. Moreover, sometimes this mismatch resulted in counter-intuitive scripting choices, such as the example demonstrated in Fig. 7.22 using a gesture semantically labeled $< g/Pleased >$ to

Wait	Child suggests simulation
R1	<g/Fear2> <s/terrified> Simulating the past? <g/Fear2> And changing it!?
delay	1000
R1	<g/Fear2> <s/whispering> Don't you know how dangerous time travel is <childName>?
delay	500
R1	<s/whispering> Last time I was in the past, I made mistakes! <g/FearEyes>
R1	<g/discomfort3> <s/whispering> You're asking me to go back in time <g/FearEyes> and try to fix what's already broken?
R1	<g/Fear2> <s/terrified> Like, what if I make it worse?
Wait	child reaction
R1	I couldn't simulate that memory <g/Shake> even if I wanted to, 'cause I don't even remember the details.
R1	<g/Annoyed2> —thanks to the glitch!
delay	1000
R1	Oh well, guess I'll just have to **<g/Pleased>** get used to glitching!

Figure 7.22: Screenshot from StorySync illustrating the mismatch between semantic label and dramatic function. The final row uses a gesture labeled as *Pleased* to represent AVATAR shrugging off terror, despite the gesture's inherent joyful attribution.

visually convey AVATAR shrugging off its terror in resignation and trying to "act cool", demonstrating that the gesture's physical appearance, and how it works in tandem with the script supersedes the label it has been annotated with.

Second, the reliance on discrete, canned emotional labels makes blending gestures to create nuanced emotional expressions infeasible; for instance, one cannot easily overlay gestures to script a robot behavior that looks "sad but trying to seem happy," or "confused and mildly irritated." Finally, timing, pacing and transition between gestures is difficult. Human actors transition smoothly, but a robot actor, drawing from a library, may abruptly jump from one gesture to another, or fail to dynamically match the length of its gestures to to the dialogue, resulting in jarring facial expressions that break dramatic tension.

Challenges with Affective Prosody

Parallel challenges arose with affective prosody when using Text-to-Speech (TTS) systems. The Speech synthesis of robot actors in REMind was powered by Microsoft Azure TTS engine [251], which offers SSML tags for customizing the "style" of utterances (namely:

angry, cheerful, excited, friendly, hopeful, sad, shouting, terrified, unfriendly, and whispering). While these tags are useful for adding prosodic variability to synthesized speech, the models often produce a stereotypical, or even exaggerated, version of emotion. For example, applying the SSML style tag for "excited" to a line intended to convey subtle encouragement, such as: *"That's a clever idea. We should try it,"* may result in the robot exhibiting an overly enthusiastic high-pitched rapid delivery, failing to capturing the required subtlety of the emotional performance necessary for natural character believability, and rendering the output inappropriate for the dramatic context.

Moreover, Most TTS engines also lack SSML tags for emotive vocalizations, such as laughing, crying, or sighing. While some engines offer such tags (namely Acapela's "Voice smileys" [6]), using them is challenging — just because a tag produces a generic *"haha"* does not guarantee it will be the right kind of *"haha"* for a specific dramatic context. That is, nuanced affective distinctions such as a joyful chuckle, a sarcastic snort, or a sinister cackle remain beyond the expressive granularity of the state of art TTS systems.

Additionally, TTS systems struggle with dynamic emotional shifts. Human speech naturally includes irregular pauses, breaths, or sudden tempo changes to convey urgency or distress, but programmatically replicating this controlled variability in a robot's voice is labor-intensive and challenging, and often makes the speech sound disjointed. These limitations meant that a script written with the hope of conveying a specific emotional tone often sounded completely different when performed by the robot, rendering the traditional approach of "script first, rehearsal later" impractical for robot drama.

Technical Rehearsals and Affective Tuning

To prepare REMind for playtesting with children, we held 10 sessions of Technical Rehearsal ($\tilde{2}$0 hours) spread-out over 3 months. These sessions involved a theatre director, the wizard, and the joker, and and pilot testers. During these sessions, we pilot tested prototypes of REMind as it was under development, discussed feedback and iteratively refined the system. During technical rehearsals, we co-developed and refined the robot drama. These rehearsals, ultimately served as the environment for affective tuning of the robot drama.

The core tuning process involved marking problematic deliveries where emotional subtext was conveyed incorrectly or the dramatic delivery felt off, based on pilot tester reactions and our own discussions. We then iteratively adjusted these modules by changing dialogue, adding gestures, tweaking prosody, and refining audio cues. Since affective tuning was extremely labor-intensive, we reserved highly granular fine-tuning for the most emotional parts of the story. This iterative refinement yielded several specific solutions:

Refining Gestures To address the ambiguity of the gesture library, the designer tested all the available gestures and annotated them situationally to account for the dramatic context (e.g., distinguishing an "I'm figuring out the murderer" thinking gesture from an "I'm trying to remember where I parked" thinking gesture). This provided a more reliable, context-specific vocabulary and made it easier and less time-consuming to remember the content of gestures and adjust the script. Moreover, in order to convey nuanced emotional expressions at specific points in the story (e.g., the robot shaking its head with a sigh and looking down in despair) we moved beyond the gesture library. We watched the robot perform the dialogue, recorded ourselves acting out the appropriate gesture and converted the human performance into a custom facial expression executable on the robot (using the same process described in Section 7.5.3).

Dialogue Adjustment One strategy developed during the affective tuning process was the frequent adjustment of the LLM-generated script. Many lines relying on nuanced prosodic delivery (such as, "OH WOW, You *actually* did it!") were inherently difficult for TTS to perform correctly. To mitigate this, we shifted the script's reliance, wherever possible, from *showing* emotion through prosody and gesture to *telling* emotion explicitly through dialogue. This often resulted in scenes where the robot would explicitly verbalize *shifts* in feelings to provide appropriate narrative feedback. For example, after the empathy training module is completed, AVATAR provides feedback by verbalizing its new-found emotional understanding of the victim's feelings:

> *"I was there too, but I didn't feel afraid. I didn't feel sad. That's why I thought it wasn't a big deal! But... If I were Jitter? I would have wanted someone to notice! I would have wanted someone to say something!"*

While this approach violated the "show, not tell" golden rule of storytelling, it was a necessary design trade-off. Also, using LLMs made such script adjustments faster; although getting LLM to generate script that does not rely on affective prosody was hard to prompt for, because LLMs, being primarily trained on text, lack a reliable grasp on prosody. Nonetheless, it enabled us to streamline the subsequent intensive affective tuning process.

Prosodic Refinement For the most emotional bits of the story, we incorporated a highly iterative process for nuanced affective tuning the vocal delivery. The group would watch a specific short sciene from the robot drama, and manually refine the dialogues by experimenting with SSML styles, and tweaking prosodic attributes such as pauses, volume, speech-rate and pitch, until the delivery was compelling (see an example in Fig. 7.23).

R1	<s/sad> So, <d/500> Jitter felt afraid... and sad. <g/BrowFrown> <d/1000>
R1	<s/sad> And that means… <g/GazeUpLeft>
R1	<g/BrowFrown> <d/2000>
R1	<p/-25%> <s/whispering> oh! <d/1000>
R1	<g/oh> <p/-40%> <s/whispering> Oh wow! <d/1500>
R1	<g/surprise> <p/-10%> <s/whispering> Now I get it!! <d/1000>
R1	<s/sad> I didn't understand before, but now…. <g/sad> <d/500> I can feel what Jitter went through. <g/browFrown> <d/1000>
R1	<g/BrowFrown> <s/sad> I was there too, but I didn't feel afraid. I didn't feel sad. <d/1000>
R1	<s/hopeful> That's why I thought it wasn't a big deal! <d/500>
R1	<s/hopeful> But... If I were Jitter? <g/GazeUpLeft> <d/1500>
R1	<g/sad> <s/sad> I would have wanted someone to notice! <g/sad> I would have wanted someone to say something! <g/sad> <d/1500>
R1	<s/sad> oh <childName>... <d/500>
R1	<g/sadLong> <s/sad> poor Jitter must have felt so alone!

Figure 7.23: Screenshot from StorySync: AVATAR's reaction after the empathy training module. This snippet was affectively fine-tuned during the technical rehearsals, where we added Furhat robot gestures ($g/$), and pauses ($d/$), and tweaked speech rate ($p/$), and style ($s/$) to enhance robot's dramatic performance.

During this process, the StorySync toolkit evolved to include granular SSML controls for adjusting prosodic attributes.

Incorporating Ambient Cues REMind used ambient audio-visual cues to convey emotional subtext beyond the robots' dialogue. For example, to establish the social pressure surrounding the bullying, the scripted scene included a background sound of group laughter (see Fig. 7.24), drawing inspiration from children's storyboards that frequently depicted this as in their stories about school bullying. Visual examples include conveying victim's affective experience via thunderstorm lightning effects paired with sound-escape, described in section 7.4.3. During technical rehearsals, we also made adjustments to specific environmental cues. For example, most testers had trouble correctly guessing the second affective ambient display, which was designed as fear; based on this feedback, we decided to overlay a soundtrack of a fast heart-beat to the audio cue to improve the display and reduce

ambiguity.



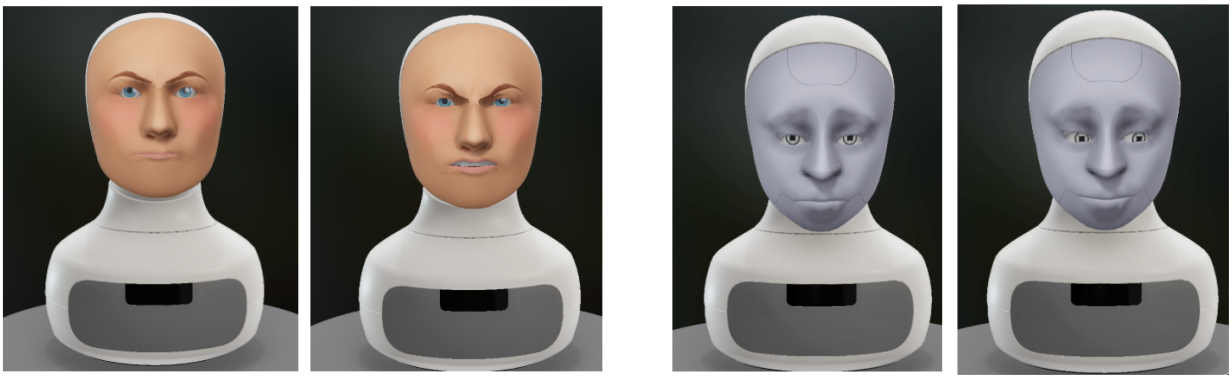
Figure 7.24: Children's storyboards from co-design sessions often depicted group laughter as part of peer bullying scenarios. This informed the inclusion of ambient laughter in REMind's bullying scene to evoke the intended emotional context.

Static Affective Configuration of Robotic Characters

The three robot actors in REMind were animated using distinct AZURE voices, and Furhat textures (i.e., projected faces). We modified aspects of robots' behaviors to further develop them as three distinct characters. Namely, we changed the static configurations of their vocal prosody, facial parameters, and head-pose (see Fig. 7.25).

Vocal Configuration The pitch of all three voices was modified to sound child-like. All voices were designed to be gender-neutral. AVATAR could be customized using one of two player-selectable voices—one sounding slightly more like a boy, the other slightly more like a girl. To create distinct vocal personalities, each character voice is configured using Azure SSML prosody tags. FUSE uses a fast rate and loud volume. JITTER uses a slow rate and soft volume. AVATAR uses a normal rate and volume.

Facial Parameters To visually reinforce character personalities, each was assigned persistent facial configurations using custom blendshape parameters. FUSE had a raised chin, arched brows, upward gaze, and flared nostrils, giving the impression of an angry and



(a) FUSE with upward head tilt, raised chin, arched brows, and flared nostrils.

(b) JITTER with downward head tilt, lowered chin, tilted brows, and sad lips.

Figure 7.25: Static facial and head pose configurations were used for emotional design of (a) FUSE, the bully robot; and (b) JITTER, the victimized robot.

assertive character. JITTER had a lowered chin, tilted brows, wide pupils, and a downturned mouth, producing a shy and sad appearance. AVATAR facial parameters remained at baseline, presenting a neutral expression.

Head Posture FUSE's neck was tilted slightly upward, contributing to a more bossy or dominant appearance. JITTER's neck was tilted slightly downward, reinforcing a shy or withdrawn demeanor. AVATAR's neck posture remained at baseline, looking straight.

7.6.3 Imaginative Play and Perception of Magical Causality

By using props REMind incorporates the aesthetics of imaginative play. Make-believe allows children to construct and navigate fictional worlds, which in turn fosters abstract thinking, problem-solving, and creativity. In *Theory of Make-Believe* [379], Walton proposes that fiction arises when props guide imaginative engagement according to *agreed-upon rules*, which determine how participants interpret and interact with the fictional world. We argue giving names to game props (such as "NIMBUS") is in essence an act of setting agreed-upon fictional rules. Walton argues that in this way, props provide tangible points of reference that enable participants to construct and navigate imaginary worlds [379]. Embodied interaction with props, allows children to suspend disbelief and enter the "magic circle" of make-believe, where physical objects scaffold the creation of immersive narratives. Props thus serve as bridges between the real and the imaginary, fostering hands-on

engagement that immerses them in the fictional world.

Furthermore, certain interactions in REMind are designed to create experiences that feel *indistinguishable from "magic"*. In this framing, a "magical" experience has three defining characteristics: a perceived effect, caused by an invisible agent, that violates the logical or natural expectations (causing surprise). For example, a door suddenly swinging open without anyone nearby may be perceived as a magical experience, unless there is a possible logical explanation such as the wind. We argue that for the mind of the observer to perceive magical causality, there should be a *perception of intentionality*, which is either inferred, or conveyed via intentional use of specific *words*, *objects*, or *actions* (also known as spells, props, or rituals) that carry symbolic meaning.

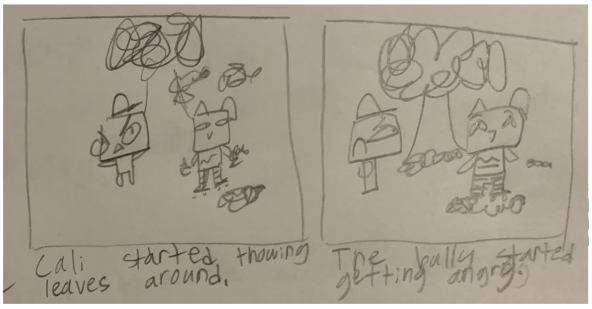
REMind incorporates all three elements to evoke a logic of magical causality. For instance, when the player uses the verbal spell "let the adventure begin," the game environment responds with immersive multi-modal feedback. An example of a *prop* is the sudden appearance of tokens in the Heart-Meter, implemented via drawer with a hidden compartment (commonly used in magic tricks). And an example of a *ritual* is the structured sequence of interaction steps that players follow to connect the robot to the TV using the Access-Cloud and an everyday object. We argue that by disrupting the observer's mental model of causality, magical causality creates a sense of wonder and enhances dramatic engagement.

7.6.4 Believable & Realistic Scenario Design

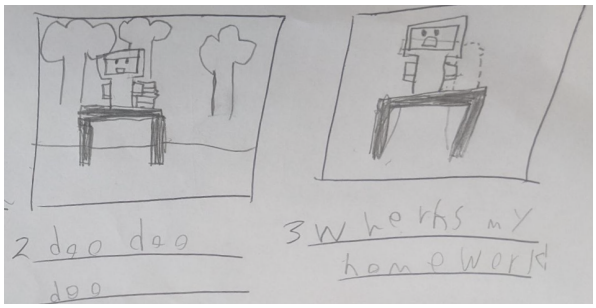
A core aesthetic goal of REMind was designing scenarios that are realistic and immediately relatable to children's day-to-day social experiences. Teachers in our prior design research stressed that this relatability may be paramount for effective intervention training (see Chapter 5). To ensure this aesthetic realism, the scenario design was guided by three strategies:

Grounding in Empirical Data Bullying can take many various forms, and teachers in our previous co-design efforts stressed the importance of designing scenarios that are realistic and reflective of children's day to day experiences. According to a 2019 Canadian Health Survey on Children and Youth (CHSCY) by Statistics Canada [341], being made fun of, called names or insulted (59%), and getting excluded from activities (32%), are among the most common forms of bullying experienced by youth. This is reflected in the actions of the bully character (FUSE) in avatar's past memory, who is name-calling JITTER by referring to them as PIXEL-FACE, makes fun of the volume of their voice and the robotic design of their face, and has excluded them from playing games during recess.

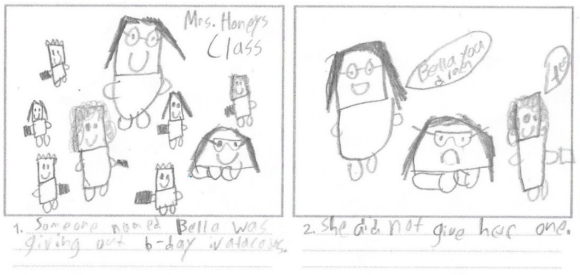
Adopting Content Co-Designed By Children To capture authentic scenarios, we directly integrated patterns of archetypal bully behaviors observed in children's storyboards created in previous design work, as well as dialogues and catch-phrases throught the story. This process was to ensure that the core conflicts felt familiar and emotionally resonant to the target audience. For instance, the backstories shared by AVATAR, which establish FUSE's pattern of bullying, are based on scenarios co-designed by children, including social exclusion, stealing, and retaliating against innocent play (see examples in Fig. 7.26).



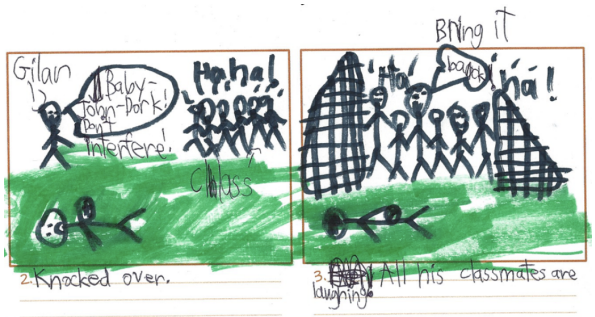
(a) "Cali [Victim] started throwing leaves around"; "The bully started getting angry".



(b) A happy robot is walking and whistling. Robot is shocked: "where's my homework"?



(c) At "Mrs Honey's class": "Someone named Bella was giving out b-day invitations"; "She did not give her one"; Teacher: "Bella you done?", Bella: "Yes".



(d) A robot hit by a ball and knocked over. Bully: "Baby-John-dork! Don't Interfere!"; All his classmates are laughing.

Figure 7.26: The behavioral patterns established in REMind backstories (section 7.4.3) were derived from archetypal bully behaviors observed in children's storytelling: antagonistically reacting to a peer's innocent fun activity (a); stealing a victim's homework as a prank (b); socially excluding a classmate from a birthday party (c); and verbal taunting by calling a victim named John "baby-John-dork" (d).

AI-Assisted Script Refinement The co-creation process with an AI assistant served as the third strategy for refining the aesthetic of realistic dialogue. The AI helped adjust the script to ensure the robot characters talked and reasoned like a child. This included stylistic choices that emphasized childlike perception and language. For example, when explaining what caused the glitch, AVATAR uses an AI-generated dialogue to explain:

> *"The glitch is caused by a big misunderstanding. Not a small misunderstanding, or a medium-sized one. A big one! What makes it big is that a lot of robots have the exact same confusion."*

In this way, AVATAR is alluding to the societal nature of the glitch, which represents *misperception of the group norms*, using simple child-like language.

7.6.5 Digital Scenography

In theatrical performances, digital scenography refers to the use of digital media in set to create immersive environments. Digital scenography in REMind includes use of short custom-designed futuristic videos on GUI as elements of visual storytelling, typically used for illustrating cognitive processes in robot's "mind" which functions by providing narrative justification for smooth transition to the next game module. To view examples, please refer to the footnotes on the game script in appendix H. Blending retro and futuristic audio-visual elements is a common aesthetics theme in the these videos.

7.7 Discussion

7.7.1 Revisiting Design Goals

The granular dissection of REMind into its five core elements (Learning Goals, Mechanics, Narrative, Technology, and Aesthetics) reveals that the system's strength lies not in the sophistication of any single part, but in their intentional and integrated alignment. The process described throughout this chapter demonstrates how the overarching Learning Goals, informed by expert consultation, guided the game design process.

Goal 1. Identifying Bullying

The goal of accurate identification is supported by the interactive "Bully-Detector" prop. This physical, logic-gate-based mechanical element forces players to analyze the simulated

scene against the three established criteria. This method moves beyond abstract definition by requiring applied moral reasoning, and embedding learning in embodied interaction with a make-believe game prop.

Goal 2. Practicing Intervention Strategies

Intervention practice is facilitated through the game-play first funneling the player toward two core, expert-validated strategies (Be Firm to FUSE or Comfort JITTER). And then, by using the Puppet Mode mechanic, the game directs the player to perform the selected strategy and translate the abstract concept of how to help into a specific improvised performance that the robot then executes, and thereby engages the learner in embodied rehearsal of bystander intervention.

Goal 3. Understanding Outcomes of Defending

The game conveys the three-fold outcomes of bystander intervention by evidence-based modeling of the threefold intervention outcomes. Through interaction with the Heart-Meter prop, it provides a tangible representation of the increase in the defender's (AVATAR's) peer status.

Using the narrative mechanics that allow the player to view the ending from the perspective of different characters in the room (i.e., Access-Cloud and Marshal-Box), the game demonstrates at least two possible endings for FUSE, to convey that bullying may or may not end, countering unrealistic outcome expectations. Finally, the system demonstrates the positive impact of intervention on alleviating the emotional pain of the victims by presenting before/after frames of JITTER using ambient audio-visual display of affect and thought-bubbles on the GUI.

Goal 4. Cultivating Empathy and Compassion

Empathy training is central to the system's aesthetic design. The Empathy Training via Affective Interpretation module grounds the affective experience in multi-modal cues (FEELMOON light, music, and thought bubbles). The player is positioned as the co-meaning-maker who must take affective perspective of the victim robot and explain their emotions (fear and sadness) to the robotic avatar. This is complemented by the immediate next step guiding the player to guess what the victim robot would be thinking, facilitating cognitive empathy. This process of "learning by teaching" compels the player to engage in reflection and practice cognitive and affective perspective-taking.

Goal 5. Exposing Bully's Motivation

Exposing bully's motivation is addressed in the Debug Mode module, when the player is explicitly asked to speculate on FUSE's Motivation (see section 7.4.3). In response, the AVATAR shares its own reflections on the bully's underlying need for power, directly communicating the core lesson from SMEs.

Goal 6. Challenging Misperception of the Norms

The game's overarching "Glitch" metaphor and its subsequent resolution function as the mechanism for addressing misperception of the norms. The narrative reveals that the social problem (The Glitch) is a "big misunderstanding"—a shared, secret disapproval of bullying. To convey this within the narrative the programmer used visualizations on the screen to describe the robots' social modeling process, showing that each robot, though privately disapproving of the bullying, observed the silence of the others and mistakenly inferred it as collective approval, leading them to suppress their own discomfort and stay quiet (see details in Appendix H).

Goal 7. Reflecting on Self-Efficacy

At a high-level, Self-efficacy, the belief in one's capacity to act, is promoted through the learner's role as a mentor to the avatar robot. The game continuously models internal resistance (e.g., low confidence) as a temporary, solvable Robot Error, placing the player as the person who "fixes" the robot's belief system. For example, triggering a "Self-confidence too low!" error, this instantly shifts the player into a position of authority, requiring them to boost the robot's self-confidence by improvising reasons why the avatar can believe in its own ability to make a difference. Additionally, the Joker (facilitator), prompts player's reflection on their own self-efficacy in relation to intervention strategies by asking probing questions at relevant points during the gameplay. This will be discussed in more detail in the next chapter.

7.7.2 Towards Scalable Authoring Toolkit for Robot Role-Play Games (RPG)

Designing Robot RPG presents unique engineering challenges: unlike video games where all elements are virtual, or live theatre where actors adapt on the fly, robots are embodied

agents with limited improvisational ability. They cannot dynamically interpret unscripted interaction, autonomously synchronize, or improvise social and emotional nuance. Therefore, any tools used for script must not only manage synchronization of multimodal cues, but also anticipate variability in human interaction and scaffold semi-guided responsiveness.

While useful tools exist for scripting interactive narrative in games (e.g., Articy Draft [336]) and multimodal theatrical cues (e.g., QLab [336]), at the time of developing REMind, such tools were not available for scripting robot RPGs. REMind software integrates StorySync, the spreadsheet-based authoring toolkit described in section 7.5.2. However, StorySync is limited: it is tightly coupled to a specific hardware stack (e.g., it only supports the affordances of Furhat robot which is not a mobile platform), and it lacks real dialogue understanding. For RMAD to scale beyond bespoke installations, future work may explore architecturing a robust, modular authoring toolkit for designers and educators.

Ideally, such a toolkit would support hardware-agnostic robot coordination, scripting of multi-modal stories (e.g., environmental storytelling elements), and branching interaction logic. Also, it would allow non-programmers to choreograph complex multi-robot scenes, integrate props, and define responsive behaviors. Ultimately, an authoring toolkit will lower the barrier for creating new robot RPGs and enable iterative, participatory content development across diverse domains.

7.8 Chapter Summary

This chapter provided a systemic overview of the educational game REMind, a social robot-mediated intervention designed to promote prosocial bystander behavior in children. This chapter first established seven key pedagogical objectives, which were informed by extensive consultation with subject-matter experts on peer bullying, and then used the Elemental Tetrad of game to provide an overview of REMind core Mechanics, Story, Aesthetics, and Technology. The subsequent section on Core Mechanics unpacked the central interaction patterns, including robot-mediated spect-actorship (Puppet Mode) for rehearsing intervention, the custom-made Bully-Detector for practicing moral reasoning, and the use of tangible props such as metaphoric containers to represent abstract social-cognitive variables. The Narrative Design section then explained how the story structure is cognitively scaffolded by the five phases of the bystander intervention model, outlining characters, and the storyline. An overview of the Technology detailed the technical system which involves a multi-robot multi-robot, ambient light and sound systems, and GUI, and the custom-built StorySync toolkit, which facilitated multi-modal synchronization and wizarding the

experience. The chapter concluded with a discussion of the system's Aesthetics, covering the emotional design choices.

Importantly, the game is not same as the experience. Rather, the game is the structure that supports and creates the experience; the experience itself occurs in the mind of the player [324]. Therefore, understanding systems and effectively analyzing them arises not from dissecting them (as this chapter did), but from experiencing them as they operate in context [326]. The next chapter explores this through an evaluation study of REMind via play-testing sessions with children.

ACKNOWLEDGMENT I thank Dr. Christina Salmivalli and Dr. Claire Garandeau from the University of Turku, Finland, for being generous with their expertise and time, and contributing invaluable consultations and feedback that shaped REMind.

Chapter 8

Evaluating REMind: Playtesting with Children

> *"Play is a child's most important means of communication. Children are not self-conscious about playing. They play out what they think is real. That is the ultimate honesty. Children bring their whole inner drama to any relationship."*
> — Fred Rogers

To evaluate whether a game effectively evokes the intended player experience, playtesting is an essential step [324]. This chapter presents a playtesting study with 18 children (ages 9–10) conducted to evaluate REMind. Each child participated in a two-hour, single-player session at the university. This live experience was facilitated by a two-person research team: one researcher acted as a hidden operator behind the scenes (the Wizard), while the other was physically present in the room as a facilitator (the Joker).

The purpose of this chapter is to detail the evaluation study itself: the experimental design, the measurements used, the role of the human facilitators, and the observed outcomes. To that end, section 8.1 will provide a high-level overview of the player experience - to fully understand the player experience, readers should first review chapter 7. Section 8.3 will provide details on the experiment design, by describing the experimental setup, facilitation protocol, and how measurements were collected pre-, post-, and during the gameplay. Then, the quantitative results will be reviewed in section 8.4, and the qualitative observations will be presented in section 8.5. And finally, section 8.7 will discuss the limitations of this study in light of a reflection on the conflict between scientific rigor versus experiential pedagogy.

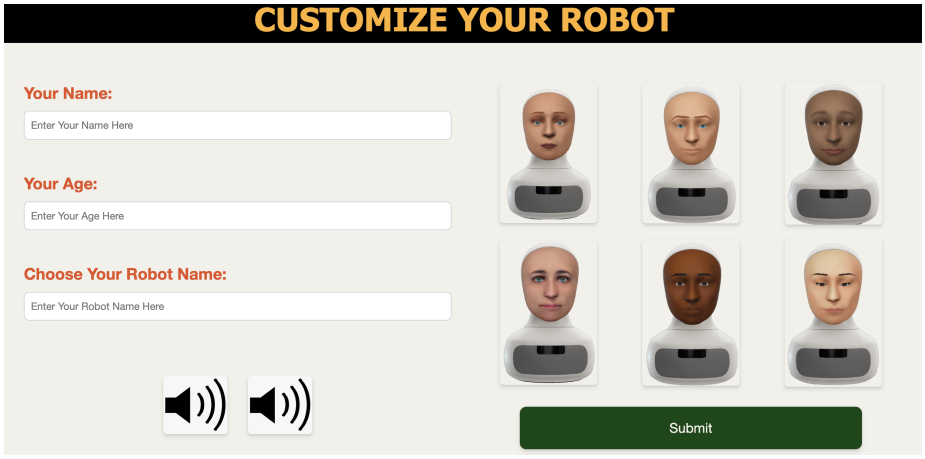


Figure 8.1: REMind avatar robot customization GUI

8.1 Player Experience Overview

This section describes the player experience of the game from a first-person, in-game perspective, structured around five progressive interaction phases. While Chapter 7 outlined the individual game design elements in detail, this section centers on the player's embodied experience with the entirety of the system. The experience is structured around a five-phase narrative arc, mirroring the cognitive steps of bystander intervention described in section 7.4.2 [1].

8.1.1 Phase 1. Entering the Magic Circle

The experience begins in the dimly lit KERNEL lab. In Area 1 (see Fig. 8.4), the player meets the Programmer (researcher) and uses a GUI to customize their robot avatar, AVATAR, selecting its name, face, and voice (see Fig. 8.1). The player then selects AVATAR's physical accessories. They select a favorite plush toy and pack it in AVATAR's tiny backpack, and also choose a hat for the robot. The programmer also gives the player AVATAR's Access-Cloud.

The player moves to Area 2, places the hat on the robot, and uses the Access-Cloud to connect to it, which causes the robot's profile picture to immediately appear on the MATRIX (the GUI). To initiate the game, the player places a hand on the ORACLE (a plasma light) and speaks the command, "Let the adventure begin!" (See Fig. 8.2). The

[1] For a simplified version of the script, see H

environment responds: the room gradually brightens, a start-up video plays on the MATRIX, and AVATAR wakes up. AVATAR introduces itself to the player, then immediately expresses concern about a pervasive glitch in the robot society, enlisting the player's help to solve the problem.



Figure 8.2: Players start the game by placing their hand on the ORACLE (plasma light) and saying the "magic words".

8.1.2 Phase 2. Simulating the Memory & Fixing the Bully-Detector

This phase introduces the central conflict and the mechanic for identifying bullying behavior (i.e., the Bully-Detector).

Guided by an in-game clue, the player suggests to AVATAR that it should simulate the memory of its first glitch. Avatar expresses self-doubt due to its low social status. The player physically confirms this status by opening and checking the robot's nearly empty Heart-Meter.

The player finds the past memory (floppy disk) in the room, connects it to the robot and initiates the simulation of AVATAR's glitchy memory. During the simulation, the two Non-Player Characters (JITTER and FUSE) enact the peer bullying scenario involving verbal mockery and social exclusion, while AVATAR passively observes.

After the simulation, AVATAR wakes up. Guided by another game clue, player asks AVATAR why it failed to intervene. When AVATAR explains that it believed the aggressor

was merely *"teasing"* the victim, an error message appears indicating that its Bully-Detector is broken.

Player To resolve this error, the player searches the room to find the Bully-Detector prop. The player activates the device and explores the three diagnostic questions. To do so, the player collaborates with AVATAR to find out the correct answers. In this process, AVATAR shares the 3 backstories about FUSE & JITTER.

Once all three questions are answered, the player activates the large TEST button, which triggers the device's beacon alarm rotating with bright red light. The buzzer is too quiet for the robot avatar to hear, the player may "repair" the device by adjusting the volume knob to unmute the alarm, ensuring that future incidents of bullying can no longer go unnoticed by the robot. This process is illustrated in Fig. 8.3.

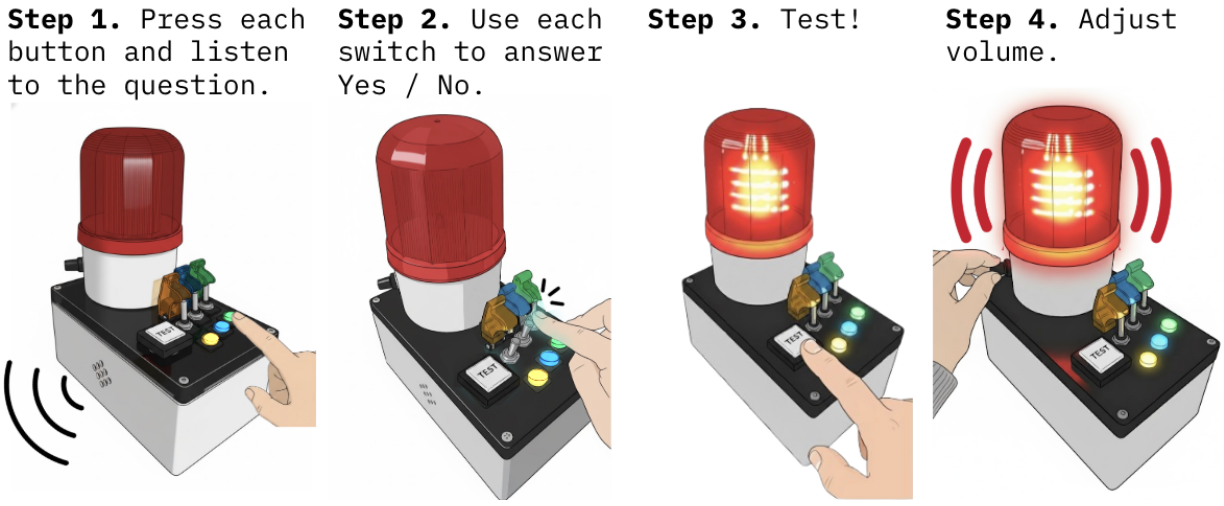


Figure 8.3: Steps for fixing the Bully-Detector.

8.1.3 Phase 3. Debug Mode: Empathy-Training & Perspective-Taking

The experience transitions to addressing the underlying cognitive barriers to intervention.

The player activates AVATAR's Debug Mode, which displays a list of missing social information on the MATRIX.

Empathy Training The first missing data is JITTER's emotions. AVATAR explains its inability to "feel" emotions, relying instead on representations. To fill this gap, AVATAR displays two detected emotions through an ambient display of colored light (FEEL-MOON) and affective music, sequentially (depicted in Fig. 7.4). The player is prompted to interpret these displays: naming the emotion, describing what it feels like, and sharing a story related to it. Following this interpretive exercise, AVATAR processes the information and explicitly verbalizes an empathic understanding of JITTER's (victim's) experience. Next, the player is prompted to improvise a response to infer JITTER's perspective (what JITTER was thinking).

Exposure to Fuse's Motivation Next, the player speculates on FUSE's motivation for bullying. AVATAR reflects on these suggestions, communicating the expert-informed reasoning that the bullying is likely driven by an underlying need for power or insecurity, concluding, *"Maybe FUSE needs help too. If someone feels the need to hurt others to feel better, they might not be very happy inside."*

8.1.4 Phase 4. Puppet Mode: Intervention Rehearsal

This phase focuses on practicing a corrective response to the bullying scenario.

AVATAR displays two intervention strategies on the MATRIX screen: "Comfort JITTER (500 points)" or "Be Firm with FUSE (1000 points)". The player selects one strategy on AVATAR's behalf.

The player is prompted to brainstorm and demonstrate the chosen intervention. AVATAR attempts imitation but experiences a scripted malfunction, which is resolved by activating Puppet Mode. In this mode, the player records their own improvised intervention. With help from the programmer, they convert the recorded intervention to a gesture that AVATAR can play when the Puppet Mode button is pressed.

The bullying scene is re-simulated. When the player deems the timing appropriate, they press the button to puppeteer AVATAR's reaction to the bullying scene (i.e., replaying their own intervention on the robot). Upon completion, AVATAR acknowledges the success: *"I actually did it—I stood up for JITTER!"*

8.1.5 Phase 5. Outcomes and Resolution

The final phase provides multi-layered narrative feedback on the consequences of the player's intervention.

Impact on the Bully On the TV, ORACLE appears in a video message announcing that it has processed AVATAR's new reaction, offering to show multiple simulated outcomes. By using the Acess-Cloud the player observes two simulated outcomes using the Marshal-Box: one where FUSE's confidence collapses and the bullying de-escalates, and an alternative where FUSE retaliates. This teaches that defending may or may not stop the bully.

Impact on the Victim The perspective shifts to JITTER, showing a before-and-after contrast. In the "before" scene, FUSE's bullying is accompanied by a thunderstorm light effect, and JITTER's thoughts reveal despair. In the "after" scene, AVATAR's intervention is immediately followed by a burst of rainbow light and cheerful music, with JITTER's thought bubble revealing relief and new friendship. This demonstrates that intervention helps the victim feel better.

As the final act of resolution, the player and AVATAR learn about the big misunderstanding that caused the "glitch": robots disliked the bullying but stayed silent, mistakenly believing their peers approved; as a result, they gave bullies too much power. To fix this, the player locates the Power Box prop placed near FUSE and physically removes the thunderbolt tokens, symbolizing the reclaiming of power. The AVATAR remembers the names of its friends, signifying the resolution of the glitch. The game concludes with AVATAR thanking the player and gifting them its favorite plush toy.

8.2 Research Questions

This chapter investigates the following central research question: To what extent does the REMind experience facilitate the achievement of the seven evidence-based learning objectives (identified in Section 7.2.2) for fostering effective bystander intervention?

Grounded in the learning goals established through expert consultation, the hypotheses for this playtesting study are categorized into quantitative predictions and qualitative pedagogical expectations. The first set of hypotheses concerns quantitatively measurable constructs and participant self-reports:

[H1] Perceived self-efficacy will increase following the intervention.

[H2] Children's affective empathy will increase as a result of the intervention and be projected onto the avatar.

- **(a)** Participants will report higher affective empathy (i.e., greater emotional responsiveness to others) after the intervention.

(b) Participants' self-reported affective empathy toward a victim of bullying will be positively associated with their empathy toward the robot avatar.

[H3] Outcome expectations of defending will shift according to the story's resolution.

(a) Expectations that intervening will stop the bullying will shift toward a midpoint post-test, reflecting the partial success shown in the story.

(b) Expectations that intervening will help the victim feel better will increase toward the maximum value, consistent with the positive story outcome.

Complementing the quantitative measures, the following hypotheses address the qualitative evidence and conceptual understanding emerging from the intervention:

[H4] Participants will be able to correctly identify the three criteria of bullying (repetition, power imbalance, and intent to harm).

[H5] Participants will demonstrate evidence of understanding the underlying motivations of the bully, namely the desire for social dominance and power.

[H6] Participants will demonstrate an understanding of the "The Glitch" metaphor, recognizing it as a misperception of social norms where peer silence is mistakenly interpreted as collective approval of bullying.

[H7] Through the selection and enactment of defending strategies in Puppet Mode, participants will generate evidence of practicing safe bystander intervention strategies (i.e., assertive defending or comforting the victim).

8.3 Experiment Design

8.3.1 Setup

The experiment room (see layout in Fig. 8.4) was divided into three functional areas: (1) setup and avatar customization, where participants were onboarded, (2) the main game area with the robots and the game GUI, and (3) a wizarding station hidden behind room dividers. The setup included 3 Furhat robots on a dining table, 3 smart lights, a large TV (game GUI), and a camera.

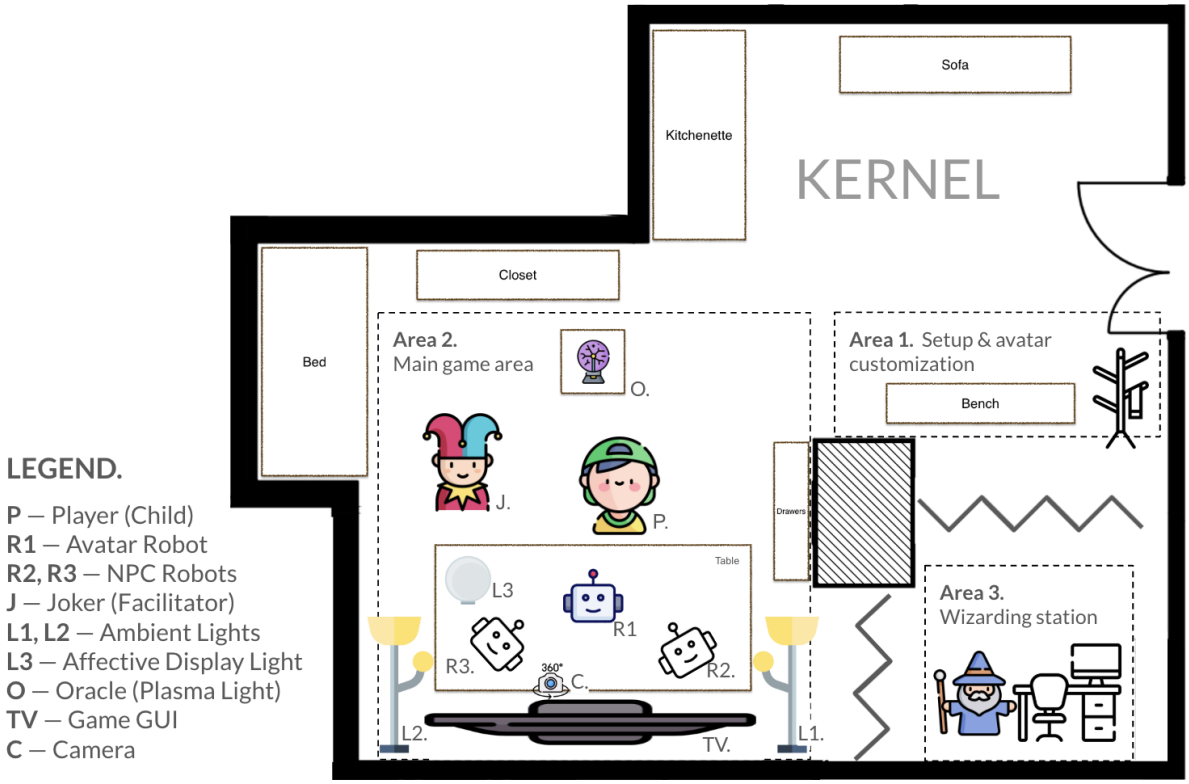


Figure 8.4: Layout of the play-testing room (KERNEL), showing the three designated areas: avatar setup and onboarding, the main game area with robots and Game GUI, and the hidden wizarding station behind room dividers.

8.3.2 Facilitation

Using Natural Language Understanding (NLU) technology to support real-time child–robot interaction presents significant challenges due to developmental variability in children's speech and language (e.g., less consistent articulation), unpredictable utterances (e.g., asking a random question), and the need for fast, context-sensitive interpretation. These challenges are exacerbated in embodied, narrative-driven scenarios like pedagogical role-play, where misrecognition can disrupt engagement, learning outcomes, and sense of emotional safety. For example, in the context of REMind, children may share emotionally-rich information related to bullying; a robot using NLU would struggle with generating socially and emotionally appropriate responses. Such limitations rendered the use of NLU impractical in this project. Instead, REMind relies on semi-scripted interactions and a two-person human-in-the-loop operational protocol.

Specifically, REMind relied on the coordinated effort of a two-person team: the Wizard (technical operator) and the Joker (applied drama facilitator).

Role of The Wizard

The technical aspects of REMind are facilitated using the Wizard of Oz (WoZ) technique [297]. In WoZ, a hidden human operator, known as the wizard, simulates system interactions in response to user input. In REMind the wizard sits behind a room divider (i.e., area 3 in 8.4), observes the player through cameras in the room and interprets their input interaction in order to control the timing of pre-scripted events, as well as narrative branching. For example, at the specific game module when the player presses the "simulate" button, the button plays a recorded sound-bit — upon hearing this sound, the wizard triggers the initiation of the 3-robot dramatization, thereby simulating the system's response.

Role of the Joker

The design choice to incorporate a dual-facilitator structure, specifically the Joker role, emerged from expert advice with applied drama scholars, notably those from the Centre for Spectatorship and Audience Research (CSAR) at the University of Toronto, who emphasized that a human facilitator is essential to guide the intervention and ensure the transfer of learning. Experts emphasized the key facilitation role of the Joker under the Forum Theatre framework, and underscored the importance of this given the sensitive nature of the topic and the necessity for monitoring the child's emotional safety.

Joker in Boal's Forum Theatre In Augusto Boal's Forum Theatre [43], which REMind builds upon, the Joker (or curinga) is the essential non-acting facilitator who mediates the dramatic exchange between the performers and the audience. They explain the structure of the performance, guide discussion, and transform passive spectators into spect-actors: participants who actively intervene on stage to challenge and change the outcome of an oppressive scenario. The Joker achieves this by maintaining the rules of the forum, asking probing questions to challenge participants' assumptions about power dynamics. The Joker does not impose solutions but helps create a space for reflection and collective problem-solving. They are playful, critical, and open-minded—a kind of "wildcard" figure who keeps the process adaptive, participatory, and focused on exploration rather than prescription. This role serves as a pedagogical bridge, maximizing the critical and creative agency of the audience to rehearse concrete solutions for social issues.

Joker in REMind The role of the facilitator, or Joker, in REMind was to adopt the in-story persona of the "robot programmer" to manage the technical and narrative complexity of the live experience. The Joker served as the responsive intermediary, guiding the participant through the role-play and ensuring seamless transitions between modules. Key responsibilities included improvising dialogue to address unscripted participant questions or minor technical issues, thereby maintaining narrative flow and engagement. Drawing from the principles of Forum Theatre, the Joker also posed probing questions during modules like empathy training to deepen the participant's moral reflection. Their technical role was most critical during Puppet Mode, where they converted the participant's live-recorded performance into a functional robot gesture in real-time, an action that was narratively consistent with their fictional role as the programmer. Though the Joker's performance was inherently adaptive, it was guided by a semi-structured facilitation protocol to ensure consistent pedagogical delivery.

8.3.3 Procedure

Recruitment

To recruit participants, we posted study flyers in public spaces, such as local libraries. The flyers contained a QR code linking directly to an online Qualtrics form, which guided parents through a multi-step informed consent process. First, parents reviewed a detailed information letter outlining the study's two-part structure: a 2-hour, single-player play-testing session and a subsequent group debriefing. Second, parents accessed an assent letter designed with simple language for their child, and were asked to confirm that their child understood and assented to participate. Third, parents provided formal parental permission for participation. Finally, upon successful completion of all steps, the form allowed parents to book the single-player play-testing session.

The assent letter explained to children that they would be playing an anti-bullying robot game to help researchers test if it is a fun and helpful way to teach kids how to stand up to bullying. Furthermore, it explained that in the game, they would **pretend** to assist a programmer (played by a researcher) in fixing a robot that failed to intervene in a simulated bullying memory. Their job was to mentor the robot, helping it learn and act out the correct response, and then observing the story's consequences. Participants were also informed that they would be invited to a 1-hour group discussion some days later to talk about their experience. They were explicitly told the activity is voluntary, they could stop at any time and no one would be upset or mad, and they might skip any questions that made them feel sad or uncomfortable. This research protocol was approved by the University of Waterloo Human Research Ethics Board.

Single-player Play-testing Session

Participants were dropped off by their parents at the experiment site (third floor of a university building) at their pre-scheduled time, were greeted by the Joker, and entered the experiment room. After confirming child assent, the Joker conducted a brief semi-structured pre-test interview. The child was first asked to recall the last time they saw someone being bullied and describe what they did. Then, the Joker asked questions to assess their attitudes toward bullying and defending. Finally, children directly responded to two sliding scale items assessing empathy with victims of bullying and perceived self-efficacy for defending.

The gameplay experience unfolds across the five phases outlined in Section 8.1 and detailed in the previous chapters — in this section, we focus on the Joker's role and data collection. Gameplay was briefly paused at designated points to administer mid-test measures. Specifically, at the end of the first time AVATAR's memory is simulated (Phase 2), all would be momentarily robots powered off. Before AVATAR woke up from the simulation, the Joker asked 3 short open-ended questions probing the child's first impressions of the scene and the avatar's inaction, recording their responses: *"What do you think happened here?"*, *"How do you feel?"*, and *"Why do you think AVATAR did not do anything"?*

In Phase 3, the Joker guided the participant to explain their interpretation of the affective displays to the robot and asked probing questions to scaffold empathic reflection —for instance, *"How would you explain fear to a robot?"*, *"What clues tell humans they are afraid?"*, or *"How does fear make people want to react?"*.

In Phase 4, when the child selected a defending strategy for the avatar, the Joker noted their choice, helped them brainstorm, supported them in rehearsing the intervention, and helped them record their intervention via an iPhone. Then, the player sat beside the joker, as she showed them a demo of how a recording of their performance can be converted into a Furhat robot gesture. This process took a few minutes to complete. To keep the child engaged during this step, the Joker (aka, the programmer) involved the child in the process, explained every step in simple terms, and answered any questions they had about the technology, before resuming gameplay.

In Phase 5, the Joker played a role in unfolding the story by explaining to the player and AVATAR that shared misunderstanding that caused the glitch was robots disliking the bullying but mistakenly interpreting each others' silence as approval. To do so, the Joker, by acting as their in-game role of the programmer used visualizations on the screen to describe the robots' social modeling process, showing that each robot, though privately disapproving of the bullying, observed the silence of the others and mistakenly inferred it

as collective approval, leading them to suppress their own discomfort and stay quiet (see details in Appendix H).

After the robot said goodbye and was powered off, the Joker conducted the post-test inquiry. First, the child registered their responses to the post-test empathy item. Then, the child responded to 2 open-ended reflective questions from the Joker: *"What was The Glitch?"* and *"In REMind, you took away a bully's power by removing power charms from a box. How do you take away a bully's power in real-life?"*

This was followed by the post-study interview that included a brief re-assessment of their attitudes toward bullying and defending, knowledge of defending strategies, perceived self-efficacy for defending, and outcome expectations. More specifically, the Joker asked the child to imagine witnessing bullying in the future, and asked follow-up questions probing their attitudes toward bullying and defending, knowledge of defending strategies, perceived self-efficacy for defending, and outcome expectations. Finally, the child responded to an item probing their affinity with the game characters by sorting the three robots in the order of which one they liked the most. Once this was completed, the child received an "exit ticket," (see Appendix G) which they filled out before being picked up by a family member.

Collective Debriefing

Parents were invited to enroll their child in a group debriefing session. In this session, children gathered around a round table to reflect collectively on their experience, recall elements of the game, and discuss whether they had encountered peer bullying in the weeks following play and how they responded. After the group reflection, children returned to the experiment room for a "behind-the-scenes" demo of REMind, where the wizarding station dividers were removed and the wizard demonstrated how they controlled various aspects of the game. Children could ask questions and interact with the setup.

The collective debriefing sessions lasted 1 hour and were facilitated by the Joker and one of the Wizards. They were scheduled up to a month after the original interaction. Participants who were not able to participate received detailed debriefing letters in simple language.

Audience research experts at the Centre for Spectatorship and Audience Research (CSAR) of the University of Toronto had highlighted the value of conducting collective debriefs after the intervention. Experts emphasized that collective debriefing sessions can serve as *moments of rupture*, where participants could reflect on their experiences, share their insights, and process the intervention collectively.

8.3.4 Measurements

Unless otherwise noted, interview responses and game-logs were recorded by the Joker (entered into Qualtrics), while children entered their own responses to sliding-scale items.

Attitude Toward Bullying and Defending

We measured this construct using the Bystander Type questionnaire item from prior work by Dotta et al. [99], which asks participants to describe how they responded the last time they witnessed bullying: "I ignored it,"; "I did nothing at the time, but I tried to stop it from happening again,"; "I asked a teacher or another adult for help,"; "I did something to try and stop it from happening,"; "I laughed along with others who saw it,"; and "I did something else." The participant responded conversationally to this prompt; the Joker carefully listened to their explanations, jotted down notes, and recorded their response by selecting all the relevant multiple choice options. To re-evaluate this construct at post-test, the items adjusted by asking participants to imagine a future scenario where they see someone get bullied, and speculate on what they might do.

Knowledge of Bullying

To assess players' knowledge of bullying pre-test, the joker asked the player to explain *how* they recognized that the incident they recalled was bullying. As the child responds, the joker listened carefully, and recorded any mention of the 3 key criteria for identifying bullying: repetition, power imbalance, and intention to harm. For instance, if a participant said *"that was not the first time it happened,"* the joker marks the "repetition" criterion on the questionnaire item. To re-assess this construct post-test, the joker asked the participant whether they recall how the robot was able recognize that the incident was bullying; and records their response using the same questionnaire item.

Knowledge of Defending Strategies

To evaluate players' understanding of how to intervene as a bystander, in the pre-test, the joker asked the player: *"If you wanted to defend the victim, what could you do?"* The participants' responses were recorded using a multiple-choice item based on five bystander strategies from prior work [381]: Assertive Defending, Comforting the Victim, Reporting to Authority, Aggressive Defending, and Tactical Defending. The same question was asked again in the post-test, with respect to the imagined future scenario.

Self-Efficacy for Defending

To assess children's perceived self-efficacy for defending a peer, we included a follow-up question at the end of the interview, by adopting an item from Pöyhönen et al. [287]: "How easy or hard would it be for you to defend the victim?" Participants were invited to reflect on their perceived self-efficacy regarding the defending strategy they had just discussed, and directly input their response to this question by using a sliding scale ranging from Very Hard to Very Easy. This item was used both pre-test and post-test.

Outcome Expectations

We measured children's outcome expectations for defending a victim of bullying by taking 2 items used in prior work by Pöyhönen et al. [287]: "Do we think the bully would listen if you told them to stop," and "Do we think telling the bully to stop would help the victim feel better"? Children directly recorded their response on a sliding scale ranging from Definitely Not to Definitely Yes. These items were repeated post-test.

Empathy Towards Victims

Affective empathy was assessed using mixed methods. For quantitative assessments, we borrowed an item from Pöyhönen et al. [287], reworded to align with the narrative framing. At pre-test, this item captured baseline empathy toward a human victim—*"When the bullied person was sad, I also felt sad"*. At mid-test, immediately after completing the empathy training module, we assessed the participant's projected empathy onto the avatar robot: *"When Jitter is sad, my robot feels sad as well"*. At post-test, we reversed the framing and probed whether the participant felt sad when the avatar robot was sad, to confirm identification with the avatar and validate the mid-test proxy: *"When my robot is sad, I feel sad as well"*. Participants directly recorded their response to these items, using a sliding scale from Never to Always. Qualitative data on affective empathy with victim was collected during the gameplay. In phsae 2, after participants watch the simulated memory for the first time with the second question from the Joker ("How do you feel") directly probes affective empathy.

Perspective-Taking

During the gameplay, participants were prompted to reflect on the perspective of the bystander, the victim, and the bully. Participants reflected on the underlying reasons for

bystander inaction by responding to this question immediately after the first time they viewed the bullying scene: "Why do you think your robot didn't do anything?" Here, the participant provided an explanation to the Joker. Furthermore, participants reflected on the cognitive perspective of the victim, as well as the bully by improvising a response to the following two questions during the Debug Mode: "If we could hear JITTER's thoughts, what would we hear?", and "Why do you think FUSE bullied JITTER?" Here, the participant improvised a response directed to the robot avatar. The Joker recorded their responses (See Appendix G).

Character Affinity

Children completed a drag-and-drop ranking task, ordering the three robots characters from most favorite to least favorite, post-test.

Exit Ticket

At the end of the session, children completed a printed "exit ticket" consisting of three items: (i) selecting an emoji to indicate their current feeling and explaining why; (ii) listing their top fun and not-fun moments; and (iii) describing what they think stuck with their robot from the session.

8.3.5 Data and Analysis

We collected 3 parimary types of data across the play sessions:

1. **Quantitative survey responses** from children, including Likert-scale survey items on empathy, perceived self-efficacy, and outcome expectations, as well as character ranking.
2. **Structured qualitative data**: recorded by the Joker during pre- and post-test interviews using a Qualtrics form, including attitude towards bullying, knowledge of bullying, knowledge of defensing strategies, and so on.
3. **Open-ended in-game responses (video data)**, including improvised reflections during key narrative moments (e.g., empathy training module).

Quantitative Analysis

To test the hypotheses outlined in Section 8.2, we conducted a series of within-subject comparisons using one-tailed paired-sample t-tests. All self-reported questionnaire items

were on 0–100 scales, with higher values indicating stronger endorsement of each construct. Perceived self-efficacy and affective empathy gains were examined using one-tailed paired-samples t-tests. A Spearman correlation was used to assess the association between empathy toward humans and empathy toward the robot avatar. To examine outcome expectations, we defined normative targets based on the narrative outcomes (50 for expectations about the bully and 100 for expectations about the victim). For each participant, we computed the absolute distance from these targets at pre- and post-test, and use a one-tailed paired t-test to assess whether this distance decreased following the intervention, indicating alignment with the story logic. Finally, we present descriptive stats exploring potential effects of children's choice of intervention strategy, as well as patterns in character affinity.

Qualitative Analysis

To analyze the qualitative data, we conducted inductive thematic analysis of all the structured qualitative data; and evaluated intercoder reliability.

For the empathy training videos, we carried out deductive thematic analysis: three researchers independently coded inductively, then collaboratively refined latent themes that captured deeper patterns beyond what was explicitly said. We also draw on anecdotal evidence from video data to contextualize and reflect on design implications.

8.4 Quantitative Results

8.4.1 Participants

REMind was play-tested by 18 children aged 9 and 10 year olds (M= 9.22, sd = 0.43). In verbal and written communication, parents referred to 11 children using he/him pronouns and 7 using she/her pronouns.

8.4.2 Perceived Self-Efficacy

Children's perceived self-efficacy significantly increased from pre-test (M = 39.2, SD = 20.5) to post-test (M = 53.9, SD = 21.3), $t(17) = 3.12$, $p = .003$. This result suggests a substantial improvement in perceived self-efficacy following the intervention. Cohen's $d = 0.74$ indicated a medium-to-large effect size. See Fig. 8.5.

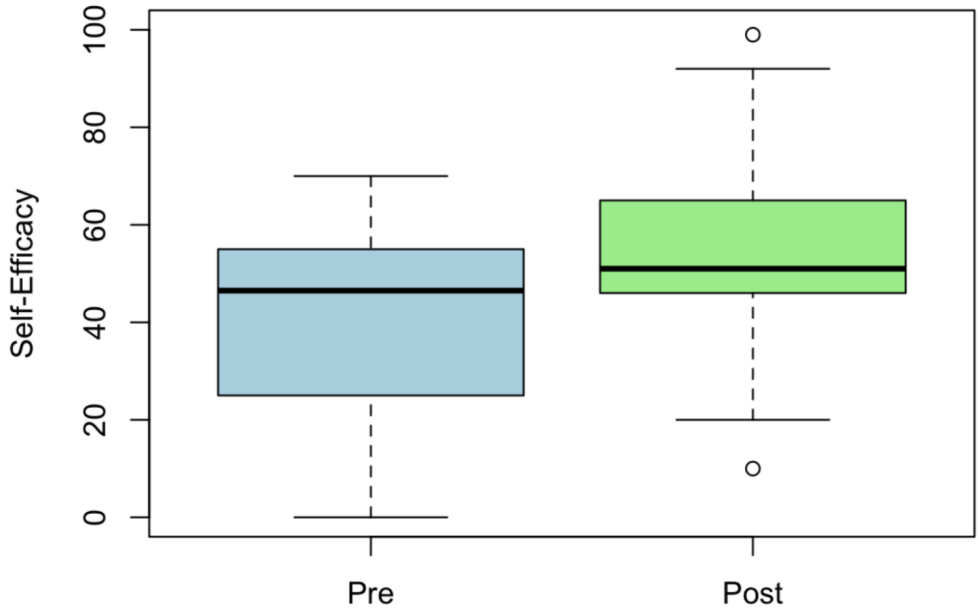


Figure 8.5: Perceived self-efficacy for defending increased post-intervention. Boxes show the interquartile range (IQR); whiskers extend to 1.5× IQR.

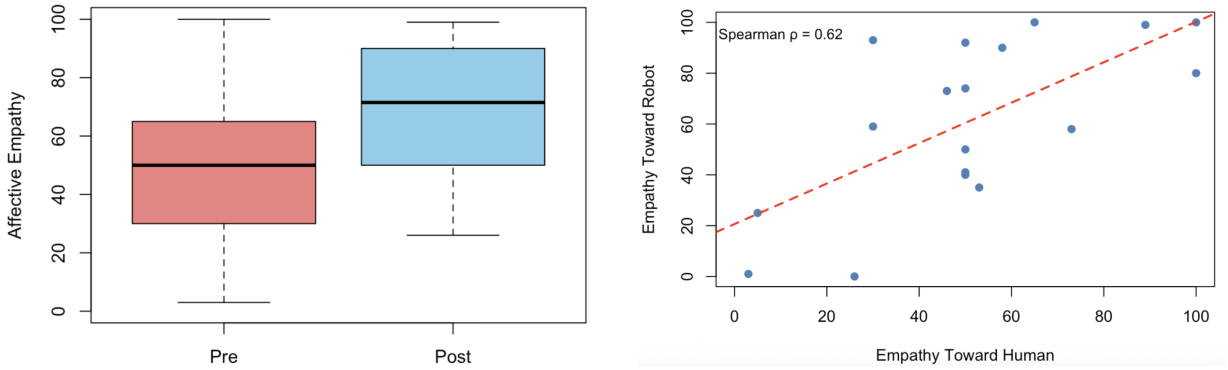
8.4.3 Empathy

Empathy scores increased by 15.7 points, but the change was not statistically significant, $t(17) = 1.62$, $p = .062$. H2.1 was not confirmed. A significant positive correlation was found between empathy toward the human character at pre-test and the robot avatar at post-test, Spearman's $\rho = .62$, $p = .006$, confirming H2.2, this indicates that children with higher baseline empathy were more likely to empathize with the robot. See Fig. 8.6.

8.4.4 Outcome Expectations

For the bully-related item (target = 50), expectation scores decreased from M = 52.22 to 47.44. A one-tailed paired t-test on distance from target showed a significant reduction, $t(17) = -3.11$, $p = .003$. H3.1 confirmed.

For victim expectations (target = 100), scores increased from M = 70.94 to 78.06, but change was not significant: $t(17) = -0.89$, $p = .193$. H3.2 not confirmed.



(a) (b)

Figure 8.6: Empathy-related findings. (a) Affective empathy scores before and after empathy training. No significant change was observed. (b) Empathy toward human vs. robot. Children with higher baseline empathy were more likely to empathize with the robot avatar.

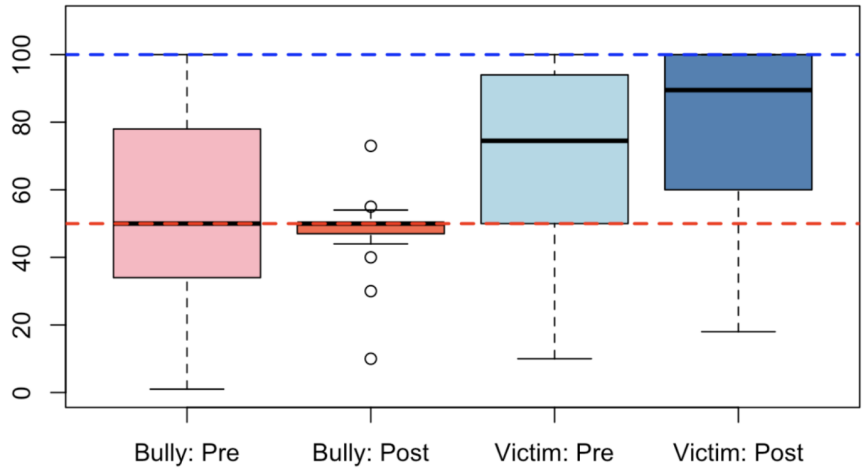


Figure 8.7: Outcome expectations before and after the intervention. Red dashed lines shows normative target regarding the bully, and the blue dashed lined shows normative target regarding the victim.

8.4.5 Descriptive Comparison based on Chosen Strategy

Among the two choices of defending strategies, only 4 participants selected the comfort strategy. On average, participants who chose to comfort the victim reported higher perceived self-efficacy for their chosen action (M = 64.5, SD = 25.2) compared to those who chose to confront the bully (M = 42.6, SD = 21.1). They also reported higher expectations that their action would help the victim (M = 95.0, SD = 10.0 vs. M = 74.2, SD = 27.1). Participants who chose to confront the bully reported higher expectations that the bully would stop (M = 59.5, SD = 20.4 vs. M = 40.0, SD = 22.0).

These descriptive findings must be interpreted with caution due to the severe group size imbalance.

8.4.6 Character Affinity

At post-test, children ranked the avatar robot, JITTER (victim), and FUSE (bully) characters from most to least liked. On average, children showed a consistent preference for their avatar (M = 1.06, SD = 0.24), followed by JITTER (M = 1.94, SD = 0.24), with FUSE ranked last (M = 3.00, SD = 0.00). A Friedman test showed significant differences in rankings, $\chi^2(2) = 34.11$, $p < .001$. Wilcoxon signed-rank tests (Bonferroni-adjusted $\alpha = .0167$) confirmed that the avatar was ranked higher than JITTER ($p < .001$), and both were ranked higher than FUSE ($p < .001$).

8.5 Qualitative Observations

8.5.1 Intercoder Reliability Testing

To ensure reliability, a second researcher used the code-book to double-code 25% of the dataset (threshold recommended by related work [275]), which yielded 94% agreement and a Cohen's Kappa of 0.93 (near-perfect agreement).

8.5.2 Perspective-Taking

Right after simulating the glitchy memory (multi-robot dramatization of the bullying scenario), Joker asks participants 3 questions, all 3 robots go to sleep. Before the avatar wakes

up, Joker asks participants 3 questions and takes notes: What do you think happened? How do you feel? Why do you think your robot did not do anything?

Inductive coding of children's responses to 'How do you feel' revealed that 94% of participants (17 out of 18) indicated feeling sad for JITTER (victim), and one child responded with 'I don't know'. Also, 16% were both sad for JITTER (victim) and mad at FUSE (bully). For example, when asked this question P10 replied: "That guy shouldn't bullying. I don't know," pointing to JITTER (victim) they said "I feel bad for him," pointing to FUSE (bully) added "and mad at him" (see figure 7.4).

Bystander Inaction

In response to *"Why do you think your avatar didn't do anything?"*, children reflected on potential reasons for bystander inaction. Over half (55%) attributed it to low skills or confidence (e.g., *"maybe she didn't feel confident, because of FUSE's rude words."* [P9], or *"she doesn't know how to stand up."* [P2]). Responses from 38% of children indicated fear of bully's retaliation as a reason for avatar's inaction (e.g., *"hmmmm[...] because he also didn't wanna get bullied" [sic]*[P18]. 16% hinted at reasons related to peer status, e.g., *"because he wasn't popular and he didn't think he can get out of this situation. "* [P8]). Finally, 11% indicated that avatar was indifferent (e.g., *"because he didn't really get involved with the problem"* [P5]).

Victim's Internal State

When asked to imagine *"What JITTER might be thinking"*, children projected both emotional distress and unmet social needs. The first emerging theme reflected how children imagined the victim responding to and coping with the bullying. Half of the participants indicated that the victim wishes for the bullying behavior to end, imagines fighting back, talking back, or expressing anger toward bully (e.g., *"stop, I don't like what you're doing, just stop"* [P12], *"why are you bullying me?"* [P10]). 27% of players indicated that the victim has a desire to escape the situation, wants to leave, disappear, or avoid the bullying context (e.g., *"get me out of this place!"* [P4], *"oh I wish I wasn't here today, oh my god I want to disappear"* [P13], *"I never want to go back to school"* [P14]). Finally, 16% of participants imagined the victim hopes or wishes that a bystander would intervene, support, or help (e.g., *"Bob! please help me! or someone! at least somehow!"* [P6], *"I wish someone can stand up for me"* [P17], *"William [avatar robot], why wouldn't you stand up for me"* [P14]).

The second emerging theme focused on the victim's internalized emotional experience. Responses from 38% of participants suggested victim has negative self-image, low self-worth, shyness, self-blame, or feeling unwanted or alone (e.g., *"I must be so shy[...] I must be so weird[...] nobody likes me"* [P2], *"I'm not important[...] I'm alone"* [P1], *"I want to talk louder, but I can't, I'm too shy"* [P11], *"I have no friends"* [P16]). Furthermore, one third of participants imagined the victim expressing emotional distress, feeling sad, scared, overwhelmed, or upset (e.g., *"I'm sad and also scared"* [P9], *"I don't feel safe"* [P12]).

Bully's Motivation

When asked to reflect on why FUSE may have acted the way he did, children offered a range of interpretations. Some children demonstrated awareness of the power and social dynamics at play. 38% of participants described FUSE as motivated by seeking social dominance, power, or attention from others (e.g., *"because FUSE wanted lots of attention and wanted JITTER to feel ashamed"* [P2], *"cuz he wanted to make the crowd laugh, and to make JITTER feel bad"* [P11], *"I don't think this is a good reason, but I think he wanted to be popular"* [P15]). 27% of responses emphasized that JITTER was an easy target because of perceived vulnerabilities (e.g., *"because he knew JITTER didn't have any friends"* [P3], *"either he wasn't having a good day, or he just saw JITTER was very shy and he felt like JITTER was an easy target"* [P13]).

The second emerging theme reflected reflected processes of moral disengagement. 27% of responses indicated that FUSE bullies due to personal struggles, or family problems (e.g., *"because FUSE was sad. something was going on in their life"* [P6], *"maybe he is having rough moments, and his father is sick, he's taking his anger on JITTER"* [P9], *"Most adults will say, oh , his parents aren't very nice, or something at home isn't very good for him"* [P10]. 16% suggested that FUSE's behavior was linked to JITTER's perceived flaws (e.g., *"because FUSE thinks that JITTER is bad at everything"* [P16], *"FUSE bullied JITTER because he looked really plain"* [P18]). 11% framed it as entertainment or joking (e.g., *"FUSE wanted to joke; but they weren't kind and [JITTER] didn't like it, but FUSE thought it was just a joke"* [P7]). Finally, a few responses (2 out of 18) offered essentialist explanations, portraying FUSE's behavior as an inherent trait rather than situational (e.g., *"because FUSE is a bully"* [P7]), and one player expressed uncertainty.

8.5.3 Narrative Engagement

Believability of Bullying Scenario

To assess whether children perceived the bullying scenario as believable, we asked them what they thought happened in the glitchy memory. Most participants (72%) explicitly identified the scenario as "bullying"; for example, *"FUSE was bullying JITTER. FUSE was saying that JITTER's face is not finished, and he has a pixelface." [P18]*).

The remaining 27% identified the problem, but did not explicitly label the scenario as bullying, e.g., *"FUSE was being mean to JITTER, making fun of JITTER"* [P5].

Emotional Response to Robot Drama (Bullying Scene)

Immediately after the bullying scene, we asked: *"How do you feel?"* Nearly all participants (94%) expressed feeling bad for JITTER (victim), suggesting affective empathy (e.g., *"I feel sad about jitter"* [P2]). Some (16%) also expressed anger toward FUSE (e.g., *"I feel a little sad and a little mad that FUSE is doing that." [P4]*). (See Fig. 8.8).



Figure 8.8: A participant reflecting on how they feel after watching the bullying scenario enacted by 3 robot characters.

While nearly all children articulated affective empathy in response to the prompt, video data revealed a spectrum of emotional engagement—observable through their verbal and non-verbal behaviors. For instance, some children remained quiet or neutral in expression, while others appeared emotionally invested. One participant [P12], visibly annoyed and seemingly morally outraged by the scene, confronted the bully robot directly, exclaiming: *"You know who can't take a joke? You, FUSE! You and I need to have a chat!"*

Interpreting The Glitch

At post-test, we asked children to reflect on the meaning of one of the game's central metaphors by answering the question: *"What was The Glitch?"* Their interpretations converged around several recurring themes. 60% of responses perceived *The Glitch* as caused by bullying (e.g., *"The Glitch was FUSE's energy"* [P1]). 44% attributed *The Glitch* to bystander inaction (e.g,. *"not doing anything when someone was getting bullied"* [P12]). 22% of responses simply described *The Glitch* with its symptoms (e.g., *"like, it made people forget stuff, I don't know why. "* [P17]). Importantly, 7 out of 18 children (39%) articulated that *The Glitch* reflected the misperception of norms related to bullying among peers (e.g., *"everyone thought everyone was ok with it, but people truly weren't, but since no one did anything, that caused The Glitch"* [P15]). This interpretation is especially significant because it reflects the central, complex idea the game was designed to convey via this metaphor: that bullying is sustained not only by the bully's actions, but also by group silence, caused by their misperception of the acceptable attitudes and behaviors among themselves.

Taking Away Bully's Power

We also asked children to reflect on a second core metaphor by answering: *"In this game, you took away the bully's power by emptying tokens in a container; in real life, how do you take away a bully's power?"* Responses to this prompt question were more diverse and exploratory. Children offered a broad range of ideas without converging on a shared explanation. Several children asserted that to take back the power of bullies in real life one must stand up to the bully, either individually or collectively (e.g., *"[...]by standing up for the other person*" [P1], *"tell them to stop with a firm voice" [P17]*, *"maybe get a bigger group to stand up to theme"* [P11]), or report it to an authority (e.g., ' *'you have to go tell a teacher or an adult"* [P7]). Others suggested ignoring the bully (e.g., *"just stop listening to them and tell everyone else when they talk not to listen. I like to think of it as they are shrinking."* [P12]). Some framed it in terms of showing attitude in public, making it clear that the bullying is not seen favorably or that the victim is valued (e.g., *"you show them that it's not funny"* [P10], *"because they think they have power when they make someone feel less, maybe [you can take the power away] if you make them feel like they're* ***not*** *making that person feel less."* [sic] [P13]). A few reflections emphasized inclusion (e.g., *"in real life, you make your own game, include everybody"* [P14]). While no consistent themes emerged, qualitative evidence reflected diverse and creative thinking about how to challenge bullying in real life.

8.6 Latent Thematic Analysis: Empathy Training

We conducted a latent thematic analysis of the video data was conducted on the *"Empathy Training"* module. In this module, children were asked to interpret two affective audio-visual scenes that represented the emotions the avatar robot had "detected" but could not understand. The analysis was conducted by three researchers who performed cycles of individual inductive coding and then collaboratively discussed observed patterns to identify interpretive themes.

Labeling Emotions

The first affective scene was designed to convey sadness. All participants labeled it as sadness, unanimously.

The second affective display was designed to convey fear. Over half of the participants (10 out of 18) described it by identifying more than one emotion - e.g., P14 described the second emotion as a mix of *"madness"*, *"frustration"*, and *"sadness"*, and told the avatar that humans call this *"a jumbled emotion"*. Among the labels children gave to the second affective display, 55% of children mentioned *"angry"* or its synonyms (i.e, *"mad"*, *"feels rage"*, *"[robot] has violence in him"*), 45% mentioned *"afraid"* or equivalents (e.g., *"scared"*, *"anxiety"*), 22% identified *"embarrassment"* or comparable emotions (e.g., *"humiliated"*, *"shy"*), 16% mentioned *"frustrated"* or similar words (e.g., *"annoyed"*), 16% labeled it as *"depressed"* or *"sad"*, and one child described it as *"sick"* and when asked what kind of sick explained *"sometimes you can get homesick and that feels very sad[...] you might throw up, for us humans" [sic] [P4].*

Describing Emotions

After labeling each emotion, the player was asked to explain the identified emotion to the robot. The explanations provided by players were coded and categorized into the six following types of definitions.

Emotion as Experience Several children described emotions relationally by narrating a situation or story from their own experience that would elicit the feeling. An example of a child describing anger to the robot as an experience would be, *"angry feels like when somebody says you have no brain and you're not smart at all" [sic]* [P2], and another described shyness as, *"being shy [sic] is kind of like [when] you're doing a presentation,*

you're scared to go there and say it. " [P17]. Other participants described sadness as, *"sad is when you lose something valuable, or you are lonely, or left out."* [P15], *"when my friend discluded me for like a couple months, [I felt sad]". [sic]* [P5], and *"if you lost your favorite stuffy"* [P8]. The perceived complexity of this emotion is illustrated by P4, who defined the emotion as sadness to the robot with an implicit mix of frustration and anger as *"like, how would you feel if a soccer ball went into your face or a ball hit your face?"* [P4]. This description of sadness being mixed in with other strong arousal emotions like *"[Madness is] when your whole body is like: Arghhh why won't this guy stop following me?[...]And then sometimes it just takes over your body and then you start kicking and punching and stuff. And then people get hurt and you get in trouble."* [P14]

Emotion as Bodily Sensation Some children provided definitions to the robot through physiological reactions that they believed were elicited by the emotion. An example of this is when P16 defined anxiety as, *"Anxious is when your heart feels* ***fast and pumpy****."* and when P9 tried to explain it in phyisiological robot terms as, *"like, your heart is beating really fast, and for you, it would probably be your motors, that go on and off and on and off and on and off, and just, like, feeling very much like anxiety."* Similarly, sadness was described as *"[...]you might throw up for us humans."* [P4], *"[...]feels like your heart's empty."* [P5], *"moving slowly, talking softly, maybe sometimes tears."* [P18] or *"I can tell that I'm sad when there's liquids in my eyes, but also my eyes feel scorched up, and my face just feels like droopy and stuff. "* [P14]

Emotion as Urge Children also defined emotions by the behavioral impulses or urges they provoke. Anger was described as, *"when you can't control what you say, and you say what you feel without thinking."* [P11] Sadness creates a desire to be *"left alone"* [P11], or to cry when *"You really don't know what to do"* [P12], Similarly, fear and anxiety were described as making the child want to run away and hide [P7, P12, P18] or makes you feel like *"you don't know how to get rid of it."* [P11]

Emotion as Thought Pattern Some explanations centered on emotion as a thought pattern, highlighting the cognitive states associated with a feeling. Sadness was characterized as a feeling that *"no one likes you"* [P18] or that, *"[...]there's no happiness left in me, there's no happiness left in the world, or if you feel like that nothing will get any better at all."* [P14]. Anxiety was defined by the thought pattern of constantly preparing for negative outcomes i.e., *"you think oh this will happen I have to be prepared, oh that will happen and I have to be prepared."* [P16]

Emotion as An Embodied Gesture In some cases, children explained emotions through embodied gestures using their bodies, in a performative manner, to demonstrate a feeling (see Fig 8.9. For instance, participants depicted sadness through furrowed eyebrows, head bowing, or through a small dance that depicted happiness, and then explained sadness to be the opposite experience.



Figure 8.9: Children instruct the robot through embodied expression: (Left) how sadness shapes the eyebrow, (Middle) how bowing the head symbolizes sadness, (Right) how anxiety can be shown through inter interlocked fingers.

Emotion as Definition Finally a few children provided more abstract explanations of emotions. One participant defined depression as *"when you just feel like no emotion a bit. But if you feel no emotion, you're not happy, you're not sad."* [P5] Another defined anxiety as feeling sad because *"you think something's going to happen but it's not really going to happen, and sometimes it does"* [P1].

Emotional Fluency

The children's ability to articulate emotional states varied, reflecting different developmental stages of emotional fluency. Some participants had a rich set of vocabulary for describing emotions and telling them apart. For example, [P16] distinguishing between anxious and scared: *"anxious means to be scared of the future, but, but scared is when it's in the present, like now."* Another example is when they made sophisticated distinctions and could translate complex human feelings into a robotic context. For instance, when explaining fear, one child [P9] told the robot it would feel *"like, your heart is beating really fast, and for you, it would probably be your motors, that go on and off"*. This shows a high-level ability to conceptualize emotion abstractly and engage in perspective-taking.

On the other hand, several participants struggled with verbalizing their understanding of emotions. Common patterns included using circular definitions (e.g., *"sad feels like if you're not feeling happy"* [P7]) and *"anger is when you just feel really mad"* [P9]) or describing the inner experience of one emotion, but labeling it with another emotion.(e.g. described the second emotion as mad or sick, *"it feels like sometimes you can get homesick and that feels very sad; you might throw up for us humans."* [P4] Some children also described different emotions with the same explanation, such as P12 who said that, *"[Embarrassment] is like when you're sad and you don't know what to do and you really just feel like you don't know what to do."* but then also described sadness with similar vocabulary: *"[sadness] makes you feel like you want to cry and you just don't know what to do and you just really don't feel nice."* This does not indicate a lack of feeling but rather illustrates a developmental stage in translating complex internal states into specific language.

Empathic Accuracy

Beyond fluency, children exhibited different levels of empathic accuracy, the ability to correctly infer the specific content of others thoughts and feelings. This was evident in several ways. Some children demonstrated a complex theory of mind, inferring inhibited emotions, as when P7 suggested the victim robot (JITTER) felt a hidden rage and wanted to bully back but restrained himself.

Others displayed metacognition, reflecting on internal conflicts, such as P9's description of the bystander's dilemma: *"your brain wants to help, but you just can't."*

There was also a notable difference in how children made social versus non-social descriptions; some linked their emotional explanations directly to the bullying scenario, while others recalled non-social personal experiences, like a fear of missing a plane[P1]. This suggests a key distinction between a child's ability to verbalize feelings and their capacity to mirror another's emotions in a specific social context.

we would like to note that this was independent from emotional fluency. That is, there is a distinction to be made between how much children can verbalize feelings, versus what they can feel / how much they can mirror another's emotions.

Metaphorical Understanding of Emotions

The affective displays, which used abstract combinations of light and sound, were designed to be multi-sensory representations of emotion rather than literal depictions. The analysis reveals that children successfully engaged with this design, using the provided cues to

form a metaphorical understanding of emotions. They did not just see a colored light; they interpreted it as an embodiment of feeling. Some participants formed direct, one-to-one associations, with one stating, *"I think it's mostly fear because it's purple"* [P18], reflecting common cultural links between colors and emotions. More impressively, some children performed a kind of "emotional algebra", deconstructing the metaphor to infer more complex states. P14 offered a particularly nuanced interpretation of the purple light, reasoning that it represented a blended feeling: *"There's more sadness than madness, because sadness is a blue emotion, and madness and frustration is a red emotion, and if you look at the [feelmoon] it was purple."* This comment is highly insightful, as it shows the child understood that emotions are often not pure, isolated states but are frequently "jumbled" or mixed. By interpreting the color purple as a combination of blue (sadness) and red (madness), the child was able to infer a complex emotional state that accurately reflects the inner experience of a victim. This demonstrates the success of the system's design in using abstract representation to create a rich canvas for interpretation, allowing children to engage their imaginative and metaphorical thinking to deepen their empathic reflection.

8.7 Discussion

8.7.1 Evaluating Pedagogical Outcomes

Qualitative evidence from this study suggests REMind supported meaningful engagement and learning across all pre-deteremined learning objectives. Here we review the observed pedagogical outcomes in light of the seven learning goals.

Goal 1. Identifying Bullying

The main mechanism for reinforcing this goal was the Bully-Detector prop. Of the first 13 participants, only 2 participants demonstrated increase in knowledge of bullying criteria (i.e., named criteria post-test that were not mentioned pre-test).

When P14 was about to interact with the Bully-Detector prop, a technical difficulty arose, causing the Joker to leave the player alone for a few minutes to troubleshoot the in the system[2]. As a result, P14 freely explored the interactive prop on their own. By the time

[2]Technical difficulties were improvisationally framed as a 'glitch' to not break the narrative immersion. This was explained to children during the debriefing.

the technical difficulty was resolved, the participant had tried to answer all three questions on their own (without AVATAR's input). We proceeded with phase 2 as previously planned, so they solved the puzzle again with help from the robot. During the post-test interview, we noticed that P14 easily recalled all three criteria. When their parent came to pick them up, they immediately wanted to show them the Bully-Detector.

Inspired by this observation, we decided to adjust this game module for the remainder of the participants (total of 5 out of 18) by letting them explore the device on their own before jumping to conversation with AVATAR. Among them, 4 participants perfectly recalled all criteria, and the last person mentioned the buttons on the Bully-Detector but struggled with recalling the questions. We will revisit this decision and the implications for scientific rigor in the next chapter.

Goal 2. Practicing Intervention Strategies

All participants willingly finished the two-hour game experience and produced learning evidence by recording a gesture for Puppet Mode. Furthermore, 14 out of 18 participants named at least one new intervention strategy post-test (i.e., one of the choices introduced in the game), with one participant specifically stating " I would say exactly what I told $< RobotName >$ to say" [P7].

Goal 3. Understanding Outcomes of Defending

Outcome expectations related to the bully showed a significant reduction in the distance from the target (50/100) for the bully-related item ($p = .003$), indicating player expectations aligned with the narrative model of partial success (sometimes the bully stops, sometimes they retaliate). The increase in victim-related outcome expectation was not significant; however, it was also not deviate much from the target value pre-test. We did not quantitatively probe children's outcome-expectations related to the defender's peer status.

Goal 4. Cultivating Empathy and Compassion

Qualitative observations on perspective-taking shows that 94% of participants reported feeling sad for the victim immediately after the bullying scene. Also, the latent thematic analysis of the empathy training module reveals qualitative evidence suggesting that most children demonstrated meaningful engagement with cognitive and affective perspective-taking.

Goal 5. Exposing Bully's Motivation

Qualitative observations on participants' reflections on FUSE's motivation revealed that 38% of children correctly identified the bully's motive as seeking social dominance, power, or attention, and an additional 27% attributed it to the bully's personal struggles or emotional state. This data was collected before the AVATAR explicitly communicated the expert-informed reasoning about the underlying need for power.

Goal 6. Challenging Misperception of the Norms

As suggested by the qualitative observations on interpreting the glitch, 7 out of 18 children (39%) demonstrated understanding that it represented the misperception of norms. Appendix G shows an exit ticket by a participants that responded to "What stuck with my robot today" by writing "when you stand up for someone people like you more" [P16].

Goal 7. Reflecting on Self-Efficacy

Quantitative findings on perceived self-efficacy showed a significant increase from pre-test ($M = 39.2$) to post-test ($M = 53.9$) with a medium-to-large effect size. Also, qualitative observations on bystander inaction also suggested that over half of the children (55%) initially attributed the avatar's inaction to low skills or confidence. Furthermore, all participants produced evidence for reflection on perceived self-efficacy by improvising a response when they encouraged the AVATAR to believe in itself (to resolve the "low self-confidence" error).

In addition, 12 out of 18 participants participated in the collective debriefing study. Among those, at least 4 participants told the group that they stood up to a bully in real-life in the days that followed the gameplay.

8.7.2 Use of Prop-Based Narrative Mechanics

Participants in this study enjoyed interacting with the prop-based narrartive mechanics. This was reflected in the exit-tickets where finding and use game props (keys, buttons, etc.) was indicated by the participants as the second most "fun" thing in the game (closely following Puppet Mode). The buttons, as mentioned in the previous section, allowed participants to understand the overall functions of the narrative mechanics. This was evidence through participants pre-emptively interacting with buttons they had used before, for example, finding and pressing the simulate button the next time the robot was ready for simulation (see Fig. 8.10).

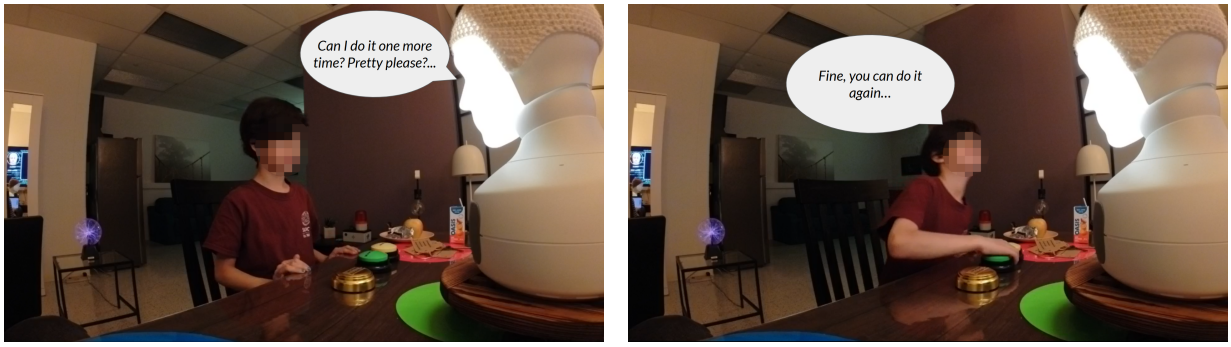


Figure 8.10: Player interaction in REMind demonstrating a participant pre-emptively pressing game buttons.

The "Bully-Detector" prop also piqued the interest of participants, wherein they were forced to ponder on the factors of bullying. One such evidence was seen where a participant was going through the factors posed by the prop, one by one, and found that the buzzer was not going off with just one of the switches (factors) selected [P14].

There was also evidence that props prompted some participants to reflect on abstract concepts. For example, one participant reflected the power of bullies by sharing a reflection with the joker that you can take power away a bully's power by no longer listening to them, and added, *"I like to imagine the bully starting to shrink" [sic]* [P13], as they were interacting with the prop.

8.7.3 Importance of Technical Rehearsals for Wizard-Joker Coordination

The Technical Rehearsals described in the previous chapter were very useful for wizard-joker coordination. During these sessions, the joker and the wizard developed their own language for working together, and helped complete the StorySync wizarding tools to fit that language. For example, we invented a theatre-inspired cue language between the joker and the wizard by color-coding two buttons for the wizard. The dynamic buttons on the wizarding interface typically included instructions (e.g., wait for player reaction). By color-coding these buttons, we distinguished ones that could be clicked on as soon as the timing was right, from buttons that required the wizard to take another action before proceeding (e.g., make sure robot gaze is direct towards player). This improve the cognitive load on the wizard.

Examples of cues used between the joker and the wizard include wizarding commands embedded in the script that asked the wizard to wait until a specific gesture (thumbs up) or phrase is used by the joker directed towards the robot. Also, in case of a technical difficulty in the room that was not visible from the wizarding station (e.g., robot's gaze being misdirected), the joker communicated by the wizard by putting their hand on ORACLE and giving instructions (e.g., "hey oracle, AVATAR is glitching, help the robot look at the player"). This enabled us to troubleshoot a range of problems without breaking the dramatic immersion.

Sometimes cues from the joker may be missed and the wizard may have to move on without them (e.g. waiting for a thumbs up but the joker is busy organizing something else, like the questionnaire on their laptop or debugging puppet mode). Thus, is is important for the wizard and joker to rehearse sufficiently to building a reasonable understanding of one another's intentions.

Outside of scripted sections, the wizard could improvise to make the robot appear more responsive by using a one-off gestures (such as a smile or nod). However, not many participants created scenarios where highly-customized reactions were needed, especially because of the Joker's role in facilitation, who would jump in to handle unscripted interactions.

Also, during the technical rehearsal sessions, we realized the importance of providing the wizard with a tight line-by-line control over the script. Prior to that StorySync would organize narrative based on acts. This way, if technical difficulty came up, the wizard would be able to navigate to the same point in the script, without needing to repeat larger chunks of the gameplay.

Finally, during tech rehearsal sessions, we developed a procedure for starting the game, which involved setting up the avatar robot as server, connecting the other robots as clients, loading characters on FUSE and JITTER, and setting the gaze directions of all three characters so that whenever one of the speaks, the other robots turn their gaze towards the speaking robot.

8.7.4 Towards Long-term Real-World Deployment

To enable real-world adoption, future work must explore and mitigate the practical barriers for long-term deployment of such systems in educational setting. In facilitating REMind, we argue that the role of the joker should not be automated. Joker plays a key facilitator role in Forum Theatre [43] by guiding reflection and encouraing participation. In real-world use, a drama educator may take the joker role; as REMind is meant to augment, not replace, educators. The wizard however, controls the narrative flow and their role

should be fully automated. Future work could explore simplified teacher-facing interfaces (e.g., clicker-based story progression) and the use of pre-trained large language models (LLMs) to support light narrative branching and dialogue handling. Also, future work should work with educators to identify other barriers, functional needs, and opportunities for deployment in educational settings.

8.7.5 Ethical Considerations

In this project, a design concern was whether nudging children to "feel others' pain" might be emotionally harmful to them. We posed this concern to expert psychologists. They emphasized that while empathy may lead to uncomfortable feelings, this is not inherently harmful as, "we cannot protect young people from all possible negative feelings." Instead, they stressed focusing on teaching compassion— turning empathy into helpful action to alleviate the suffering of another. REMind was designed with this objective. The Joker monitored children for signs of discomfort, and while children reflected on the emotions of victims of bullying, we did not observe any discomfort that we deemed as cause for concern.

Importantly, we were transparent about the make-believe nature of the experience, explicitly framing the experience as pretend-play. In Theory of Make-Believe, Kendal Walton explains that fiction arises not from deception, but from mutual agreement: props and scenarios invite participants to engage imaginatively, within clearly defined boundaries [379]. We believe this aligns with the principles of applied drama, which use fictional scenarios as safe spaces for reflecting on real-world challenges without risking the real-world harm that typically accompanies them.

8.7.6 Limitations and Future Work

While our findings offer insights into the design and evaluation of robot-mediated, drama-based anti-bullying interventions, the study is subject to several limitations that constrain the generalizability and interpretability of the results.

First, the study design privileged experiential richness and participant responsiveness over strict experimental control. Aspects of the intervention, such as the two-person facilitation protocol, use of improvisation by Joker, and interactions with props — were intentionally kept flexible to accommodate participant engagement, self-reflection and pedagogical flow. While this approach is consistent with the ethos of applied drama and human-centered design, it introduces variability that limits reproducibility and makes it difficult to

isolate the causal effects of specific design elements. As such, outcomes observed, such as increased peer reflection or empathic engagement, cannot be straightforwardly attributed to any one system component.

Furthermore, embedding the researcher in the facilitation of the sessions introduced limitations. Although it enabled a closer reading of children's affective and narrative responses, it also raises the possibility of researcher bias, particularly in the qualitative interpretation of children's actions and verbalizations. Although we tried to mitigate this, for example by allowing children to directly respond to scale-based questionnaire items and conducting inter-coder reliability testing, we strongly believe that future studies would benefit from incorporating independent observers to strengthen analytic validity.

Another limitation is the absence of long-term follow-up. The current study captures immediate reactions and reflective responses during or shortly after the intervention, but does not assess whether these experiences translate into durable learning or behavior change. Without longitudinal data, it remains unclear whether the intervention has sustained effects on children's attitudes toward bullying or their real-world bystander behavior. Moreover, conducting group debriefing sessions meant that when players came together, the time between the individual playtesting sessions and the debriefing sessions varied for participants which introduced more limitations. Follow-up assessments would be necessary to evaluate the long-term impact of this form of social robot–mediated pedagogy.

Finally, this study did not include a control or comparison group. While REMind was designed as a novel alternative to traditional anti-bullying programs, we did not empirically compare it to existing interventions, such as video-based instruction, or non-robotic role-playing games. As a result, we cannot claim superiority or unique efficacy of the robotic system over other pedagogical approaches. Future work should incorporate comparative conditions to better understand the specific contributions of the robot, narrative framing, and drama-based elements to children's learning and engagement.

8.8 Chapter Summary

This chapter details the playtesting study conducted to evaluate REMind with 18 children (ages 9–10) in a two-hour, single-player session, facilitated by a two-person research team operating a Wizard-of-Oz protocol: the Wizard (hidden technical operator) and the Joker (in-room applied drama facilitator). The chapter first outlines the immersive player experience, structured around a five-phase narrative arc that mirrors the cognitive steps of bystander intervention. This setup allowed researchers to collect pre-, post-, and mid-test

data on critical learning outcomes, including perceived self-efficacy, empathy, and knowledge of defending strategies.

The quantitative results of the study demonstrated the game's success in key areas, showing a statistically significant increase in children's perceived self-efficacy for defending and a shift in their outcome expectations regarding the bully to align with the model presented by the game's narrative of partial success. Furthermore, qualitative observations provided evidence of meaningful engagement with game modules: nearly all participants articulated affective empathy for the victim, and many demonstrated meaningful reflection on bystander inaction and the bully's motivations. Also, 39% of children accurately interpreted the game's central metaphor, "The Glitch," as representing the misperception of social norms (the idea that bullying is sustained by peers mistakenly believing that others approve of the behavior).

The next chapter will draw on lessons learned from this study to reflect on the delicate balance between maintaining scientific rigor and leveraging the adaptive, experiential pedagogy of human facilitation, among other things.

ACKNOWLEDGMENT I thank experts at the Centre for Spectatorship and Audience Research (CSAR) the University of Toronto for their valuable feedback on incorporating the role of the Joker, and conducting collective debriefing sessions.

Chapter 9

A Reflection on RMAD: Towards Systems Thinking and Experience Design in HRI

The primary contribution of this dissertation is **Robot-Mediated Applied Drama (RMAD)**, a novel pedagogical approach that leverages interactive drama practices with social robots to support experiential learning. In this framework, participants observe, reflect on, and intervene in dramatized social scenarios enacted by robots, allowing for the practice of situated learning within a psychologically safe environment.

Previous chapters have traced an iterative design journey to address the pervasive social challenge of peer bullying, specifically focusing on the mobilization of the passive bystander. Through the development and evaluation of **REMind**, as a proof-of-concept prototype system for RMAD, we have explored how social robots can serve as emotionally resonant proxies for embodied situated learning. The findings from REMind playtesting demonstrate that children meaningfully engaged with the robotic avatar to rehearse intervention strategies, resulting in improvements in all seven pre-determined learning goals, including a statistically significant increase in perceived self-efficacy for defending victimized peers, after a single experience (i.e., a two-hour single-player gameplay).

This chapter can be read not only as a reflection on a single system, but as a methodological contribution situated within **Research through Design (RtD)** [397], a research approach in which tacit knowledge is generated through the iterative design, enactment, and reflection on artifacts, treating design itself as a primary mode of inquiry rather than as a means to test predefined hypotheses. Rather than optimizing a fixed intervention or testing a narrow hypothesis, REMind was developed and evaluated as a design probe into how

RMAD experiences might support complex **Social-Emotional Learning (SEL)**. Viewed through this lens, the contributions of REMind extend beyond the empirical outcomes of a single playtesting study.

Within this framing, this dissertation makes three primary contributions. First, it introduces RMAD as a novel pedagogical approach that leverages social robots to support experiential and embodied learning in complex social domains. Second, it presents REMind, an innovative proof-of-concept system that instantiates RMAD and demonstrates how social robots, narrative framing, and human facilitation can be integrated to support SEL. Third, it articulates and reflects on the design-led inquiry, process, rationale, and evaluation of both the approach and the system, offering methodological insight into how such experiential, robot-mediated learning environments can be responsibly designed and studied.

The remainder of this chapter reflects on these contributions through a broader methodological and design-oriented lens. We first reflect on the tensions surfaced by the REMind study between scientific rigor and experiential pedagogy, and consider what these tensions reveal about shifting from reductionist approaches to interaction design toward systems thinking and experience design in the field of **Human–Robot Interaction (HRI)**. We then abstract from the REMind system to identify reusable design patterns and principles that may inform the design of future RMAD experiences. Finally, the chapter situates the contributions of REMind within the RtD framing, using a set of evaluation lenses established in the literature [397] to articulate the broader significance of this work.

9.1 Scientific Rigor VS Experiential Pedagogy

In designing and evaluating REMind, we found ourselves continuously negotiating between two different modes of inquiry: the logic of scientific rigor and the ethos of experiential pedagogy. By surfacing this tension explicitly, we argue that evaluating RMAD as a socially situated, robot-mediated learning experiences requires methodological frameworks that can accommodate both interpretive richness and empirical accountability.

This tension manifested most vividly in moments when design decisions had to be made that would either support the player's learning experience or uphold methodological purity. One such moment is the example of the Bully-Detector module described in Section 8.7.1 of the pervious Chapter. Early participants interacted with the Bully-Detector device only after AVATAR prompted them with clues. However, following a technical delay that left one participant to explore the device freely, we observed a deeper engagement with the intended learning goal (recalling the criteria for identifying bullying). Inspired by this, we

adjusted the facilitation protocol for future sessions to allow self-driven exploration first. This was an interventionist move that undeniably compromised experimental consistency, but arguably enhanced pedagogical value. This decision typifies a broader principle we adopted: to bend the protocol in service of learning goals, rather than bend learning to fit the stiff protocol.

This might be seen, from a traditional empirical standpoint, as a methodological "sin." Yet, for the facilitation team, it was a necessary act of pedagogical care.

9.1.1 The Myth of Reproducibility

Much of behavioral science aspires to reproducibility. But in embodied, dramatic, human-mediated interactions (especially long sessions involving children) reproducibility is a mirage. In the REMind playtesting study, each session was different: each child brought a different mood, history with bullying, and temperament. The Joker's role was to improvise and the improvisations changed, the timing of wizarded responses varied based on how talkative or quiet the children were, and at certain sessions we had to deal with unpredictable technical difficulties (e.g., the GUI disappearing). These variabilities are not design flaws to be eliminated, but fundamental characteristics of the experiential medium we chose to work with: robot-mediated, dramatic, child-centered system.

Still, this does not mean rigor was abandoned or deemed irrelevant. Rigor, in this work, did not mean uniformity or control, but instead it meant reflexive awareness of all the human and non-human elements that caused variations. Rigor in this work meant taking children's input seriously and involving them at every step of the design process, involving their educators in the process, and doing our best to follow the evidence-based and research-informed best practices in hopes that this pedagogical tool would yield learning in a child that would make an actual difference one day. So, rather than treating rigor as a checklist, we understand it as a posture of care: toward method, toward evidence, and toward participants.

9.1.2 Maximalist Pedagogy vs. Minimalist Experimentation

We argue that pedagogy, especially when grounded in applied drama, is a maximalist art. The teacher (in this case, the Joker) uses every tool in the toolbox to reach the learner: props, narrative metaphors, embodied interaction, direct questioning, and improvisation. The aim is not to isolate variables but to truly serve the pedagogical goals of the design: orchestrate an experience that opens up moral reflection and insight. This contrasts with

the logic of minimalist experimentation, where researchers must subtract, isolate, and control every variable in the lab (or at least pretend they did). While this approach is vital for certain kinds of questions, we contend it is insufficient for capturing the kinds of meaning-making at the heart of interventions like REMind.

We could have run a between-groups comparison: a full version vs. a limited, less interactive version. But to do so would have meant depriving one group of children of a richer, more empathic, more imaginative experience - and for what? To satisfy an epistemology that does not recognize the full complexity of the intervention? As the designer of REMind, I chose not to do that, and when I think about the serious and long-term consequences of peer bullying that motivated this dissertation, I do not regret this choice.

Could someone reproduce our exact sessions? No. Could they reproduce the game logic, the dramatic structure, the core narrative arcs and pedagogical affordances? Absolutely. Could they learn from our process, replicate our mechanisms, and improve them? We hope so. This is the rigor we stand by: one that makes meaning visible, treats learning as sacred, and lets the creative teacher stretch the system in service of the child—not the other way around.

In completing this work, I have come to see rigor not as the absence of uncertainty but as a disciplined way of living with it; and scientific integrity, not as strict compliance to protocol, but honesty in the claims, care in the design process, and openness in the reflections. Academic rigor as I have come to understand it in completing this PhD in Systems Design asks that creativity remain accountable, and that imagination submit itself to verification without losing its spark.

9.1.3 Why a Design-Led Research Framing Is Needed

The playtesting study presented in Chapter 8 reveals a tension that is difficult to fully account for using conventional experimental frameworks alone. On one hand, the study demonstrates meaningful engagement, reflection, and short-term learning outcomes among children. On the other hand, many of the design decisions that appeared pedagogically important (such as flexible facilitation, improvisation, and responsiveness to children's emotional states) introduced variability that complicates reproducibility, causal isolation, and standard notions of experimental rigor. Framed strictly as limitations, these characteristics risk obscuring what the study is able to show about how learning unfolds in socially situated, robot-mediated experiences.

This tension points to a broader challenge in human–robot interaction research: when

interactive systems are designed not merely to deliver information, but to support experiential learning, moral rehearsal, or meaning-making, their effects cannot be fully understood by treating the system as a fixed stimulus and the user as a passive subject. In such cases, the experience emerges through the interaction between the designed system, the human facilitators, and the participants themselves. Variability is not incidental, but an inherent feature of how the system functions in practice.

RtD offers a useful frame for reasoning about this kind of work. Rather than asking only whether a system "works" under controlled conditions, RtD treats the design and enactment of interactive artifacts as a way of investigating possibilities, tensions, and trade-offs in how technology can shape experience. From this perspective, designed systems are not only objects of evaluation, but instruments for inquiry: they make certain questions visible, surface constraints, and reveal how theoretical ideas play out when embedded in real interactions. This frame allows the methodological choices made in REMind, particularly those that prioritize experiential pedagogy, to be understood not simply as compromises, but as integral to the kind of knowledge the work seeks to produce.

9.2 Towards Experience Design in HRI

The traditional paradigm in HRI research has predominantly been *reductionist*. Reductionism is rooted in ideas of Rene Descartes and Isaac Newton [107, 262], who viewed the universe as a collection of machines that can be decomposed into their individual components. While this approach has been central to scientific inquiry since the 17th century, it does not fully capture the complexities of real-world interactions, where isolated factors rarely determine the outcome. In the real world, organisms are treated as holistic entities, and humans interact with each other naturally, without compartmentalizing their responses or stimuli. For instance, researchers exploring communication between dogs and owners do not restrict the pets to a single mode of communication. Similarly, behavioral psychology experiments allow confederates to engage with participants authentically and holistically. HRI research should embrace this same complexity to avoid oversimplifying and misrepresenting real-world interactions.

In contrast to reductionism, **Systems Thinking** views entities as networks of interdependent, interrelated, and **interconnected parts** that create **meta-stable wholes** that are **more than the sum of their parts**. In the context of HRI, adopting a systems lens means understanding that every component of the HRI system — from the robot's design features such as communicative cues and interactive affordances, to the environmental variables and the person's pre-existing mental models — collectively shape the emergent

user experience. When multiple communicative features are combined, we are no longer designing an isolated interaction; we are crafting a **whole experience** that transcends the sum of the individual parts, including isolated robot features. Even seemingly peripheral elements, such as minor technical difficulties in a tightly controlled lab or ambient noise in a real-world setting, contribute to the overall perception of the user. From a systems perspective, the robot does not exist in isolation, it is enmeshed in its social context. The robot and the environment it is embedded in coalesce into a dynamic, unified system that shapes user experience in ways irreducible to any hardware or behavioral component.

A key concept in systems thinking is *emergence*: the appearance of properties or behaviors in a system that its individual components do not possess [162, 326]. An anecdotal example in HRI is documented in reporting a recent study by Mott et al. [260] that showed robots significantly reducing children's anxiety and pain. The authors attribute this success not just to the robots' functional design, but to what they called *"the playful magic of the interaction."* This phrase exemplifies emergence in HRI: a synergistic interplay between robot, child, and the ludic interaction space that gives rise to inter-elemental effects that transcend the individual elements, creating an experience perceived by the child as "magical."

We argue that experience is not a byproduct of interaction, but the primary emergent property of the HRI system. Therefore, we believe that a promising future direction for social robotics lies in designing holistic experiences rather than isolated behaviors. add better transition plz

9.2.1 Understanding Systems

Borrowing from Sellers [326], we define systems as sets of interdependent *parts* that interact through feedback *loops* to produce a persistent, organized *whole*. Importantly, this whole exhibits properties and behaviors that are not found in any of the individual parts. This phenomenon is known as *emergence* [326]: the appearance of new system-level effects that result from the interactions among parts and are not present in the parts themselves. For example, a water molecule (H_2O) possesses properties such as fluidity, surface tension, and wetness—none of which are present in individual hydrogen and oxygen atoms.

The parts within a system, whether they are atoms in a molecule, birds in a flock, or agents in a multi-agent interactive experience, are interconnected. Their behavior is decentralized, yet coordinated in a way that contributes to the system as a whole. Each part has an internal state, a boundary, and a set of behaviors:

1. **Internal State** of a part is typically understood as a combination of attributes, each

holding a specific value at a given moment. In systems design, such states are often simplified to "spreadsheet specific" [326] name–value pairs (e.g., a robot's operational mode being set to "listening").

2. **Boundary** of a part is not necessarily physical but is defined in relation to the network of interactions in which it is embedded. If a part's behavior influences the behavior of the higher-level system, it is considered to fall within that system's boundary. For instance, a robot's gaze is considered within its boundary because modifying gaze parameters alters the robot's overall behavior.

3. **Behaviors** of a part enable it to interact with other parts by exchanging information or resources, and potentially altering their internal states. For example, a robot's camera may detect a human approaching, pass the coordinates of the person to the internal control system which may trigger the actuators in its neck to turn its head in the appropriate direction. This physical shift may then update the human's mental model of the robot's situational awareness, leading them to conclude, 'the robot noticed me.'

Based on this definition, we argue that **Human-Robot Interaction (HRI)** should be viewed as a system: the human, and the machine, are *parts*; their interaction creates *loops* between them; and as such, they form a *whole*. What emerges from this system, is the user *experience*. This user experience, which takes place in the mind of the human, transcends the sum of the technical specifications of the robot, and the human's inner state (e.g., their pre-existing mental models of robots).

9.2.2 Understanding the HRI Experience as Emergence

This dissertation argues that the emergent property of the HRI system is precisely the user's subjective holistic experience. That is, the interpretations, emotional responses, and mental models that arise from the dynamic coupling between the human and the robot and the feedback loops of their interaction — a system that is inherently embedded within a social context. That is to say, even non-social robots are arguably to be considered social — unless they operate without any real human interaction.

Borrowing from systems theory, systems are inherently dynamic: they cannot be fully understood by examining their parts in isolation or by freezing them in time [326]. Building on this, and the understanding of systems discussed in Section 9.2.1, we argue that an HRI system should be viewed not as a closed mathematical equation frozen in time, but an open, dynamic, and adaptive loop:

$$\text{System} = \{\text{Human}\} + \{\text{Robot}\} + \{\text{Loops of HRI}\}$$

This systemic feedback loop unfolds as follows:

1. The **Robot** acts on its programming and sensors, producing actuator outputs.
2. The **Human** perceives these outputs, and their internal cognitive/emotional systems are forced to interpret them. This processing generates the emergent Experience (such as, trust, anxiety, understanding), potentially modifying their mental model of the robot.
3. The **Experience** then becomes a new input that the human's subsequent action (a command, a withdrawal, a gesture), which is no longer based on their initial mental state, but on the new, emergent state created by the interaction.

Thus, the emergent experience becomes the **accumulative** result of the constant, iterative feedback loops between the human's actions, the robot's responses, and the human's subsequent interpretation and mental model adjustment.

In psychology, **Theory of Mind (ToM)** is the human cognitive ability to attribute mental states (such as beliefs, intents, desires, emotions, knowledge) to oneself and to others, and to understand that others have mental states that are different from one's own [290]. Applying ToM allows you to predict your friend will be happy if you bring them coffee because you attribute the desire for coffee to them. When a human interacts with a robot (an artifact that moves autonomously, speaks, or responds in a seemingly goal-directed way) their highly-evolved ToM mechanism is automatically activated. When the human starts asking questions like, "Why did the robot stop? Was it confused? Is it waiting for me? Is it offended," they do not treat the robot merely as a tool (like a hammer); they treat it as an agent. By projecting human-like qualities onto the robot, the human is applying ToM. This application of ToM onto the robot, situated within the open dynamic loop of HRI, is arguably where the emergence happens.

Therefore, we argue that the emergent experience may result from the system-level validation (or invalidation) of the human's projected ToM. For example, the experience of *trust* emerges not only from the robot's technical specs, but from the robot's actions consistently aligning with the human's attributed intent yielding the psychological confirmation that their social models are effective in predicting the robot's behavior.

If experience is the emergent property of an HRI system, then designing HRI becomes less about specifying isolated interactions and more about deliberately structuring the system that gives rise to that experience.

9.2.3 Game Design As A Systems Tool for Experience Design

Due to the inherent complexity and interactivity of systems, their effective design and analysis requires contextualized, experiential engagement. Seller articulates this point by contending that systems must be experienced to be fully understood and designing engaging games is "by far the best way to experience and understand systems" [326]. In this way, game design should be understood as the process of shaping experiences through systems. In this sense, game design offers not a metaphor for HRI, but a concrete design practice for organizing parts, feedback loops, and goals to deliberately shape emergent experience.

Games function as complex ecosystems where representational tokens, rules, and player decisions come together to create synergistic whole experiences. Game design involves constructing interconnected parts and feedback loops that produce a cohesive whole, which is not the game object itself but the experience the system enables [326]. Building on this concept, we propose Game Design as a gateway to moving towards systems thinking and experience design in HRI.

Understanding Games as Systems

Since Johan Huizinga, the Dutch historian, examined play as a crucial component of culture in his influential book *Homo Ludens* [168], numerous scholars have attempted to define games. Sellers [326] reviews a selection of these definitions in his book on Advanced Game Design, from which we extract the following 4 defining characteristics of games that we deem most relevant to HRI:

1. **Well-Defined Boundaries**: Games exist within their own special world or interaction space, separate from the everyday world (e.g., arena, card table). This *magic circle* is where "special rules obtain" [168].

2. **Tokens and Rules**: Games may be modeled as dynamic resource networks that employ tokens as representations of objects or entities within the game world, and rules that operate on them.

3. **Goals and Outcomes**: Games possess clear objectives or goals that players strive to achieve. These goals drive player actions and lead to recognizable valorization of outcomes or conclusions.

4. **Active Participation**: Games are interactive, requiring active engagement from the player. Games demand player input and decision-making to unfold the experience. In this way, games can be understood as *"a series of interesting choices."* [305].

Applying Game Design Beyond Entertainment-Oriented Robotics

The usefulness of Game Design for shaping HRI experiences is not limited to entertainment-oriented robots, but is a broader framework applicable across diverse robotic applications. For applying the definition above to a typical HRI experience, let's consider a care robot employed as a delivery system in a hospital setting. The robot's interactions would be confined to designated pathways within the hospital, allowing for safe and efficient navigation; that is, the interaction exists within certain pre-defined **Boundaries**. The **Tokens** in this scenario could include items like the badges nurses use for scanning, the goods the robot delivers, or door openers that need to be activated along the delivery path. An example of a **Rule** governing these tokens is that the robot's secure compartment will only open upon scanning the correct receipt badge at the delivery destination. Nurses utilizing the robot have a clear **Goal** for each delivery task, and successful completion or failure of the delivery constitutes a recognizable **Outcome**. Finally, **Active Participation** from the nurses is required to load items onto the robot, specify the delivery destination, or receive the delivered item.

If we acknowledge HRI as a system, and the user experience as the emergent component of this system, then it can be argued that game design may be understood as a systems thinking lens to **organize the components of an HRI experience**. In line with this view, this dissertation has demonstrated that the players' experience of REMind was not merely the result of a single interaction with the robot, but the emergent property of a system where mechanics, narrative, aesthetics, and technology were purposefully aligned with pedagogical goals.

9.2.4 A Paradigm Shift for HRI Design: From Reductionism to Systems Thinking

This perspective challenges HRI designers to shift their focus. If we adopt a systems-thinking lens, we can no longer design and evaluate robot behavior by considering only their discrete interaction capabilities (such as its gaze, speech, or gestural behavior) in isolation. Instead, we must design for the emergent whole: the user experience as it is dynamically constructed through interaction.

In practice, this means expanding the scope of design beyond the robot itself to include the full interactional ecosystem: the physical environment, the social setting, the user's prior experiences, and the temporal unfolding of interaction. Embracing this systems-oriented approach moves HRI toward experience-centered design, where the focus is on cultivating emergent phenomena — not merely assembling features.

Thomas Kuhn, in his seminal work on *The Structure of Scientific Revolutions* [216] argues that a scientific revolution occurs when: (a) the new paradigm emerges that explains the observations better and offers a model closer to the objective reality; and (b) the new paradigm renders the way the old paradigm saw the world "incommensurable". We argue that going from a reductionist lens to a systems lens in HRI research would characterize such a paradigm shift. There, this dissertation advocates for a paradigm shift in HRI from *reductionism* to *systems thinking*, moving from *interaction design* to *experience design.*

9.3 Towards Design Patterns for RMAD Experiences

The development and evaluation of REMind as a proof-of-concept demonstrated the feasibility and promise of RMAD as a pedagogical tool for experiential learning. We argue that designing an RMAD intervention like REMind is akin to building a theatrical stage rather than just a tool. While a tool is designed for efficiency and a single function, a stage provides the constraints and "props" that allow a participant to step into a new role and safely explore a different reality.

As an instantiation of RMAD, REMind is a deliberately crafted pedagogical system that combines embodied social simulation and interactive storytelling to facilitate **Theory of Mind (ToM)** activation. In RMAD, such a pedagogical process is scaffolded through unique robot affordances that go beyond analogue puppets, and virtual agents confined to a 2D screen.

We argue that RMAD may be used to facilitate several psychological processes central to SEL. This includes cognitive perspective-taking in complex social situations, fostering empathy through story-driven reflection, and embodied rehearsal through using improvisation techniques for robot pupeteering. In this way, RMAD can support SEL by engaging learners in social dilemmas that resist easy answers, and providing a hypothetical and safe simulation space that allows experimentation and graceful failure.

In REMind, the learning task is organized as a Robot Role-Play Games (RPG). Doing so required deliberate alignment of the pleasures of robot role-play games (identified in Chapter 6) with a set of SEL objectives (outlined in Chapter 7). As a result of this process, REMind introduced a suite of interaction mechanics and narrative design patterns, such as affective interpretation and robot-mediated spect-actorship (see Chapter 7) that scaffold experiential learning of specific SEL skills, such as empathy and perspective-taking. Such skills are generalizable beyond the immediate domain of peer bullying, and may be used to support a diverse range of SEL applications. To do so, REMind game modules may be analyzed for capturing reusable subsystems that can be synthesize into a prescriptive library

of **Reusable Experience Design Patterns for RMAD**. Consider, as an example, a Conflict Resolution scenario where a player must mediate a misunderstanding between two robots, requiring them to accurately assess the mixed emotions of both parties from the perspective of one another. Using Conflict Resolution as a testbed, future work can explore the extent to which specific RMAD design patterns (e.g., affective interpretation of ambient audio-visual cues) could be generalizable to other domains of SEL.

Importantly, while REMind was a single-player experience, many applied drama practices are inherently collaborative. Such a library of patterns should be extended beyond the REMind prototype to accommodate for group-based interactions. Translating these practices into RMAD will require novel mechanics for group interaction, negotiation, and shared decision-making. Below, we discuss a few examples of reusable patterns of experience design for RMAD.

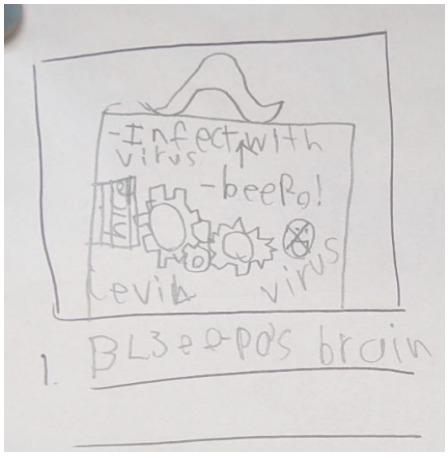
9.3.1 Revealing Invisible Mental States with the Robot Metaphor

One of the most pedagogically promising aspects of the REMind experience was the use of the robot as a metaphorical device for externalizing internal mental states. This technique unlocked new ways for learners to reason about emotions, intentions, and perspectives, which are core competencies in ToM [290].

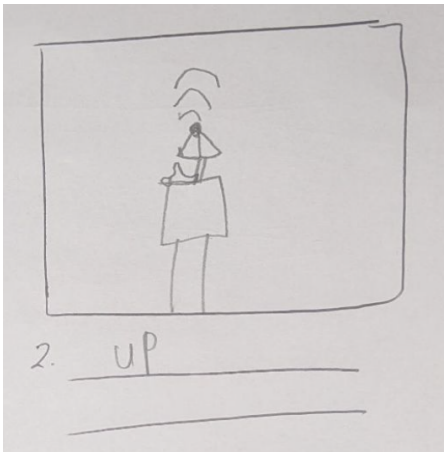
Here, one reusable pattern is the idea of **visualizing a robot's "mind"**. This concept originated from a storyboard drawn by one of the participants in the narrative co-design study with children (Chapter 4) who created a storyboard visualizing a bully robot whose brain contained an "evil virus," alongside the phrase "nice" locked in jail, and a central command to "infect" another robot (see 9.1). The participant extended this metaphor over a sequence of storyboards: the bully robot infected another robot by uploading the virus into its mind, the victim robot visited a doctor who resolved the problem, this resulted in a "repaired" brain where the "virus" is locked away behind bars and a central command reads "be kind". These depictions offer a compelling example of how the robot metaphor may be used to render the typically invisible internal social-emotional states and processes legible and interactive.

This conceptual device was carried into REMind's design, where the game GUI visualized aspects of the robots' "mind," such as its thought bubbles — allowing players to reason about invisible mental contents by making them visible via the unique **Metaphoric Affordances** of the robot.

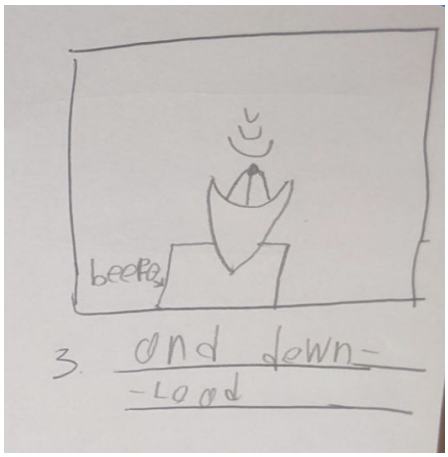
This design choice seemed to catalyze moments of rupture in some participants. For example, in one session, a 9 year old received the in-game "Perspective Taker" badge.



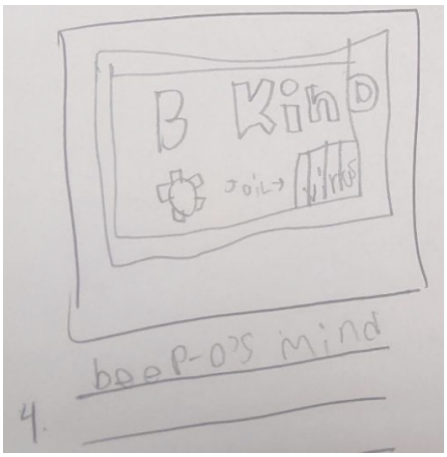
(a) "[Bully robot] BL3ee-po's brain" is depicted as a box containing: two viruses, the word "nice" in jail, a happy emoji crossed out, and a central command that reads "Infect bleepo [robot] with evil virus".



(b) BL3ee-po, the bully robot, uploads the virus.



(c) The virus uploaded by Bl3ee-po is "downloaded" by the other robot, Beepo.



(d) After a doctor's visit, in "Beep-o's brain": the word "virus" is behind the bars, and a central message reads: "B[e] Kind".

Figure 9.1: The idea of visualizing robots' minds on a GUI was inspired by storyboards drawn by children in previous co-design studies.

Prompted by the unfamiliar word, they asked the Joker what "perspective" meant. The

joker explained by using the game module they had just completed (i.e., guessing JITTER's thoughts) as an example. After a brief moment of reflection, the child pointed their finger above their head and said: *"Imagine there is a bubble above your head, and it's like what you're thinking." [sic]* This metaphor, possibly facilitated by the robot thought bubbles displayed on the game interface, reveals how the design scaffolded ToM (see Figure 9.2).



Figure 9.2: Participant reflects on the meaning of "perspective" by likening it to an imaginary "bubble above your head" that makes your thoughts visible.

In this way **the robot metaphor is like a prism**: a prism does not create light, it refracts light; and in doing so, allows us to see the individual parts that are invisible as a whole. Likewise, a social robot does not create "mind" — but the metaphor it offers can refract the mind we project onto it: we can "show" the robot mind. The ability to treat abstract cognitive concepts of characters (such as desire, intent, belief), as visualizable, manipulable system states, is a unique metaphoric affordance of the artifact that designers can use to scaffold more complex SEL.

9.3.2 Containers & Tokens as Embodied Metaphor

REMind features several mechanics that use embodied interaction with tangible tokens within containers to represent flow of abstract social resources — for example, players took away "bully's power" (represented by lightning bolt charms) by emptying out a "power-box" that belong to the bully robot, and discovered that avatar robot's "heart-meter" has filled up with heart-shaped tokens (representing peer status). We argue that this mechanic has immense potential as a reusable interaction design pattern.

Lakoff and Johnson, in their seminal book *Metaphors We Live By* [220], propose that metaphors are not just figures of speech, but fundamental building blocks of human cog-

nition. They explain that "container" is a basic cognitive model that human brain uses to make sense of metaphors [220]. That is, we speak about abstract things (like emotions, relationships, or the self) as if they were physical containers — for example, when we say "he is in a bad mood", the mood is conceptualized as a container. We argue that what makes using containers as imaginative models of abstract concepts powerful is that they tap into the core of how the human brain understands metaphors, which has interesting implications for embodied interaction design.

A parallel insight comes from systems thinking in game design. Adams and Dormans, in their influential work on *Game Mechanics, Advanced Game Design* [7] explain that the*Machinations* framework (widely adopted for simulating system dynamics), is driven by the theoretical vision that "gameplay is ultimately determined by the flow of tangible, intangible, and abstract resources through the game system" [7]. Exemplifying this, the container props in REMind transform *invisible* abstract social metrics (such as peer status) into *visible* system states. Embodied interaction with these props changes these system states, thereby representing the flow of abstract social resources.

As the joker of the REMind playtesting sessions, I observed some of the deepest reflections from the participants in this study organized by the most basic of props, such as the 'power box' —— Of all the questions that the joker asked in this study, this was the question that got children to *visibly* reflect: *"In this game, you took the power away from the bully by taking these charms out of that box. In real life, bullies don't have power-boxes, but they hold power. So, how might we take away a bully's power in real life?"* What made a simple prop like power-box useful was not technological glamour. It was embodied interaction with a symbolic prop-based metaphor embedded strategically within a narrative.

To generalize this as a reusable design pattern, we can consider several key interaction parameters that modulate meaning. The following list is not exhaustive, but illustrates the kinds of variables designers can tune to produce distinct effects:

1. **Semantic Representation**: The tokens can represent different abstract values — status, confidence, empathy, attention — shaping the metaphor's narrative and emotional resonance.

2. **Flow Direction**: Tokens may be added to or removed from containers, signaling accumulation or loss (e.g., extracting power vs. gaining peer support), or be traded for other tokens.

3. **Flow Causality**: Changes can be player-driven (agentive) or system-revealed (discovered), which affects perceived agency and narrative meaning.

4. **Ownership and Access**: Containers may belong to the player or to another character, and tokens may be manipulated with or without permission from that character (e.g., taking excess power from a bully vs. observing changes in avatar).

By tuning these interaction parameters, designers can create a diverse range of embodied metaphors without relying on technological complexity. Instead, meaning emerges through narrative framing and embodied interaction. By embedding the system state changes into embodied interactions with physical props, we bridge abstract system modeling with the active, dramatic engagement of applied drama practices, specifically strengthening the cognitive ability to reason about the underlying, non-observable elements of social interaction. This positions containers and tokens as a powerful, low-tech grammar and a reusable design pattern for experiential learning in RMAD.

9.3.3 Cognitive Scaffolding of the Experiential Learning Journey

In using RMAD to support experiential learning, the player practices 'learning by teaching' by being positioned in the role of a mentor who guides an avatar robot as it navigates a Core Problem. The RMAD experience is structured in three chunks: first the social situation related to the core problem is simulated; then the player is guided through step-wise problem-solving; and finally, they see the outcome of their choices.

In case of REMind, the core problem of interest was bystander inaction in peer bullying situations. Following the RMAD structure, the problem was simulated via a three-robot dramatization of a believable peer-bullying scenario. Then, the problem-solving steps were simulated by using Latane & Darley's five-step model of bystander intervention [222] as a **cognitive scaffold**. And finally, once the player solves the problem (by puppeteering an intervention using the robotic avatar) they observe the narrative outcomes which are modeled based on the three outcomes of bystander intervention which we determined in consultation with subject-matter experts (see Section 7.2 in Chapter 7). If the REMind prototype is to be adapted to target a different core problem related to SEL — the gameplay may be cognitively structured by believably simulating the core problem, identifying a research-informed model that describes the cognitive steps of solving that core problem, and appending it with another model that describes the narrative outcomes of solving that core problem.

By mapping the cognitive structure of an RMAD experience based the experiential learning journey, many other design patterns from REMind can be easily translated to new pedagogical domains. Below, we describe three reusable RMAD design patterns that can complement this form of narrative-based cognitive scaffolding.

Embodied Rehearsal with Robot-Mediated Spect-Actorship

In REMind, the 'Puppet Mode' enables players to puppeteer a robotic avatar by rehearsing bystander intervention as if they are the character. This interaction draws from Augusto Boal's concept of the "spect-actor" [43]: an audience member who steps into a dramatic scene to explore transformative action. Puppet Mode in REMind is robot-mediated spect-actorship. The robot becomes both a mirror assisting player's social-emotional reasoning, and a proxy that allows them to enact and externalize social-emotional decisions. This mechanic introduces a reusable pattern of Robot-Mediated Spect-Actorship: players rehearse social decision-making by controlling a tangible, animated proxy within an unfolding dramatic context. Crucially, this is not passive observation or abstract choice-making; it is physicalized, affectively rich, and narratively situated action.

Robot puppeteering creates a unique learning dynamic: players must model a robot's mental state, rehearse a moral decision from a distanced perspective, and observe its social consequences. This triadic loop—*simulate, act, reflect*—is rooted in both developmental psychology and applied drama, and has powerful potential as a pedagogical tool for fostering moral reasoning and empathy.

While role-playing and perspective-taking are common in applied drama, the addition of a robot performer introduces new dimensions of objectivity, repeatability, and reflective distancing. In functioning as mediators of social learning, robotic characters are akin to puppets, but they offer several distinct advantages. Unlike puppets, which are clearly understood as extensions of a human facilitator, robots are perceived as having more autonomy, even when they are controlled by a human operator. This perceived autonomy supports more authentic social modeling and allows learners to treat the robot as a *quasi-social other*, rather than a symbolic tool. Whereas puppets tend to exaggerate affect for legibility, robots may rely on more ambient and multimodal cues (e.g., speech, GUI, facial expressions and other non-verbal gestures), inviting audience to engage in more nuanced affective interpretation and TOM reasoning. Robots can also support re-enactment and reflective practice by replaying a person's input — enabling *self-as-other* learning that puppets cannot replicate without manual intervention. Finally, the technological infrastructure of robots allows for system-level synchronization of branching narratives, complex timing, and multimodal feedback across channels — something puppets alone cannot achieve. Taken together, these differences suggest that while robots may be used as technological puppets that afford the expressive immediacy for richer scaffolding of complex, embodied, and narrative-driven SEL experiences — enabling rehearsal of moral action without the social cost of failure.

Modeling Reasoning with Logic-Gate Puzzles

Finally, the Bully-Detector mechanic in REMind uses a 3-way AND gate to create a tangible prop for practicing moral reasoning about bullying. This can be reframed as a general pattern for teaching multi-criteria reasoning using logic-gate puzzles. This structure is highly flexible: logic gates (AND, OR, NOT, etc.) can be used to create abstract models for virtually any logical decision-making process.

Framing Internal Conflict as Debuggable System Errors

By presenting internal social-cognitive challenges as literal system errors, and cognitive and affective perspective-taking elements as *NULL* values in the robot's mental model that a player must address, REMind transforms abstract internal states into tangible, solvable obstacles. This mechanical framing provides the player with a clear mandate to debug the avatar's flawed social reasoning, directly aligning the core interaction loop with the established learning objective of overcoming cognitive hurdles to moral action. Moreover, the recurrence of these errors supports an episodic narrative structure that mirrors real-life experiences of navigating a socio-emotional challenge. The player's repeated encounters with breakdown and repair offer opportunities for moral reflection, perspective-taking, and rehearsal of pro-social actions.

9.4 REMind as an RtD Contribution

Evaluating RtD is inherently challenging, as the knowledge it produces is often implicit in the designed artifact and the experiences it enables, rather than expressed solely through formal hypotheses or generalizable results. Prior work has noted difficulties in formalizing RtD contributions, including the lack of standardized evaluation criteria, the situated and tacit nature of design knowledge, and the challenge of documenting insights that emerge through practice rather than controlled experimentation [398]. To address this, Zimmerman, Forlizzi, and Evenson [397] propose a set of criteria, as four lenses, for evaluating an interaction design research contribution: Process, Invention, Relevance, and Extensibility. These lenses provide a useful framework for articulating the contributions of REMind beyond traditional empirical metrics.

First, **Process** examines the rigor applied to research methods, the rationale behind choosing them, as well as their documentation. Because RtD involves subjective design judgments, the expectation is not that another researcher following the same process will

produce the exact same artifact; rather, the documentation must be sufficiently detailed so that the community can follow and reproduce the underlying process. This work contributes at the level of *process* by explicitly documenting an iterative sequence of design studies that provide a rigorous rationale for the final artifact, which involved: a crowdsourced feasibility study establishing that observers perceive aggression toward robots as morally wrong, validating their use as pedagogical proxies; a character & narrative co-design study with children that helped identify storytelling patterns and preferences for emotionally expressive robot characters; a series of semi-structured interviews with teachers to ensure the design addressed classroom realities and gaps in existing anti-bullying programs; focus groups with children that help identify 28 elements of "fun" specifically for robot role-play games, ensuring the intervention would be engaging; and expert consultations that grounded the learning goals and facilitation protocols in evidence-based practices through consultation with subject-matter experts; and finally, a series of technical rehearsal sessions involving a theater director, wizard , joker, and pilot testers which were used for co-development, refinement, and affective-tuning of the REMind experience. While reproducibility in the strict scientific sense is admittedly a mirage due to the subjective nature of RMAD experiences, the documentation of the RtD process is exhaustive, making it possible for the community to follow the same design research steps, or reuse the insights generated along the way.

Second, **Invention** concerns the novelty and insight embodied in the artifact. A successful RtD contribution must constitute a significant invention that advances the current state of the art, demonstrating a novel integration of various subject-matters to address a specific situation. In applying this lens, an RtD contribution should provide "technical opportunities" for engineers by showing how nearly possible technologies could be integrated to benefit the world. This dissertation contributes a significant *invention* by introducing the RMAD framework, which integrates Augusto Boal's Forum Theatre [43] with Social Robotics and Game-Based Learning, and advances the state of the art through providing a systemic blueprint of the REMind system as a proof-of-concept for RMAD. This dissertation presents a concrete set of novel game mechanics, details narrative elements and structure, and overviews challenges for technological implementation and aesthetics refinement that unique to the RMAD medium and provides possible workarounds. Additionally, the set of narrative mechanics introduced in REMind, present interaction rituals that combine imaginative play with tangible interaction with simple physical props (e.g., Access-Cloud), which represent a novel integration of nearly possible technologies that can be synthesized with existing IoT platforms to create immersive embodied narrative systems that may serve as an engaging learning environment.

Third, **Relevance**, addresses the artifact's ability to transition a situation toward

a "preferred state". In this research, the preferred state is articulated as where peer bystanders transition from passive observers to active defenders who take prosocial action against bullying. The playtesting study presented in this dissertation demonstrated this transition by documenting improvements across seven pre-determined learning goals. Quantitatively, participants showed a statistically significant 37.5% increase in perceived self-efficacy for defending; they also significantly shifted their outcome expectations regarding bully's reaction to match what was modeled by the narrative. Qualitatively, the system fostered deep emotional engagement, with 94% of participants expressing affective empathy for the victim; 14 out of 18 children naming new intervention strategies they had not previously identified; and 4 generating evidence of learning the three criteria for identifying bullying post-intervention. Also, 39% of children accurately interpreted the "Glitch" metaphor as the complex SEL concept of misperception of peer norms (i.e., the idea that people dislike bullying but stay silent because they mistakenly think others approve). Finally, every single participant generated evidence of embodied practice of bystander intervention skills (via using the Puppet Mode); and out of the 12 children who participated in the collective debriefing study, 4 told the group that they stood up to a bully in real-life following the REMind experience. By achieving these multi-dimensional gains, REMind proves its relevance as a "social laboratory" that aims to bridge the gap between passive disapproval and empowered prosocial action.

Finally, *Extensibility*, which considers how the knowledge produced can be understood, reused, or built upon by the broader community. This work is documented as a theoretical and practical foundation intended to be leveraged by the broader research community. This chapter identifies specific reusable design patterns generalizable to using RMAD in other areas of SEL. Designing RMAD experiences present unique engineering challenges: unlike video games where all elements are virtual, or live theatre where actors adapt on the fly, robots are embodied agents with limited improvisational ability. They cannot dynamically interpret unscripted interaction, autonomously synchronize, or improvise social and emotional nuance. Therefore, scripting must not only manage synchronization of multimodal cues, but also anticipate variability in human interaction and scaffold semi-guided responsiveness. While tools exist for scripting game narrative (e.g., Articy Draft [336]) and multimodal theatrical cues (e.g., QLab [5]), there are no publicly available tools for scripting robot Role-playing Games. This dissertation also contributes StorySync: an innovative spreadsheet-based tool developed for rapid-prototyping of REMind, which enables pupeteering an entire embodied narrative system (multiples robots, GUI, lights, and sound) in sync by using a robot as a centralized server. StorySync toolkit can serve as a blueprint for a modular authoring toolkit that bridges multimodal ambient cues ('a la theatre), narrative branching logic ('a la games), and hardware-specific robot choreography, demonstrating technological opportunities for designers to rapidly prototype interactive

and embodied storytelling systems.

Viewed through this lens, the contributions of REMind extend beyond the empirical outcomes of a single playtesting study. Taken together, these contributions position REMind not only as a functional protoype, but as a design-led inquiry into how embedding social robots in RMAD experiences might support experiential learning in complex social-emotional domains. From an RtD perspective, the value of this work lies in its integration of theory, technology, and practice, and in the insights it provides for future researchers seeking to design, study, and reflect on socially situated human–robot interactions.

9.5 Conclusion

This dissertation presented the iterative design, development, and evaluation of REMind: A Robot Role-Playing Game To Promote Bystander Intervention, a novel intervention that employs Robot-Mediated Applied Drama (RMAD) to support prosocial action against peer bullying. Drawing on Augusto Boal's Forum Theatre [43], REMind invited children to take on the role of "spect-actors" who engage in reflexive, embodied rehearsal of intervention strategies. This work employed a Research through Design (RtD) methodology to iteratively investigate the feasibility, design requirements, and pedagogical efficacy of robot-mediated role-play in anti-bullying education. A series of interlinked studies scaffolded the design of REMind. First, a foundational feasibility study demonstrated that people perceive mistreatment of robots as morally wrong, validating the potential for robots to serve as believable, yet emotionally buffered, proxies for bullied characters. Through co-design studies with children, and analyzing the patterns in stories they created, we found that they envision robot characters as highly customizable, imperfect, and emotionally expressive characters capable of assuming roles such as bully, victim, or bystander. Furthermore, interviews with local teachers confirmed the critical need for relatable, modern anti-bullying interventions that reduce teacher workload, and are relatable to children. To ensure the educational game was effective, it was crucial that it also be fun. By conducting focus groups with children and analyzing the patterns in their game design concepts, we identified a framework of key pleasures children sought in robot role-play games.

Integrating insights from this iterative design process, REMind system is structured around five interdependent elements: Learning Goals, Mechanics, Narrative, Technology, and Aesthetics. The Learning Goals, derived from consultations with subject-matter experts (i.e., psychologists and educators), guide the design of all four game elements toward seven specific learning objectives. Mechanics include a suite of unique interaction patterns like "Puppet Mode" for robot-mediated spect-actorship and the "Bully-Detector" prop for

moral reasoning, forming the game's rule-based structure. The Narrative is scaffolded by the bystander intervention model and uses core metaphors like "The Glitch" (representing misperception of norms) to drive the plot in accordance with the learning goals. The Technology enables authoring and deploying the multi-agent multi-robot interactive storytelling experience by using a custom spreadsheet-based scripting toolkit, StorySync, which coordinates the entire experience via a two-person human-in-the-loop facilitation protocol. Finally, the Aesthetics utilize multi-modal affective displays (e.g., ambient light and music cues) and use various techniques to enhance the emotional design of the experience. We evaluated REMind through a playtesting study with children aged 9–10. Quantitative data indicated a significant increase in children's perceived self-efficacy for bystander intervention, while qualitative responses revealed meaningful engagement with social-emotional learning constructs such as empathy, perspective-taking and misperception of the norms.

Beyond the immediate application of anti-bullying education, this research makes a broader contribution to the field of HRI. It argues for a shift in HRI research toward adopting systems thinking and moving from interaction design to designing holistic experiences. In this context, game design serves not only as a methodological tool but also as a conceptual framework for shaping experiences through systems. Ultimately, this dissertation contributes by introducing a theoretical framework for Robot-Mediated Applied Drama (RMAD), and presenting the REMind system as a high-fidelity prototype and a proof-of-concept that showed promising empirical results in using HRI for experiential learning in the context of peer bullying.

References

[1] FearNot Software.

[2] KiVa games – for revision and practising. \url{https://newzealand.kivaprogram.net/kiva-games/}.

[3] VICTEC - Virtual ICT with Empathic Characters.

[4] School Crime Supplement. Technical report, National Center for Education Statistics and Bureau of Justice Statistics, US Department of Education, 2011.

[5] Figure 53. QLab (multimedia / show control software), 2025.

[6] Acapela Group. Voice Smileys. Acapela Group Website.

[7] Ernest Adams and Joris Dormans. *Game mechanics: advanced game design*. New Riders, 2012.

[8] Eliza Ahmed. Stop it, that's enough: Bystander intervention and its relationship to school connectedness and shame management. *Vulnerable Children and Youth Studies*, 3(3):203–213, 12 2008.

[9] Samer Al Moubayed, Jonas Beskow, Gabriel Skantze, and Björn Granström. Furhat: a back-projected human-like robot head for multiparty human-machine interaction. In *Cognitive Behavioural Systems: COST 2102 International Training School, Dresden, Germany, February 21-26, 2011, Revised Selected Papers*, pages 114–130. Springer, 2012.

[10] Irene Alcubilla Troughton, Kim Baraka, Koen Hindriks, and Maaike Bleeker. Robotic Improvisers: Rule-Based Improvisation and Emergent Behaviour in HRI. In *Proceedings of the 2022 ACM/IEEE International Conference on Human-Robot Interaction*, pages 561–569, 2022.

[11] Patricia Alves-Oliveira, Patricia Arriaga, Ana Paiva, and Guy Hoffman. Yolo, a robot for creativity: A co-design study with children. In *Proceedings of the 2017 Conference on Interaction Design and Children*, pages 423–429, 2017.

[12] Amazon Mechanical Turk. Amazon Mechanical Turk, 2023.

[13] Christopher Andersen. Learning in "as-if" worlds: Cognition in drama in education. *Theory into Practice*, 43(4):281–286, 2004.

[14] Henrik Andershed, Margaret Kerr, and Håkan Stattin. Bullying in school and violence on the streets: Are the same people involved? *Journal of Scandinavian Studies in Criminology and Crime Prevention*, 2(1):31–49, 2001.

[15] Julian M Angel-Fernandez and Markus Vincze. Introducing storytelling to educational robotic activities. In *2018 IEEE Global Engineering Education Conference (EDUCON)*, pages 608–615. IEEE, 2018.

[16] Luca Argenton, Esther Schek, and Fabrizia Mantovani. Serious games as positive technologies. In *International Conference on Virtual, Augmented and Mixed Reality*, pages 169–177. Springer, 2014.

[17] Lindsey Arnold, Kung Jin Lee, and Jason C Yip. Co-designing with children: An approach to social robot design. *ACM Human-Robot Interaction (HRI)*, 2016.

[18] Hamna Aslam and Joseph Alexander Brown. Affordance theory in game design: a guide toward understanding players. *Synthesis Lectures on Games and Computational Intelligence*, 4(1):1–111, 2020.

[19] Ruth Aylett. Education through Characters with emotional-Intelligence and Role-playing Capabilities that Understand Social interaction. Technical report, 2005.

[20] Ruth Aylett, Marco Vala, Pedro Sequeira, and Ana Paiva. Fearnot!–an emergent narrative approach to virtual dramas for anti-bullying education. In *International Conference on Virtual Storytelling*, pages 202–205. Springer, 2007.

[21] Ruth S Aylett, Sandy Louchart, Joao Dias, Ana Paiva, and Marco Vala. FearNot!–an experiment in emergent narrative. In *International Workshop on Intelligent Virtual Agents*, pages 305–316. Springer, 2005.

[22] Hyunin Baek, Viviana Andreescu, and Shawn M Rolfe. Bullying and fear of victimization: Do supportive adults in school make a difference in adolescents' perceptions of safety? *Journal of school violence*, 18(1):92–106, 2019.

[23] Rene Baker. Puppets and objects–medium and mediator. *Moving in!*, page 103, 2012.

[24] Albert Bandura. Moral disengagement in the perpetration of inhumanities. *Personality and social psychology review*, 3(3):193–209, 1999.

[25] Alex Barco, Jordi Albo-Canals, and Carles Garriga. Engagement based on a customization of an iPod-LEGO robot for a long-term interaction for an educational purpose. In *9th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 124–125. IEEE, 2014.

[26] Jaclyn Barnes, S Maryam FakhrHosseini, Eric Vasey, Chung Hyuk Park, and Myounghoon Jeon. Child-robot theater: Engaging elementary students in informal STEAM education using robots. *IEEE Pervasive Computing*, 19(1):22–31, 2020.

[27] Christoph Bartneck and Jun Hu. Exploring the abuse of robots. *Interaction Studies*, 9(3):415–433, 2008.

[28] Christoph Bartneck and Merel Keijsers. The morality of abusing a robot. *Paladyn*, 11(1):271–283, 2020.

[29] Sheri Bauman. The role of elementary school counselors in reducing school bullying. *The Elementary School Journal*, 108(5):362–375, 2008.

[30] Sheri Bauman, Russell B. Toomey, and Jenny L. Walker. Associations among bullying, cyberbullying, and suicide in high school students. *Journal of Adolescence*, 36(2):341–350, 4 2013.

[31] Andrew V Beale. Bullybusters: Using drama to empower students to take a stand against bullying behavior. *Professional School Counseling*, 4(4):300, 2001.

[32] Tony Belpaeme, James Kennedy, Aditi Ramachandran, Brian Scassellati, and Fumihide Tanaka. Social robots for education: A review. *Science robotics*, 3(21), 2018.

[33] Tony Belpaeme and Fumihide Tanaka. Social robots as educators. In *OECD Digital Education Outlook 2021 Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots*, page 143. OECD Publishing Paris, 2021.

[34] Matthew Bernier and Judith O'Hare. *Puppetry in education and therapy: Unlocking doors to the mind and heart*. AuthorHouse, 2005.

[35] Cindy L. Bethel, Zachary Henkel, Kristen Stives, David C. May, Deborah K. Eakin, Melinda Pilkinton, Alexis Jones, and Megan Stubbs-Richardson. Using robots to interview children about bullying: Lessons learned from an exploratory study. In *2016 25th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, pages 712–717. IEEE, 8 2016.

[36] Foram Bhukhanwala. Theater of the Oppressed in an After-School Program: Middle School Students' Perspectives on Bullying and Prevention: This Article Examines Students' Participation in Boalian Theater Activities to Role-Play, Rehearse, and Develop Strategies to use When Bu. *Middle School Journal*, 46(1):3–12, 2014.

[37] Mriganka Biswas and John Christopher Murray. Towards an imperfect robot for long-term companionship: case studies using cognitive biases. In *2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 5978–5983. IEEE, 2015.

[38] Adam Blatner. Drama in education as mental hygiene: A child psychiatrist's perspective. *Youth Theatre Journal*, 9(1):92–96, 1995.

[39] Adam Blatner. Role playing in education. *Disponibile all'indirizzo: http://www. blatner. com/adam/pdntbk/rlplayedu. htm*, 2009.

[40] Adam Blatner and Allee Blatner. *The art of play: Helping adults reclaim imagination and spontaneity, Rev.* Brunner/Mazel, 1997.

[41] Benjamin S Bloom, Max D Engelhart, Edward J Furst, Walker H Hill, David R Krathwohl, and others. *Taxonomy of educational objectives: The classification of educational goals. Handbook 1: Cognitive domain.* Longman New York, 1956.

[42] Augusto Boal. Theatre of the Oppressed, trans. *Charles A. and Maria-Odilia Leal McBride (New York: Theatre Communications Group, 1985)*, 122, 1985.

[43] Augusto Boal. *Theater of the Oppressed.* Pluto press, 2000.

[44] Augusto Boal. *Games for actors and non-actors.* Psychology Press, 2002.

[45] Margaret Boden, Joanna Bryson, Darwin Caldwell, Kerstin Dautenhahn, Lilian Edwards, Sarah Kember, Paul Newman, Vivienne Parry, Geoff Pegman, Tom Rodden, and others. Principles of robotics: regulating robots in the real world. *Connection Science*, 29(2):124–129, 2017.

[46] Gunhild Borggreen. "Robots Cannot Lie": Performative Parasites of Robot-Human Theatre. In *Sociable Robots and the Future of Social Relations*, pages 157–163. IOS Press, 2014.

[47] Kris Bosworth, Dorothy Espelage, Tracy DuBay, Gary Daytner, and Kathryn Karageorge. Preliminary evaluation of a multimedia violence prevention program for adolescents. *American Journal of Health Behavior*, 24(4):268–280, 2000.

[48] Sarah Lynne Bowman. Educational live action role-playing games: A secondary literature review. *The Wyrd Con Companion Book*, 3:112–131, 2014.

[49] Sarah Lynne Bowman and Andreas Lieberoth. Psychology and role-playing games. In *Role-playing game studies*, pages 245–264. Routledge, 2018.

[50] Elizabeth Bradley, Glenn Albright, Jeremiah McMillan, and Kristen Shockley. Impact of a simulation on educator support of LGBTQ youth. *Journal of LGBT Youth*, 16(3):317–339, 2019.

[51] Boyd Branch, Piotr Mirowski, and Kory W Mathewson. Collaborative Storytelling with Human Actors and AI Narrators. *arXiv preprint arXiv:2109.14728*, 2021.

[52] Virginia Braun and Victoria Clarke. Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2):77–101, 2006.

[53] Flor A Bravo, Alejandra M Gonzalez, and Enrique Gonzalez. Design of a multi-agent architecture for implementing educational drama techniques using robot actors. In *International Conference in Methodologies and intelligent Systems for Techhnology Enhanced Learning*, pages 172–180. Springer, 2018.

[54] Flor Angela Bravo Sanchez, Alejandra Maria Gonzalez Correal, and Enrique Gonzalez Guerrero. Interactive drama with robots for teaching non-technical subjects. *Journal of Human-Robot Interaction*, 6(2):48–69, 2017.

[55] Cynthia Breazeal, Andrew Brooks, Jesse Gray, Matt Hancher, Cory Kidd, John McBean, Dan Stiehl, and Joshua Strickon. Interactive robot theatre. In *Proceedings 2003 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2003)(Cat. No. 03CH37453)*, volume 4, pages 3648–3655. IEEE, 2003.

[56] Cynthia Breazeal, Kerstin Dautenhahn, and Takayuki Kanda. Social robotics. In *Springer handbook of robotics*, pages 1935–1972. Springer, 2016.

[57] Jeffrey S Brenneman. Aligning Game Narrative and Learning Outcomes. *Meaningful Play*, 2022.

[58] Elizabeth Ann Brewer. *Fighting fire with fire: The use of a multimedia webquest in increasing middle-school students' understandings of cyberbullying.* 2011.

[59] Dražen Brščić, Hiroyuki Kidokoro, Yoshitaka Suehiro, and Takayuki Kanda. Escaping from children's abuse of social robots. In *Proceedings of the tenth annual acm/ieee international conference on human-robot interaction*, pages 59–66, 2015.

[60] Allison Bruce, Jonathan Knight, Samuel Listopad, Brian Magerko, and Illah R Nourbakhsh. Robot improv: Using drama to create believable agents. In *Proceedings 2000 ICRA. Millennium Conference. IEEE International Conference on Robotics and Automation. Symposia Proceedings (Cat. No. 00CH37065)*, volume 4, pages 4002–4008. IEEE, 2000.

[61] Richard Buchanan. Wicked problems in design thinking. *Design issues*, 8(2):5–21, 1992.

[62] Bruce Burton and John O'Toole. Power in their hands: The outcomes of the acting against bullying research project. *Applied Theatre Researcher/IDEA Journal*, 10:1–15, 2009.

[63] Roger Caillois. *Man, play, and games.* University of Illinois press, 2001.

[64] Antonio Calvo-Morata, Cristina Alonso-Fernández, Manuel Freire, Iván Martínez-Ortiz, and Baltasar Fernández-Manjón. Serious games to prevent and detect bullying and cyberbullying: A systematic serious games and literature review. *Computers and Education*, 157(July), 2020.

[65] Antonio Calvo-Morata, Manuel Freire-Morán, Iván Mart\'\inez-Ortiz, and Baltasar Fernández-Manjón. Applicability of a cyberbullying videogame as a teacher tool: Comparing teachers and educational sciences students. *IEEE Access*, 7:55841–55850, 2019.

[66] Joseph Campbell. *The hero's journey: Joseph Campbell on his life and work*, volume 7. New World Library, 2003.

[67] Karel Capek. *RUR (Rossum's universal robots).* Penguin, 2004.

[68] Kristin Carbone-Lopez, Finn-Aage Esbensen, and Bradley T. Brick. Correlates and Consequences of Peer Victimization: Gender Differences in Direct and Indirect Forms of Bullying. *Youth Violence and Juvenile Justice*, 8(4):332–350, 10 2010.

[69] José Alberto Carmona, Moisés Esp\'\inola, Adolfo J Cangas, and Luis Iribarne. Mii School: new 3D technologies applied in education to detect drug abuses and bullying in adolescents. In *International Conference on Technology Enhanced Learning*, pages 65–72. Springer, 2010.

[70] James S Catterall. Enhancing peer conflict resolution skills through drama: An experimental study. *Research in drama education*, 12(2):163–178, 2007.

[71] Jessica R Cauchard, Kevin Y Zhai, Marco Spadafora, and James A Landay. Emotion encoding in human-drone interaction. In *2016 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 263–270. IEEE, 2016.

[72] Daphna Ben Chaim. Distance in the Theatre. *Ann Arbor, Mich.: UMI Research Press*, 1984.

[73] Amiy R Chatley, Kerstin Dautenhahn, Mick L Walters, Dag S Syrdal, and Bruce Christianson. Theatre as a discussion tool in human-robot interaction experiments-a pilot study. In *2010 Third International Conference on Advances in Computer-Human Interactions*, pages 73–78. IEEE, 2010.

[74] Gwo-Dong Chen, Tzu-Chun Hsu, and Mahesh Liyanawatta. Designing and implementing a robot in a digital theater for audience involved drama-based learning. In *International Conference on Innovative Technologies and Learning*, pages 122–131. Springer, 2018.

[75] R Alan Cheville. Linking capabilities to functionings: adapting narrative forms from role-playing games to education. *Higher Education*, 71(6):805–818, 2016.

[76] Takenobu Chikaraishi, Yuichiro Yoshikawa, Kohei Ogawa, Oriza Hirata, and Hiroshi Ishiguro. Creation and staging of android theatre "sayonara" towards developing highly human-like robots. *Future Internet*, 9(4):75, 2017.

[77] Fu-Yuan Chiu and Mei-Ling Hsieh. Role-playing game based assessment to fractional concept in second grade mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, 13(4):1075–1083, 2017.

[78] Henning Christiansen and Anja Lindelof. Robots on stage. *EAI Endorsed Transactions on Creative Technologies*, 7(25):167657, 2020.

[79] Volkan Cicek and Ozcan Palavan. Impact of Drama Education on the Self-Confidence and Problem Solving Skills of Students of Primary School Education. 2015.

[80] Valerio Cietto, Cristina Gena, Ilaria Lombardi, Claudio Mattutino, and Chiara Vaudano. Co-designing with kids an educational robot. In *2018 IEEE Workshop on Advanced Robotics and its Social Impacts (ARSO)*, pages 139–140. IEEE, 2018.

[81] E J Coats, R S Feldman, and P Philippot. The influence of television on children's nonverbal behavior. *The social context of nonverbal behavior*, pages 156–181, 1999.

[82] Robin Cohen, Disney Yan Lam, Nikhil Agarwal, Michael Cormier, Jasmeet Jagdev, Tianqi Jin, Madhur Kukreti, Jiawei Liu, Kamal Rahim, Rahul Rawat, and others. Using computer technology to address the problem of cyberbullying. *Acm Sigcas Computers and Society*, 44(2):52–61, 2014.

[83] E Katrinna Collins, Elizabeth M Alvarez, and Debra Elmore. *The Effectiveness of the STOPit Anti-Bullying Application*. PhD thesis, Lipscomb University, 2018.

[84] Robert W S Coulter, Jordan M Sang, William Louth-Marquez, Emmett R Henderson, Dorothy Espelage, Simon C Hunter, Matthew DeLucas, Kaleab Z Abebe, Elizabeth Miller, Brooke A Morrill, and others. Pilot testing the feasibility of a game intervention aimed at improving help seeking and coping among sexual and gender minority youth: protocol for a randomized controlled trial. *JMIR research protocols*, 8(2):e12164, 2019.

[85] Richard Courtney. *The dramatic curriculum*. Faculty of Education, University of Western Ontario London, Ontario, 1980.

[86] Andrew J Cowell and Kay M Stanney. Embodiment and interaction guidelines for designing credible, trustworthy embodied conversational agents. In *International workshop on intelligent virtual agents*, pages 301–309. Springer, 2003.

[87] Helen Cowie. Peer Support as an Intervention to Counteract School Bullying: Listen to the Children. *Children & Society*, 25(4):287–292, 7 2011.

[88] Helen Cowie. Understanding the Role of Bystanders and Peer Support in School Bullying. *International Journal of Emotional Education*, 6(1):26–32, 2014.

[89] Jeffrey Cox. The Parasite and the Puppet: Diderot's Neveu and Kleist's" Marionettentheater". *Comparative Literature*, 38(3):256–269, 1986.

[90] Laura M Crothers, Jered B Kolbert, and William F Barker. Middle school students' preferences for anti-bullying interventions. *School Psychology International*, 27(4):475–487, 2006.

[91] Mihaly Csikszentmihalyi and Mihaly Csikszentmihalyi. Toward a psychology of optimal experience. *Flow and the foundations of positive psychology: The collected works of Mihaly Csikszentmihalyi*, pages 209–226, 2014.

[92] Isabel Cuadrado-Gordillo. Repetition, power imbalance, and intentionality: Do these criteria conform to teenagers perception of bullying? A role-based analysis. *Journal of interpersonal violence*, 27(10):1889–1910, 2012.

[93] Catie Cuan, Ellen Pearlman, and A McWiliams. Output: translating robot and human movers across platforms in a sequentially improvised performance. In *Society for the Study of artificial Intelligence and Simulation of behavior convention.[Google Scholar]*, 2019.

[94] Charles E. Cunningham, Heather Rimas, Stephanie Mielko, Cailin Mapp, Lesley Cunningham, Don Buchanan, Tracy Vaillancourt, Yvonne Chen, Ken Deal, and Madalyn Marcus. What Limits the Effectiveness of Antibullying Programs? A Thematic Analysis of the Perspective of Teachers. *Journal of School Violence*, 15(4):460–482, 10 2016.

[95] Stéphane Daniau. The transformative potential of role-playing games—: From play skills to human skills. *Simulation \& Gaming*, 47(4):423–444, 2016.

[96] John M Darley and Bibb Latané. Bystander intervention in emergencies: Diffusion of responsibility. *Journal of personality and social psychology*, 8(4p1):377, 1968.

[97] Kate Darling. Extending legal protection to social robots: The effects of anthropomorphism, empathy, and violent behavior towards robotic objects. In *Robot law*. Edward Elgar Publishing, 2016.

[98] Aditya Das, Kris Doelling, H Sevil, and Julienne Greer. Robot theatre to boost excitement, engagement, and expression (e3) of STEM. 2018.

[99] Pooja Datta, Dewey Cornell, and Francis Huang. Aggressive attitudes and prevalence of bullying bystander behavior in middle school. *Psychology in the Schools*, 53(8):804–816, 2016.

[100] Kerstin Dautenhahn. The narrative intelligence hypothesis: In search of the transactional format of narratives in humans and other social animals. In *International Conference on Cognitive Technology*, pages 248–266. Springer, 2001.

[101] Kerstin Dautenhahn. Socially intelligent robots: dimensions of human–robot interaction. *Philosophical transactions of the royal society B: Biological sciences*, 362(1480):679–704, 2007.

[102] Judith Davidson. Embodied knowledge: Possibilities and constraints in arts education and curriculum. In *Knowing bodies, moving minds*, pages 197–212. Springer, 2004.

[103] Matthew DeCoursey. *Embodied Aesthetics in Drama Education: theatre, literature and philosophy*. Bloomsbury Publishing, 2018.

[104] Anna Dedousis-Wallace and Rosalyn H Shute. Indirect bullying: Predictors of teacher intervention, and outcome of a pilot educational presentation about impact on adolescent mental health. *Australian Journal of Educational \& Developmental Psychology*, 9:2–17, 2009.

[105] Daniel DeKerlegand, Ben Samuel, and Mike Treanor. Pedagogical challenges in social physics authoring. In *International Conference on Interactive Digital Storytelling*, pages 34–47. Springer, 2021.

[106] Astrid M der Pütten, Nicole C Krämer, Laura Hoffmann, Sabrina Sobieraj, and Sabrina C Eimler. An experimental study on emotional reactions towards a robot. *International Journal of Social Robotics*, 5(1):17–34, 2013.

[107] René Descartes. *Discourse on the Method*, volume 570. Newcomb Livraria Press, 1912.

[108] Design Sprint Kit - Google. Crazy 8's.

[109] Ann DeSmet, Sara Bastiaensens, Katrien Van Cleemput, Karolien Poels, Heidi Vandebosch, Gie Deboutte, Laura Herrewijn, Steven Malliet, Sara Pabian, Frederik Van Broeckhoven, and others. The efficacy of the Friendly Attac serious digital game to promote prosocial bystander behavior in cyberbullying among young adolescents: a cluster-randomized controlled trial. *Computers in Human Behavior*, 78:336–347, 2018.

[110] John Dewey. Art as experience. In *Anthropology of the Arts*, pages 37–45. Routledge, 2024.

[111] Lucy Diep, John-John Cabibihan, and Gregor Wolbring. Social robots: Views of special education teachers. In *Proceedings of the 3rd 2015 Workshop on ICTs for Improving Patients Rehabilitation Research Techniques*, pages 160–163, 2015.

[112] Timo Dietrich, Jakob Trischler, Lisa Schuster, and Sharyn Rundle-Thiele. Co-designing services with vulnerable consumers. *Journal of Service Theory and Practice*, 2017.

[113] Dominic DiFranzo, Samuel Hardman Taylor, Franccesca Kazerooni, Olivia D Wherry, and Natalya N Bazarova. Upstanding by design: Bystander intervention in cyberbullying. In *Proceedings of the 2018 CHI conference on human factors in computing systems*, pages 1–12, 2018.

[114] Joana Dimas, Iolanda Leite, André Pereira, Pedro Cuba, Rui Prada, and Ana Paiva. Pervasive pleo: long-term attachment with artificial pets. In *Mobile HCI*, 2010.

[115] Karthik Dinakar, Birago Jones, Catherine Havasi, Henry Lieberman, and Rosalind Picard. Common sense reasoning for detection, prevention, and mitigation of cyberbullying. *ACM Transactions on Interactive Intelligent Systems (TiiS)*, 2(3):1–30, 2012.

[116] Allison Druin. The role of children in the design of new technology. *Behaviour and information technology*, 21(1):1–25, 2002.

[117] Allison Druin, Jamie Montemayor, Jim Hendler, Britt McAlister, Angela Boltman, Eric Fiterman, Aurelie Plaisant, Alex Kruskal, Hanne Olsen, Isabella Revett, and others. Designing PETS: A personal electronic teller of stories. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, pages 326–329, 1999.

[118] Teun Dubbelman. Narrative game mechanics. In *International Conference on Interactive Digital Storytelling*, pages 39–50. Springer, 2016.

[119] Paul Dwyer*. Making bodies talk in Forum Theatre. *Research in Drama Education*, 9(2):199–210, 2004.

[120] Paul Ekman. Emotions revealed. *Bmj*, 328(Suppl S5), 2004.

[121] Hebah ElGibreen, Sumayah Almazyad, Shahad Bin Shuail, Miad Al Qahtani, and Latifah ALhwiseen. Robot Framework for Anti-Bullying in Saudi Schools. In *2020 Fourth IEEE International Conference on Robotic Computing (IRC)*, pages 166–171. IEEE, 2020.

[122] Sibylle Enz, Carsten Zoll, Natalie Vannini, Wolfgang Schneider, Lynne Hall, Ana Paiva, and Ruth Aylett. e-Motional Learning in Primary Schools: FearNot! An Anti-Bullying Intervention Based on Virtual Role-Play with Intelligent Synthetic Characters. *Electronic Journal of e-Learning*, 6(2):111–118, 2008.

[123] Amir Erez and Alice M Isen. The influence of positive affect on the components of expectancy motivation. *Journal of Applied psychology*, 87(6):1055, 2002.

[124] Caroline B R Evans, Mark W Fraser, and Katie L Cotter. The effectiveness of school-based bullying prevention programs: A systematic review. *Aggression and Violent Behavior*, 19(5):532–544, 2014.

[125] Christopher J Ferguson, Claudia San Miguel, John C Kilburn Jr, and Patricia Sanchez. The effectiveness of school-based anti-bullying programs: A meta-analytic review. *Criminal Justice Review*, 32(4):401–414, 2007.

[126] Kerstin Fischer, Malte Jung, Lars Christian Jensen, and Maria Vanessa aus der Wieschen. Emotion expression in HRI–when and why. In *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 29–38. IEEE, 2019.

[127] Nikolaus Franke, Martin Schreier, and Ulrike Kaiser. The "I designed it myself" effect in mass customization. *Management science*, 56(1):125–140, 2010.

[128] Aduén Darriba Frederiks, Johanna Renny Octavia, Cesar Vandevelde, and Jelle Saldien. Towards participatory design of social robots. In *IFIP Conference on Human-Computer Interaction*, pages 527–535. Springer, 2019.

[129] Barbara L Fredrickson and Christine Branigan. Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition \& emotion*, 19(3):313–332, 2005.

[130] Christian Fron and Oliver Korn. A short history of the perception of robots and automata from antiquity to modern times. In *Social Robots: Technological, Societal and Ethical Aspects of Human-Robot Interaction*, pages 1–12. Springer, 2019.

[131] Furhat Robotics. The Furhat Library. \url{https://docs.furhat.io/library/}, 2025.

[132] Michael J Furlong, Alicia C Soliz, Jenne M Simental, and Jennifer L Greif. Bullying and abuse on school campuses. *Encyclopedia of applied psychology*, 1:295–301, 2004.

[133] Epic Games. Live Link Face. \url{https://dev.epicgames.com/documentation/en-us/unreal-engine/live-link-face-device}, 2024.

[134] Claire F Garandeau, Lydia Laninga-Wijnen, and Christina Salmivalli. Effects of the KiVa anti-bullying program on affective and cognitive empathy in children and adolescents. *Journal of Clinical Child \& Adolescent Psychology*, 51(4):515–529, 2022.

[135] Claire F Garandeau and Tessa A M Lansu. Why does decreased likeability not deter adolescent bullying perpetrators? *Aggressive behavior*, 45(3):348–359, 2019.

[136] Claire F Garandeau, Tiina Turunen, Silja Saarento-Zaprudin, and Christina Salmivalli. Effects of the KiVa anti-bullying program on defending behavior: Investigating individual-level mechanisms of change. *Journal of school psychology*, 99:101226, 2023.

[137] Pierre-Alexandre Garneau. Fourteen forms of fun, 2001.

[138] James Paul Gee. What video games have to teach us about learning and literacy. *Computers in entertainment (CIE)*, 1(1):20, 2003.

[139] Petra Gemeinboeck. The aesthetics of encounter: a relational-performative design approach to human-robot interaction. *Frontiers in Robotics and AI*, 7:217, 2021.

[140] Robert Gifford. A lens-mapping framework for understanding the encoding and decoding of interpersonal dispositions in nonverbal behavior. *Journal of personality and social psychology*, 66(2):398, 1994.

[141] Gianluca Gini and Tiziana Pozzoli. Association between bullying and psychosomatic problems: A meta-analysis. *Pediatrics*, 123(3):1059–1065, 2009.

[142] Jennifer L Goetz, Dacher Keltner, and Emiliana Simon-Thomas. Compassion: an evolutionary analysis and empirical review. *Psychological bulletin*, 136(3):351, 2010.

[143] Laurie J Goldsmith. Using Framework Analysis in Applied Qualitative Research. *Qualitative Report*, 26(6), 2021.

[144] John Goodwin, Stephen K Bradley, Peadar Donohoe, Katie Queen, Maev O'Shea, and Aine Horgan. Bullying in schools: an evaluation of the use of drama in bullying prevention. *Journal of Creativity in Mental Health*, 14(3):329–342, 2019.

[145] Jonathan Gratch and Stacy Marsella. Lessons from emotion psychology for the design of lifelike characters. *Applied Artificial Intelligence*, 19(3-4):215–233, 2005.

[146] Kelly N. Graves, James M. Frabutt, and Debra Vigliano. Teaching conflict resolution skills to middle and high school students through interactive drama and role play. *Journal of School Violence*, 6(4):57–79, 2007.

[147] H. M. Gray, K. Gray, and D. M. Wegner. Dimensions of Mind Perception. *Science*, 315(5812):619–619, 2 2007.

[148] Mona Leigh Guha, Allison Druin, and Jerry Alan Fails. Cooperative Inquiry revisited: Reflections of the past and guidelines for the future of intergenerational co-design. *International Journal of Child-Computer Interaction*, 1(1):14–23, 2013.

[149] Lynne Hall, Susan Jones, Ana Paiva, and Ruth Aylett. FearNot!: providing children with strategies to cope with bullying. In *Proceedings of the 8th International Conference on Interaction Design and Children*, pages 276–277. ACM, 2009.

[150] Nour Hammad, Elaheh Sanoubari, Patrick Finn, Sowmya Somanath, James E Young, and Ehud Sharlin. Mutation: leveraging performing arts practices in cyborg transitioning. In *Proceedings of the 2019 on Creativity and Cognition*, pages 53–59, 2019.

[151] Jessica Hammer, Alexandra To, Karen Schrier, Sarah Lynne Bowman, and Geoff Kaufman. Learning and role-playing games. In *Role-playing game studies*, pages 283–299. Routledge, 2018.

[152] Jeonghye Han and Dongho Kim. r-Learning services for elementary school students with a teaching assistant robot. In *2009 4th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 255–256. IEEE, 2009.

[153] Dilys Haner, Debra Pepler, Joanne Cummings, and Alice Rubin-Vaughan. The Role of Arts-Based Curricula in Bullying Prevention: Elijah's Kite—A Children's Opera. *Canadian Journal of School Psychology*, 25(1):55–69, 3 2010.

[154] Kendall Haven. *Story proof: The science behind the startling power of story*. Bloomsbury Publishing USA, 2007.

[155] Maud Hensums, Eddie Brummelman, Helle Larsen, Wouter van den Bos, and Geertjan Overbeek. Social goals and gains of adolescent bullying and aggression: A meta-analysis. *Developmental Review*, 68:101073, 2023.

[156] Sanna Herkama and Christina Salmivalli. KiVa antibullying program. In *Reducing cyberbullying in schools*, pages 125–134. Elsevier, 2018.

[157] Kieran Hicks, Kathrin Gerling, Patrick Dickinson, and Vero Vanden Abeele. Juicy game design: Understanding the impact of visual embellishments on player experience. In *Proceedings of the annual symposium on computer-human interaction in play*, pages 185–197, 2019.

[158] Masayuki Higashino, Tamami Imado, and Masashi Inoue. Design of a Computerized Educational System about Risks of Social Networking Services for Children. In

Proceedings of the 2019 2nd International Conference on Geoinformatics and Data Analysis, pages 89–92, 2019.

[159] Michelle J Hindin. Role theory. *The Blackwell encyclopedia of sociology*, 2007.

[160] John Hodgson and Ernest Richards. *Improvisation*, volume 224. Eyre Methuen, 1974.

[161] Guy Hoffman. On stage: robots as performers. In *RSS 2011 Workshop on Human-Robot Interaction: Perspectives and Contributions to Robotics from the Human Sciences. Los Angeles, CA*, volume 1, page 21, 2011.

[162] John H Holland. *Emergence: From chaos to order*. OUP Oxford, 2000.

[163] Karen Holtzblatt and Hugh Beyer. *Contextual design: defining customer-centered systems*. Elsevier, 1997.

[164] Karen Holtzblatt, Jessamyn Burns Wendell, and Shelley Wood. *Rapid contextual design: a how-to guide to key techniques for user-centered design*. Elsevier, 2004.

[165] Leigh Anne Howard. Speaking theatre/doing pedagogy: re-visiting theatre of the oppressed. *Communication Education*, 53(3):217–233, 2004.

[166] Suo Huang. Design and Development of Educational Robot Teaching Resources Using Artificial Intelligence Technology. *International Journal of Emerging Technologies in Learning*, 15(5), 2021.

[167] Gijs Huitsing, Gerine M A Lodder, Beau Oldenburg, Hannah L Schacter, Christina Salmivalli, Jaana Juvonen, and René Veenstra. The healthy context paradox: Victims' adjustment during an anti-bullying intervention. *Journal of Child and Family Studies*, 28:2499–2509, 2019.

[168] Johan Huizinga. *Homo ludens ils 86*. Routledge, 2014.

[169] Hsiao-Tzu Hung, Joann Ching, Seungheon Doh, Nabin Kim, Juhan Nam, and Yi-Hsuan Yang. EMOPIA: A multi-modal pop piano dataset for emotion recognition and emotion-based music generation. *arXiv preprint arXiv:2108.01374*, 2021.

[170] Robin Hunicke, Marc LeBlanc, and Robert Zubek. MDA: A formal approach to game design and game research. In *Proceedings of the AAAI Workshop on Challenges in Game AI*, volume 4, page 1722. San Jose, CA, 2004.

[171] Shelley Hymel, Natalie Rocke-Henderson, and Rina A Bonanno. Moral disengagement: A framework for understanding bullying among adolescents. *Journal of Social Sciences*, 8(1):1–11, 2005.

[172] Shelley Hymel and Susan M Swearer. Four decades of research on school bullying: An introduction. *American Psychologist*, 70(4):293, 2015.

[173] Apple Inc. ARKit. \url{https://developer.apple.com/augmented-reality/arkit/}, 2025.

[174] Q S R International. NVivo, 2025.

[175] Jenny Isaacs, Ernest V.E Hodges, and Christina Salmivalli. Long-term Consequences of Victimization by Peers: A Follow-up from Adolescence to Young Adulthood. *International Journal of Developmental Science*, 2(4):387–397, 2008.

[176] Katherine Isbister. *Better game characters by design: A psychological approach*. CRC Press, 2022.

[177] Alice M Isen, Kimberly A Daubman, and Gary P Nowicki. Positive affect facilitates creative problem solving. *Journal of personality and social psychology*, 52(6):1122, 1987.

[178] Alice M Isen, Thomas E Shalker, Margaret Clark, and Lynn Karp. Affect, accessibility of material in memory, and behavior: A cognitive loop? *Journal of personality and social psychology*, 36(1):1, 1978.

[179] Carroll E Izard. Four systems for emotion activation: cognitive and noncognitive processes. *Psychological review*, 100(1):68, 1993.

[180] Niels C L Jacobs, Trijntje Völlink, Francine Dehue, and Lilian Lechner. Online Pestkoppenstoppen: systematic and theory-based development of a web-based tailored intervention for adolescent cyberbully victims to combat and prevent cyberbullying. *BMC public health*, 14(1):396, 2014.

[181] Gregory R. Janson and Richard J. Hazler. Trauma Reactions of Bystanders and Victims to Repetitive Abuse Experiences. *Violence and Victims*, 19(2):239–255, 4 2004.

[182] Linda R Jeffrey. Bullying Bystanders. *Prevention Researcher*, 11(3):7–8, 2004.

[183] Henry Jenkins. Transmedia storytelling and entertainment: An annotated syllabus. In *Entertainment industries*, pages 145–160. Routledge, 2014.

[184] Dawn Jennifer and Helen Cowie. Listening to children's voices: moral emotional attributions in relation to primary school bullying. *Emotional and Behavioural Difficulties*, 17(3-4):229–241, 9 2012.

[185] Myounghoon Jeon, Rebecca Fiebrink, Ernest A Edmonds, and Damith Herath. From rituals to magic: Interactive art and HCI of the past, present, and future. *International Journal of Human-Computer Studies*, 131:108–119, 2019.

[186] José Antonio Jimenez-Barbero, José Antonio Ruiz-Hernández, Laura Llor-Zaragoza, Maria Pérez-Garcia, and Bartolome Llor-Esteban. Effectiveness of anti-bullying school programs: A meta-analysis. *Children and Youth Services Review*, 61:165–175, 2016.

[187] Elizabeth Jochum, Evgenios Vlachos, Anja Christoffersen, Sally Grindsted Nielsen, Ibrahim A Hameed, and Zheng-Hua Tan. Using theatre to study interaction with care robots. *International Journal of Social Robotics*, 8(4):457–470, 2016.

[188] Eerika Johander, Tiina Turunen, Claire F Garandeau, and Christina Salmivalli. Interventions That Failed: Factors Associated with the Continuation of Bullying After a Targeted Intervention. *International Journal of Bullying Prevention*, pages 1–13, 2023.

[189] Katja Joronen, Annukka Häkämies, and Päivi Åstedt-Kurki. Children's experiences of a drama programme in social and emotional learning. *Scandinavian journal of caring sciences*, 25(4):671–678, 2011.

[190] Katja Joronen, Anne Konu, H Sally Rankin, and Päivi Åstedt-Kurki. An evaluation of a drama program to enhance social relationships and anti-bullying at elementary school: a controlled study. *Health Promotion International*, 27(1):5–14, 2012.

[191] Jaana Juvonen and Sandra Graham. Bullying in schools: The power of bullies and the plight of victims. *Annual review of psychology*, 65:159–185, 2014.

[192] Katarzyna Kabacińska, Tony J Prescott, and Julie M Robillard. Socially assistive robots as mental health interventions for children: a scoping review. *International Journal of Social Robotics*, 13:919–935, 2021.

[193] Peter H Kahn, Takayuki Kanda, Hiroshi Ishiguro, Brian T Gill, Solace Shen, Jolina H Ruckert, and Heather E Gary. Human creativity can be facilitated through interacting with a social robot. In *2016 11th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 173–180. IEEE, 2016.

[194] Peter H Kahn Jr, Takayuki Kanda, Hiroshi Ishiguro, Nathan G Freier, Rachel L Severson, Brian T Gill, Jolina H Ruckert, and Solace Shen. "Robovie, you'll have to go into the closet now": Children's social and moral relationships with a humanoid robot. *Developmental psychology*, 48(2):303, 2012.

[195] Takayuki Kanda, Rumi Sato, Naoki Saiwaki, and Hiroshi Ishiguro. A two-month field trial in an elementary school for long-term human–robot interaction. *IEEE Transactions on robotics*, 23(5):962–971, 2007.

[196] Martin Kandlhofer and Gerald Steinbauer. Evaluating the impact of educational robotics on pupils' technical-and social-skills and science related attitudes. *Robotics and Autonomous Systems*, 75:679–685, 2016.

[197] Karl M Kapp. *The gamification of learning and instruction: game-based methods and strategies for training and education*. John Wiley \& Sons, 2012.

[198] Antti Kärnä, Marinus Voeten, Todd D Little, Erkki Alanen, Elisa Poskiparta, and Christina Salmivalli. Effectiveness of the KiVa Antibullying Program: Grades 1–3 and 7–9. *Journal of Educational Psychology*, 105(2):535, 2013.

[199] Antti Kärnä, Marinus Voeten, Todd D Little, Elisa Poskiparta, Anne Kaljonen, and Christina Salmivalli. A large-scale evaluation of the KiVa antibullying program: Grades 4–6. *Child development*, 82(1):311–330, 2011.

[200] Idit Katz, Dafna Lemish, Rinat Cohen, and Adi Arden. When parents are inconsistent: Parenting style and adolescents' involvement in cyberbullying. *Journal of Adolescence*, 74:1–12, 2019.

[201] Naz Kaya and Helen H Epps. Relationship between color and emotion: A study of college students. *College student journal*, 38(3):396–405, 2004.

[202] Mansureh Kebritchi, Atsusi Hirumi, and Haiyan Bai. The effects of modern mathematics computer games on mathematics achievement and class motivation. *Computers \& education*, 55(2):427–443, 2010.

[203] Merel Keijsers and Christoph Bartneck. Mindless robots get bullied. In *Proceedings of the 2018 acm/ieee international conference on human-robot interaction*, pages 205–214, 2018.

[204] Daria Khanolainen, Elena Semenova, and Paul Magnuson. 'Teachers see nothing': exploring students' and teachers' perspectives on school bullying with a new arts-based methodology. *Pedagogy, Culture \& Society*, 29(3):469–491, 2021.

[205] Elizabeth S Kim, Lauren D Berkovits, Emily P Bernier, Dan Leyzberg, Frederick Shic, Rhea Paul, and Brian Scassellati. Social robots as embedded reinforcers of social behavior in children with autism. *Journal of autism and developmental disorders*, 43:1038–1049, 2013.

[206] Nancy King. *A movement approach to acting*. Prentice Hall, 1981.

[207] Heather Knight. Eight lessons learned about non-verbal interactions through robot theater. In *International Conference on Social Robotics*, pages 42–51. Springer, 2011.

[208] Hartmut Koenitz. Towards a specific theory of interactive digital narrative. In *Interactive digital narrative*, pages 91–105. Routledge, 2015.

[209] Veronika Konok, Beáta Korcsok, Ádám Miklósi, and Márta Gácsi. Should we love robots?–The most liked qualities of companion dogs and how they can be implemented in social robots. *Computers in Human Behavior*, 80:132–142, 2018.

[210] Anastasia G Konstantopoulou, Eleni N Nikolaou, Georgios N Fessakis, Stamatia P Volika, and Georgios M Markogiannakis. Designing interactive digital storytelling as a strategy of raising children's awareness of bullying in preschool education: implications for bullying prevention. *Andreas Moutsios-Rentzos*, 21(23/09):91, 2018.

[211] Raph Koster. *Theory of fun for game design*. " O'Reilly Media, Inc.", 2013.

[212] Susan Kozel. Revealing practices: Heidegger's techne interpreted through performance in responsive systems. *Performance Research*, 10(4):33–44, 2005.

[213] Morten L Kringelbach and Kent C Berridge. Pleasures of the Brain. 2010.

[214] Hyunjin Ku, Jason J. Choi, Soomin Lee, Sunho Jang, and Wonkyung Do. Designing Shelly, a Robot Capable of Assessing and Restraining Children's Robot Abusing Behaviors. *ACM/IEEE International Conference on Human-Robot Interaction*, pages 161–162, 2018.

[215] Deanna Kuhn and David Dean Jr. Metacognition: A bridge between cognitive psychology and educational practice. *Theory into practice*, 43(4):268–273, 2004.

[216] Thomas S Kuhn and Ian Hacking. *The structure of scientific revolutions*, volume 2. University of Chicago press Chicago, 1970.

[217] Sari Kujala. User involvement: a review of the benefits and challenges. *Behaviour & information technology*, 22(1):1–16, 2003.

[218] Hirokazu Kumazaki, Taro Muramatsu, Yuichiro Yoshikawa, Yoshio Matsumoto, Hiroshi Ishiguro, Masaru Mimura, and Mitsuru Kikuchi. Role-play-based guidance for job interviews using an android robot for individuals with autism spectrum disorders. *Frontiers in Psychiatry*, 10:239, 2019.

[219] Consequential Labs. The Miro Robot.

[220] George Lakoff and Mark Johnson. *Metaphors we live by*. University of Chicago press, 2003.

[221] Lydia Laninga-Wijnen, Sarah T Malamut, Claire F Garandeau, and Christina Salmivalli. Does defending affect adolescents' peer status, or vice versa? Testing the moderating effects of empathy, gender, and anti-bullying norms. *Journal of research on adolescence*, 33(3):913–930, 2023.

[222] Bibb Latané and John M Darley. *The unresponsive bystander: Why doesn't he help?* Appleton-Century-Crofts, 1970.

[223] Brenda Laurel. *Computers as theatre*. Addison-Wesley, 2013.

[224] Nicole Lazzaro. Why we play: affect and the fun of games. *Human-computer interaction: Designing for diverse users and domains*, 155:679–700, 2009.

[225] Bridget Kiger Lee, Erika A Patall, Stephanie W Cawthon, and Rebecca R Steingut. The effect of drama-based pedagogy on preK–16 outcomes: A meta-analysis of research from 1985 to 2012. *Review of Educational Research*, 85(1):3–49, 2015.

[226] Hee Rin Lee, Selma Šabanović, Wan-Ling Chang, Shinichi Nagata, Jennifer Piatt, Casey Bennett, and David Hakken. Steps toward participatory design of social robots: mutual learning with older adults with depression. In *Proceedings of the 2017 ACM/IEEE international conference on human-robot interaction*, pages 244–253, 2017.

[227] Iola Leite, Marissa McCoy, Monika Lohani, Daniel Ullman, Nicole Salomons, Charlene Stokes, Susan Rivers, and Brian Scassellati. Emotional storytelling in the classroom: Individual versus group interaction between children and robots. In *2015 10th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 75–82. IEEE, 2015.

[228] Wenbin Liang. Cyberbullying, let the computer help. *Journal of Adolescent Health*, 47(2):209, 2010.

[229] P Lievense, V S Vacaru, J Liber, M Bonnet, and P S Sterkenburg. Stop bullying now! Investigating the effectiveness of a serious game for teachers in promoting autonomy-supporting strategies for disabled adults: A randomized controlled trial. *Disability and health journal*, 12(2):310–317, 2019.

[230] Mike E U Ligthart, Mark A Neerincx, and Koen V Hindriks. Design patterns for an interactive storytelling robot to support children's engagement and agency. In *Proceedings of the 2020 ACM/IEEE International Conference on Human-Robot Interaction*, pages 409–418, 2020.

[231] Chyi-Yeu Lin, Li-Chieh Cheng, Chun-Chia Huang, Li-Wen Chuang, Wei-Chung Teng, Chung-Hsien Kuo, Hung-Yan Gu, Kuo-Liang Chung, and Chin-Shyurng Fahn. Versatile humanoid robots for theatrical performances. *International Journal of Advanced Robotic Systems*, 10(1):7, 2013.

[232] LitCharts. Tragic Hero.

[233] David V Lu and William D Smart. Human-robot interactions as theatre. In *2011 Ro-Man*, pages 473–478. IEEE, 2011.

[234] David V Lu, William D Smart, and Annamaria Pileggi. Sky Sky Sky: Exploring End-of-Life Care Through Theatrical HRI. In *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, page 411, 2017.

[235] David V Lu, Chris Wilson, Annamaria Pileggi, and William D Smart. A robot acting partner. In *ICRA Workshop on Robots and Art*, 2011.

[236] Houston Lucas, Jamie Poston, Nathan Yocum, Zachary Carlson, and David Feil-Seifer. Too big to be mistreated? Examining the role of robot size on perceptions of mistreatment. In *2016 25th IEEE international symposium on robot and human interactive communication (RO-MAN)*, pages 1071–1076. IEEE, 2016.

[237] Michal Luria, Judeth Oden Choi, Rachel Gita Karp, John Zimmerman, and Jodi Forlizzi. Robotic Futures: Learning about Personally-Owned Agents through Performance. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*, pages 165–177, 2020.

[238] LuxAI. QTrobot.

[239] D. Lynn Hawkins, Debra J. Pepler, and Wendy M. Craig. Naturalistic Observations of Peer Interventions in Bullying. *Social Development*, 10(4):512–527, 11 2001.

[240] Chris Lytridis, Christos Bazinas, Vassilis G Kaburlasos, Violina Vassileva-Aleksandrova, Mohamed Youssfi, Mohammed Mestari, Vasileios Ferelis, and Alexander Jaki. Social robots as cyber-physical actors in entertainment and education. In *2019 International Conference on Software, Telecommunications and Computer Networks (SoftCOM)*, pages 1–6. IEEE, 2019.

[241] Ania Malinowska. Demonic Interventions: On robots as performing subjects. *Performance Research*, 26(1-2):112–124, 2021.

[242] Thomas Malone. What makes computer games fun? In *Proceedings of the Joint Conference on Easier and More Productive Use of Computer Systems.(Part-II): Human Interface and the User Interface-Volume 1981*, page 143, 1981.

[243] Johnson Mark. The Meaning of the Body: Aesthetics of Human Understanding, 2007.

[244] Kory Mathewson and Piotr Mirowski. Improbotics: Exploring the imitation game using machine intelligence in improvised theatre. In *Proceedings of the AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment*, volume 14, pages 59–66, 2018.

[245] Kory Wallace Mathewson and Piotr Mirowski. Improvised comedy as a turing test. *arXiv preprint arXiv:1711.08819*, 2017.

[246] Nick Mavroudis and Pagona Bournelli. The role of drama in education in counteracting bullying in schools. *Cogent education*, 3(1):1233843, 2016.

[247] Ersilia Menesini, Annalaura Nocentini, and Benedetta Emanuela Palladino. Empowering students against bullying and cyberbullying: Evaluation of an Italian peer-led model. *International Journal of Conflict and Violence (IJCV)*, 6(2):313–320, 2012.

[248] Ersilia Menesini and Christina Salmivalli. Bullying in schools: the state of knowledge and effective interventions. *Psychology, health & medicine*, 22:240–253, 2017.

[249] Kenneth W Merrell, Barbara A Gueldner, Scott W Ross, and Duane M Isava. How effective are school bullying intervention programs? A meta-analysis of intervention research. *School psychology quarterly*, 23(1):26, 2008.

[250] Oussama Metatla, Sandra Bardot, Clare Cullen, Marcos Serrano, and Christophe Jouffrais. Robots for inclusive play: Co-designing an educational game with visually impaired and sighted children. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, pages 1–13, 2020.

[251] Microsoft. Voice and sound with Speech Synthesis Markup Language (SSML). Microsoft Learn.

[252] Microsoft. Microsoft Azure Text-to-Speech. \url{https://azure.microsoft.com/en-us/products/ai-services/text-to-speech/}, 2025.

[253] Lyn Mikel Brown, Meda Chesney-Lind, and Nan Stein. Patriarchy matters: Toward a gendered theory of teen violence and victimization. *Violence against women*, 13(12):1249–1273, 2007.

[254] Paul Milgram and Fumio Kishino. A taxonomy of mixed reality visual displays. *IEICE TRANSACTIONS on Information and Systems*, 77(12):1321–1329, 1994.

[255] ARTHUR MILLER. Tragedy and the Common Man, 1949.

[256] Piotr Mirowski and Kory Wallace Mathewson. Human improvised theatre augmented with artificial intelligence. In *Proceedings of the 2019 on Creativity and Cognition*, pages 527–530, 2019.

[257] Faye Mishna, Iolanda Scarcello, Debra Pepler, and Judith Wiener. Teachers' understanding of bullying. *Canadian Journal of Education/Revue canadienne de l'éducation*, pages 718–738, 2005.

[258] Kathryn L Modecki, Jeannie Minchin, Allen G Harbaugh, Nancy G Guerra, and Kevin C Runions. Bullying prevalence across contexts: A meta-analysis measuring cyber and traditional bullying. *Journal of Adolescent Health*, 55(5):602–611, 2014.

[259] Ilaria Moneta and Cécile Rousseau. Emotional expression and regulation in a school-based drama workshop for immigrant adolescents with behavioral and learning difficulties. *The Arts in Psychotherapy*, 35(5):329–340, 2008.

[260] Terran Mott, Joslyne Lovelace, and Bennett Steward. Design considerations for child-robot interaction in pediatric contexts. In *Companion of the 2021 ACM/IEEE International Conference on Human-Robot Interaction*, pages 252–256, 2021.

[261] Jonathan Nakamoto and David Schwartz. Is peer victimization associated with academic achievement? A meta-analytic review. *Social development*, 19(2):221–242, 2010.

[262] Isaac Newton. *The Principia: mathematical principles of natural philosophy*. Univ of California Press, 1999.

[263] Morten Birkeland Nielsen, Tone Tangen, Thormod Idsoe, Stig Berge Matthiesen, and Nils Magerøy. Post-traumatic stress disorder as a consequence of bullying at work and at school. A literature review and meta-analysis. *Aggression and violent behavior*, 21:17–24, 2015.

[264] Niels A Nijdam. Mapping emotion to color. *Book Mapping emotion to color*, pages 2–9, 2009.

[265] Annalaura Nocentini, Valentina Zambuto, and Ersilia Menesini. Anti-bullying programs and Information and Communication Technologies (ICTs): A systematic review. *Aggression and Violent Behavior*, 23:52–60, 2015.

[266] Tatsuya Nomura, Takayuki Kanda, Hiroyoshi Kidokoro, Yoshitaka Suehiro, and Sachie Yamada. Why do children abuse robots? *Interaction Studies*, 17(3):347–369, 2016.

[267] Donald A Norman. Emotional design: People and things. *Retrieved February*, 1, 2005.

[268] Charles E Notar and Sharon Padgett. From victim to bully. *National Social Science Journal*, 41(1):79–83, 2013.

[269] Signify N.V. Philips Hue. \url{https://www.philips-hue.com/}, 2025.

[270] Dan Olweus. Bullying at school. In *Aggressive behavior*, pages 97–130. Springer, 1994.

[271] Dan Olweus. Peer Harassment: A critical analysis and some important issues. *Peer Harassment in School/Guilford Publications.*, pages 4–18, 2001.

[272] Omnicore. TikTok by the Numbers (2021): Stats, Demographics & Fun Facts, 2021.

[273] OpenAI. GPT-4o: Multimodal Large Language Model. \url{https://chat.openai.com/}, 2024.

[274] John O'Toole and Bruce Burton. Acting against conflict and bullying. The Brisbane DRACON project 1996–2004—emergent findings and outcomes. *Research in Drama Education: The Journal of Applied Theatre and Performance*, 10(3):269–283, 2005.

[275] Cliodhna O'Connor and Helene Joffe. Intercoder reliability in qualitative research: debates and practical guidelines. *International journal of qualitative methods*, 19, 2020.

[276] Sharon Padgett and Charles E Notar. Bystanders Are the Key to Stopping Bullying. *Universal Journal of Educational Research*, 1(2):33–41, 2013.

[277] Ana Paiva, Joao Dias, Daniel Sobral, Ruth Aylett, Polly Sobreperez, Sarah Woods, Carsten Zoll, and Lynne Hall. Caring for agents and agents that care: Building empathic relations with synthetic agents. In *Autonomous Agents and Multiagent Systems, International Joint Conference on*, volume 2, pages 194–201. IEEE Computer Society, 2004.

[278] Yu Peng, Yuan-Ling Feng, Nan Wang, and Haipeng Mi. How children interpret robots' contextual behaviors in live theatre: Gaining insights for multi-robot theatre design. In *2020 29th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*, pages 327–334. IEEE, 2020.

[279] Perla Janeth Castro Perez, Christian Javier Lucero Valdez, Maria De Guadalupe Cota Ortiz, Juan Pablo Soto Barrera, and Pedro Flores Perez. MISAAC: Instant messaging tool for ciberbullying detection. In *Proceedings of the 2012 International Conference on Artificial Intelligence, ICAI 2012*, pages 1049–1052, 2012.

[280] Dominik Petrović, Luka Kićinbaći, Frano Petric, and Zdenko Kovačić. Autonomous Robots as Actors in Robotics Theatre-Tribute to the Centenary of ruR. In *2019 European Conference on Mobile Robots (ECMR)*, pages 1–7. IEEE, 2019.

[281] Louise H Phillips, Rory D J MacLean, and Roy Allen. Age and the understanding of emotions: Neuropsychological and sociocognitive perspectives. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 57(6):P526–P530, 2002.

[282] Jean Piaget. Piaget's theory. In *Piaget and his school*, pages 11–23. Springer, 1976.

[283] Jan L Plass, Bruce D Homer, and Charles K Kinzer. Foundations of game-based learning. *Educational psychologist*, 50(4):258–283, 2015.

[284] Jan L Plass, Richard E Mayer, and Bruce D Homer. *Handbook of game-based learning*. Mit Press, 2020.

[285] Joshua R Polanin, Dorothy L Espelage, and Therese D Pigott. A meta-analysis of school-based bullying prevention programs' effects on bystander intervention behavior. *School Psychology Review*, 41(1):47–65, 2012.

[286] Philip A Powell and Jennifer Roberts. Situational determinants of cognitive, affective, and compassionate empathy in naturalistic digital interactions. *Computers in Human Behavior*, 68:137–148, 2017.

[287] Virpi Pöyhönen and others. Defending behavior in bullying situations. 2013.

[288] Trisha N Prabhu. Method to stop cyber-bullying before it occurs, 2017.

[289] Richard Heinz Patrick Prager. Exploring the use of role-playing games in education. *The MT Review*, 2019.

[290] David Premack and Guy Woodruff. Does the chimpanzee have a theory of mind? *Behavioral and brain sciences*, 1(4):515–526, 1978.

[291] Rahat Ibn Rafiq, Homa Hosseinmardi, Richard Han, Qin Lv, Shivakant Mishra, and Sabrina Arredondo Mattson. Careful what you share in six seconds: Detecting cyberbullying instances in vine. In *Proceedings of the 2015 IEEE/ACM International Conference on Advances in Social Networks Analysis and Mining 2015*, pages 617–622, 2015.

[292] Jacques Rancière. The ignorant schoolmaster: Five lessons in intellectual emancipation. 1991.

[293] Raspberry Pi Foundation. Raspberry Pi Pico Datasheet. \url{https://datasheets.raspberrypi.com/pico/pico-datasheet.pdf}, 2020.

[294] Jared R. Rawlings and Sarah A. Stoddard. A Critical Review of Anti-Bullying Programs in North American Elementary Schools. *Journal of School Health*, 89(9):759–780, 9 2019.

[295] Byron Reeves and Clifford Nass. The media equation: How people treat computers, television, and new media like real people. *Cambridge, UK*, 10(10):19–36, 1996.

[296] Matthias Rehm and Anders Krogsager. Negative affect in human robot interaction—impoliteness in unexpected encounters with robots. In *2013 IEEE RO-MAN*, pages 45–50. IEEE, 2013.

[297] Laurel Riek. Wizard of Oz Studies in HRI: A Systematic Review and New Reporting Guidelines. *Journal of Human-Robot Interaction*, 1(1):119–136, 2012.

[298] Laurel D Riek, Tal-Chen Rabinowitch, Bhismadev Chakrabarti, and Peter Robinson. How anthropomorphism affects empathy toward robots. *Proceedings of the 4th ACM/IEEE international conference on Human robot interaction - HRI '09*, page 245, 2009.

[299] Ken Rigby. Consequences of Bullying in Schools. *The Canadian Journal of Psychiatry*, 48(9):583–590, 10 2003.

[300] Don Richard Riso and Russ Hudson. *Understanding the enneagram: The practical guide to personality types*. Houghton Mifflin Harcourt, 2000.

[301] Horst W J Rittel and Melvin M Webber. Dilemmas in a general theory of planning. *Policy sciences*, 4(2):155–169, 1973.

[302] Adam Robaczewski, Julie Bouchard, Kevin Bouchard, and Sébastien Gaboury. Socially assistive robots: The specific case of the NAO. *International Journal of Social Robotics*, 13(4):795–831, 7 2021.

[303] Furhat Robotics. Gesture Capture Tool – Furhat Robotics. \url{https://docs.furhat.io/gesture_capture_tool/}, 2025.

[304] SoftBank Robotics. Nao Robot.

[305] Andrew Rollings and Dave Morris. *Game Architecture and Design with Cdrom*. Coriolis Group Books, 1999.

[306] Gina Ross and Rhonda Nelson. Using theater and drama interventions to reduce bullying in school-aged children. *Therapeutic Recreation Journal*, 48(4):334–336, 2014.

[307] Alice Rubin-Vaughan, Debra Pepler, Steven Brown, and Wendy Craig. Quest for the Golden Rule: An effective social skills promotion and bullying prevention program. *Computers & Education*, 56(1):166–175, 2011.

[308] James A Russell. A circumplex model of affect. *Journal of personality and social psychology*, 39(6):1161, 1980.

[309] Christina Salmivalli. Bullying and the peer group: A review. *Aggression and Violent Behavior*, 15(2):112–120, 3 2010.

[310] Christina Salmivalli. Participant roles in bullying: How can peer bystanders be utilized in interventions? *Theory into practice*, 53(4):286–292, 2014.

[311] Christina Salmivalli, Ari Kaukiainen, and Marinus Voeten. Anti-bullying intervention: Implementation and outcome. *British journal of educational psychology*, 75(3):465–487, 2005.

[312] Christina Salmivalli and Eija Nieminen. Proactive and reactive aggression among school bullies, victims, and bully-victims. *Aggressive Behavior: Official Journal of the International Society for Research on Aggression*, 28(1):30–44, 2002.

[313] Christina Salmivalli and Elisa Poskiparta. KiVa antibullying program: Overview of evaluation studies based on a randomized controlled trial and national rollout in Finland. *International Journal of Conflict and Violence*, 6(2):293, 2012.

[314] Pericle Salvini, Gaetano Ciaravella, Wonpil Yu, Gabriele Ferri, Alessandro Manzi, Barbara Mazzolai, Cecilia Laschi, Sang-Rok Oh, and Paolo Dario. How safe are service robots in urban environments? Bullying a robot. In *19th International Symposium in Robot and Human Interactive Communication*, pages 1–7. IEEE, 2010.

[315] Rebecca Sanchez, Emily Brown, Kelly Kocher, and Melissa DeRosier. Improving children's mental health with a digital social skills development game: a randomized controlled efficacy trial of adventures aboard the SS GRIN. *Games for health journal*, 6(1):19–27, 2017.

[316] Elizabeth B-N Sanders and Pieter Jan Stappers. Co-creation and the new landscapes of design. *Co-design*, 4(1):5–18, 2008.

[317] Jua B P Sanders, Sarah Malamut, and Antonius H N Cillessen. Why do bullies bully? Motives for bullying. *The Wiley Blackwell Handbook of Bullying: A Comprehensive and International Review of Research and Intervention*, 1:158–176, 2021.

[318] Elaheh Sanoubari, John E Muñoz Cardona, Andrew Houston, James Young, and Kerstin Dautenhahn. Designing an Anti-Bullying Serious Game: Insights from Interviews with Teachers. In *Joint Intl. Conf. on Serious Games (JCSG)*, pages 102–121. Springer, 2022.

[319] Elaheh Sanoubari, Amanda Johnson, John Edison Munoz, Andrew Houston, and Kerstin Dautenhahn. Using Robot-Mediated Applied Drama to Foster Anti-Bullying Peer Support. In *Robophilosophy*, 2022.

[320] Elaheh Sanoubari, John Edison Muñoz Cardona, Hamza Mahdi, James E Young, Andrew Houston, and Kerstin Dautenhahn. Robots, Bullies and Stories: A Remote Co-design Study with Children. In *Interaction Design and Children*, pages 171–182, 2021.

[321] Juliana Saxton and Monica Prendergast. *Applied drama: A Facilitators handbook for working in community*. Intellect Books, 2013.

[322] Wilmar B Schaufeli, Marisa Salanova, Vicente González-Romá, and Arnold B Bakker. The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. *Journal of Happiness studies*, 3:71–92, 2002.

[323] Mark Scheeff, John Pinto, Kris Rahardja, Scott Snibbe, and Robert Tow. Experiences with Sparky, a social robot. In *Socially intelligent agents*, pages 173–180. Springer, 2002.

[324] Jesse Schell. *The Art of Game Design: A book of lenses*. CRC press, 2008.

[325] Elena Márquez Segura, Laia Turmo Vidal, and Asreen Rostami. BODYSTORMING FOR MOVEMENT-BASED INTERACTION DESIGN. *Human Technology*, 12(2), 2016.

[326] Michael Sellers. *Advanced game design: a systems approach*. Addison-Wesley Professional, 2017.

[327] Amanda Sharkey and Noel Sharkey. Children, the elderly, and interactive robots. *IEEE Robotics \& Automation Magazine*, 18(1):32–38, 2011.

[328] Megha Sharma, Dale Hildebrandt, Gem Newman, James E Young, and Rasit Eskicioglu. Communicating affect via flight path exploring use of the laban effort system for designing affective locomotion paths. In *2013 8th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*, pages 293–300. IEEE, 2013.

[329] Sonia Sharp and Peter Smith. *School bullying: Insights and perspectives*. Routledge, 2002.

[330] M. Shiakou and L. Piki. Assessing the role of drama on children's understanding of bullying. *International Journal of School and Educational Psychology*, 8(1):11–20, 2020.

[331] Huiyoung Shin and Sunjeong Gyeong. Perceived and actual norms, and norm misperceptions in explaining participant roles in bullying. *Journal of youth and adolescence*, 53(11):2683–2693, 2024.

[332] Daniel Smith, Philip Schlaepfer, Katie Major, Mark Dyble, Abigail E Page, James Thompson, Nikhil Chaudhary, Gul Deniz Salali, Ruth Mace, Leonora Astete, and others. Cooperation and the evolution of hunter-gatherer storytelling. *Nature communications*, 8(1):1853, 2017.

[333] Peter K Smith. Making an impact on school bullying. *Interventions and recommendations*, 2019.

[334] P. R. Smokowski and K. H. Kopasz. Bullying in School: An Overview of Types, Effects, Family Characteristics, and Intervention Strategies. *Children & Schools*, 27(2):101–110, 4 2005.

[335] Wing Chee So, Chun Ho Cheng, Wan Yi Lam, Tiffany Wong, Wing Wun Law, Ying Huang, Ka Ching Ng, Hiu Ching Tung, and Wing Wong. Robot-based play-drama intervention may improve the narrative abilities of Chinese-speaking preschoolers with autism spectrum disorder. *Research in Developmental Disabilities*, 95, 2019.

[336] Nevigo / Stray Fawn Studio / Articy Software. {articy:draft} (narrative design software), 2025.

[337] Novia Solichah, Muchamad Adam Basori, and Nurul Shofiah3 Iqbal Ali Wafa. Storytelling for Prosocial Behavior in Young Children: Scoping Review. In *Proceedings of the Second Conference on Psychology and Flourishing Humanity (PFH 2023)*, volume 808, page 194. Springer Nature, 2023.

[338] Sichao Song and Seiji Yamada. Expressing emotions through color, sound, and vibration with an appearance-constrained social robot. In *2017 12th ACM/IEEE International Conference on Human-Robot Interaction (HRI*, pages 2–11. IEEE, 2017.

[339] Maximilian Speicher, Brian D Hall, and Michael Nebeling. What is mixed reality? In *Proceedings of the 2019 CHI conference on human factors in computing systems*, pages 1–15, 2019.

[340] Kathleen Stassen Berger. Update on bullying at school: Science forgotten? *Developmental Review*, 27(1):90–126, 3 2007.

[341] Statistics Canada. Canadian Health Survey on Children and Youth (CHSCY), 2020.

[342] Marc Steen. Co-design as a process of joint inquiry and imagination. *Design Issues*, 29(2):16–28, 2013.

[343] Marc Steen, Menno Manschot, and Nicole De Koning. Benefits of co-design in service design projects. *International Journal of Design*, 5(2), 2011.

[344] Jennifer E Stellar, Amie M Gordon, Paul K Piff, Daniel Cordaro, Craig L Anderson, Yang Bai, Laura A Maruskin, and Dacher Keltner. Self-transcendent emotions and their social functions: Compassion, gratitude, and awe bind us to others through prosociality. *Emotion Review*, 9(3):200–207, 2017.

[345] Elizabeth Stephens and Tara Heffernan. We have always been robots: The history of robots and art. In *Robots and Art*, pages 29–45. Springer, 2016.

[346] D W Stewart, P N Shamdasani, and D W Rook. The focus group moderator. *Focus groups*, pages 69–89, 2007.

[347] Michele Garabedian Stork. Supporting twenty-first century competencies using robots and digital storytelling. *Journal of Formative Design in Learning*, 4(1):43–50, 2020.

[348] Will Storr. *The science of storytelling: Why stories make us human and how to tell them better*. Abrams, 2020.

[349] Michael Suguitan and Guy Hoffman. Blossom: A Handcrafted Open-Source Robot. *ACM Transactions on Human-Robot Interaction (THRI)*, 8(1):1–27, 2019.

[350] S Shyam Sundar. Self as source: Agency and customization in interactive media. In *Mediated interpersonal communication*, pages 58–74. Routledge Taylor & Francis Group, 2008.

[351] Iping Supriana, Ririn Dwi Agustin, Marini Abu Bakar, and Nor Azan Mat Zin. Serious games for effective learning. In *Intl. Conf. Electrical Engineering & Informatics*, pages 1–6. IEEE, 2017.

[352] Dag Sverre Syrdal, Kerstin Dautenhahn, Ben Robins, Efstathia Karakosta, and Nan Cannon Jones. Kaspar in the wild: Experiences from deploying a small humanoid robot in a nursery school for children with autism. *Paladyn, Journal of Behavioral Robotics*, 11(1):301–326, 2020.

[353] Dag Sverre Syrdal, Kerstin Dautenhahn, Michael L Walters, Kheng Lee Koay, and Nuno R Otero. The Theatre methodology for facilitating discussion in human-robot interaction on information disclosure in a home environment. In *2011 RO-MAN*, pages 479–484. IEEE, 2011.

[354] Denise Szecsei. Theatrical performances using robots as actors. In *2019 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*, pages 1–3. IEEE, 2019.

[355] Xiang Zhi Tan, Marynel Vázquez, Elizabeth J. Carter, Cecilia G. Morales, and Aaron Steinfeld. Inducing Bystander Interventions During Robot Abuse with Social Mechanisms. In *Proceedings of the 2018 ACM/IEEE International Conference on Human-Robot Interaction - HRI '18*, pages 169–177. ACM Press, 2018.

[356] Wernhuar Tarng and Weichian Tsai. The design and analysis of learning effects for a game-based learning system. *International Journal of Educational and Pedagogical Sciences*, 4(1):14–23, 2010.

[357] The Cateater Team. Stop Motion Studio.

[358] Katie Salen Tekinbas and Eric Zimmerman. *Rules of play: Game design fundamentals*. MIT press, 2003.

[359] Timo Teräsahjo and Christina Salmivalli. "She is not actually bullied." The discourse of harassment in student groups. *Aggressive Behavior: Official Journal of the International Society for Research on Aggression*, 29(2):134–154, 2003.

[360] Headlines Theatre. Practicing Democracy, 2003.

[361] Robert Thornberg, Tiziana Pozzoli, and Gianluca Gini. Defending or remaining passive as a bystander of school bullying in Sweden: The role of moral disengagement and antibullying class norms. *Journal of interpersonal violence*, 37(19-20):NP18666–NP18689, 2022.

[362] Lai Poh Emily Toh, Albert Causo, Pei-Wen Tzuo, I-Ming Chen, and Song Huat Yeo. A review on the use of robots in education and young children. *Journal of Educational Technology \& Society*, 19(2):148–163, 2016.

[363] Maria M Ttofi and David P Farrington. Effectiveness of school-based programs to reduce bullying: A systematic and meta-analytic review. *Journal of Experimental Criminology*, 7(1):27–56, 2011.

[364] Stuart W Twemlow, Peter Fonagy, and Frank C Sacco. The role of the bystander in the social architecture of bullying and violence in schools and communities. *Annals of the New York Academy of Sciences*, 1036:215–232, 2004.

[365] Stuart W Twemlow and Frank C Sacco. *Why school anti-bullying programs don't work*. Jason Aronson, 2008.

[366] Kirsikka Vaajakallio, Jung-Joo Lee, and Tuuli Mattelm\"aki. " It has to be a group work!" co-design with children. In *Proceedings of the 8th international conference on interaction design and children*, pages 246–249, 2009.

[367] Tracy Vaillancourt. *Indirect aggression among humans: social construct or evolutionary adaptation?* Guilford Press, 2005.

[368] Rozemarijn van der Ploeg, Tina Kretschmer, Christina Salmivalli, and René Veenstra. Defending victims: What does it take to intervene in bullying and how is it rewarded by peers? *Journal of school psychology*, 65:1–10, 2017.

[369] Anouk van Dijk, Astrid M G Poorthuis, and Tina Malti. Psychological processes in young bullies versus bully-victims. *Aggressive behavior*, 43(5):430–439, 2017.

[370] Tom Van Laer, Ko De Ruyter, Luca M Visconti, and Martin Wetzels. The extended transportation-imagery model: A meta-analysis of the antecedents and consequences of consumers' narrative transportation. *Journal of Consumer research*, 40(5):797–817, 2014.

[371] Natalie Vannini, Scott Watson, Kerstin Dautenhahn, Sibylle Enz, Maria Sapouna, Dieter Wolke, Sarah Woods, Lynne Hall, Ana Paiva, Elizabeth André, Ruth Aylett, and Wolfgang Schneider. "FearNot!": A computer-based anti-bullying-programme designed to foster peer intervention. *European Journal of Psychology of Education*, 26(1):21–44, 2011.

[372] Gijs Verhoeven, Alejandro Catala, and Mariët Theune. Designing a playful robot application for second language learning. In *Interactivity, Game Creation, Design, Learning, and Innovation: 7th EAI International Conference, ArtsIT 2018, and 3rd EAI International Conference, DLI 2018, ICTCC 2018, Braga, Portugal, October 24–26, 2018, Proceedings 7*, pages 385–394. Springer, 2019.

[373] Nishant Vishwamitra, Xiang Zhang, Jonathan Tong, Hongxin Hu, Feng Luo, Robin Kowalski, and Joseph Mazer. MCDefender: Toward effective cyberbullying defense in mobile online social networks. In *Proceedings of the 3rd ACM on international workshop on security and privacy analytics*, pages 37–42, 2017.

[374] Christopher Vogler. Joseph Campbell goes to the movies: The influence of the hero's journey in film narrative. *Journal of Genius and Eminence*, 2(2):9–23, 2017.

[375] Lev S Vygotsky. Play and its role in the mental development of the child. *Soviet psychology*, 5(3):6–18, 1967.

[376] Betty Jane Wagner. *Dorothy Heathcote: Drama as a learning medium.* National Education Association, 1976.

[377] Greg Walsh, Elizabeth Foss, Jason Yip, and Allison Druin. FACIT PD: a framework for analysis and creation of intergenerational techniques for participatory design. In *proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, pages 2893–2902, 2013.

[378] Michael L Walters, Kheng Lee Koay, Dag Sverre Syrdal, Anne Campbell, and Kerstin Dautenhahn. Companion robots for elderly people: Using theatre to investigate potential users' views. In *2013 IEEE RO-MAN*, pages 691–696. IEEE, 2013.

[379] Kendall L Walton. *Mimesis as make-believe: On the foundations of the representational arts*. Harvard University Press, 1990.

[380] Kendall L Walton. *Mimesis as make-believe: On the foundations of the representational arts*. Harvard University Press, 1993.

[381] Zixuan Wang, Lydia Laninga-Wijnen, Claire F Garandeau, and Junsheng Liu. Development and validation of the adolescent defending behaviors questionnaire among Chinese early adolescents. *Assessment*, page 10731911221149082, 2023.

[382] Irene White, Mairéad Foody, and James O'Higgins Norman. Storytelling as a liminal space: using a narrative based participatory approach to tackle cyberbullying among adolescents. In *Narratives in research and interventions on cyberbullying among young people*, pages 133–146. Springer, 2019.

[383] Gary Collins Brata Winardy and Eva Septiana. Role, play, and games: Comparison between role-playing games and role-play in education. *Social Sciences & Humanities Open*, 8(1):100527, 2023.

[384] Angela M Wiseman and Jill S Jones. Examining depictions of bullying in children's picturebooks: A content analysis from 1997 to 2017. *Journal of Research in Childhood Education*, 32(2):190–201, 2018.

[385] Luke Wood, Kerstin Dautenhahn, Ben Robins, and Abolfazl Zaraki. Developing child-robot interaction scenarios with a humanoid robot to assist children with autism in developing visual perspective taking skills. In *2017 26th IEEE International Symposium on Robot and Human Interactive Communication (RO-MAN)*, pages 1055–1060. IEEE, 2017.

[386] Luke Jai Wood, Kerstin Dautenhahn, Austen Rainer, Ben Robins, Hagen Lehmann, and Dag Sverre Syrdal. Robot-Mediated Interviews - How Effective Is a Humanoid Robot as a Tool for Interviewing Young Children? *PLoS ONE*, 8(3):e59448, 3 2013.

[387] Sarah Woods, Megan Davis, Kerstin Dautenhahn, and Joerg Schulz. Can robots be used as a vehicle for the projection of socially sensitive issues? Exploring children's attitudes towards robots through stories. In *ROMAN 2005. IEEE International Workshop on Robot and Human Interactive Communication, 2005.*, pages 384–389. IEEE, 2005.

[388] Sarah Woods, Lynne Hall, Kerstin Dautenhahn, and Dieter Wolke. Implications of gender differences for the development of animated characters for the study of bullying behavior. *Computers in Human Behavior*, 23(1):770–786, 2007.

[389] Peter R Wright. Drama education and development of self: Myth or reality? *Social psychology of education*, 9(1):43–65, 2006.

[390] Vivian H Wright, Joy J Burnham, T Inman Christopher, and N Ogorchock Heather. Cyberbullying: Using virtual scenarios to educate and raise awareness. *Journal of Computing in Teacher Education*, 26(1):35–42, 2009.

[391] An Yang and Christina Salmivalli. Effectiveness of the KiVa antibullying programme on bully-victims, bullies and victims. *Educational research*, 57(1):80–90, 2015.

[392] Nesra Yannier, Scott E Hudson, Eliane Stampfer Wiese, and Kenneth R Koedinger. Adding physical objects to an interactive game improves learning and enjoyment: Evidence from EarthShake. *ACM Transactions on Computer-Human Interaction (TOCHI)*, 23(4):1–31, 2016.

[393] Nesra Yannier, Kenneth R Koedinger, and Scott E Hudson. Learning from mixed-reality games: Is shaking a tablet as effective as physical observation? In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, pages 1045–1054, 2015.

[394] James E Young, Jayoung Sung, Amy Voida, Ehud Sharlin, Takeo Igarashi, Henrik I Christensen, and Rebecca E Grinter. Evaluating human-robot interaction: Focusing on the holistic interaction experience. *International Journal of Social Robotics*, 3(1):53–67, 2011.

[395] Garth Zeglin, Aaron Walsman, Laura Herlant, Zhaodong Zheng, Yuyang Guo, Michael C Koval, Kevin Lenzo, Hui Jun Tay, Prasanna Velagapudi, Katie Correll, and others. HERB's Sure Thing: A rapid drama system for rehearsing and performing live robot theater. In *2014 IEEE International Workshop on Advanced Robotics and its Social Impacts*, pages 129–136. IEEE, 2014.

[396] Yu Zhonggen. A meta-analysis of use of serious games in education over a decade. *International Journal of Computer Games Technology*, 2019, 2019.

[397] John Zimmerman, Jodi Forlizzi, and Shelley Evenson. Research through design as a method for interaction design research in HCI. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 493–502, 2007.

[398] John Zimmerman, Erik Stolterman, and Jodi Forlizzi. An analysis and critique of Research through Design: towards a formalization of a research approach. In *proceedings of the 8th ACM conference on designing interactive systems*, pages 310–319, 2010.

[399] Jakub Złotowski, Diane Proudfoot, Kumar Yogeeswaran, and Christoph Bartneck. Anthropomorphism: opportunities and challenges in human–robot interaction. *International journal of social robotics*, 7(3):347–360, 2015.

[400] JMVD Zwaan, Elke Geraerts, Virginia Dignum, and Catholijn M Jonker. User validation of an empathic virtual buddy against cyberbullying. *Studies in Health Technology and Informatics*, 181:243–247, 2012.

APPENDICES

Appendix A

Robots & Theatre in Learning

Table A.1 below provides an overview of related work using robots and theatre as a tool for learning.

Table A.1: Overview of related work using robots and theatre as a tool for learning.

Paper Title	Audience Role	Target Audience	Purpose of Theatre
Companion robots for elderly people: using theatre to investigate potential users' views [378]	Spectator	Elderly residents and carers	Illustrate the functionality, social and ethical aspects of robots in elderly care and gain feedback from potential users
Theatre as a Discussion Tool in Human-Robot Interaction Experiments – A Pilot Study [73]	Spectator	Adults (aged 20–50)	Gain participants' opinions on the acceptability of presented scenarios and the appearance of the robots
Child-Robot Theater: Engaging Elementary Students in Informal STEAM Education Using Robots [26]	Acting through Robots	Elementary school students	Engage children in STEAM programming through theatre
Social Robots as Cyber-Physical Actors in Entertainment and Education [240]	Spect-actor	Elementary school children	Facilitate interaction with robots for education and entertainment
Design and Development of Educational Robot Teaching Resources Using AI Technology [166]	Acting partner	Elementary school children	Provide students with a tool to learn and practice English language
Robot-based play-drama intervention may improve the narrative abilities of Chinese-speaking preschoolers with autism spectrum disorder [335]	Spect-actor	Children with ASD (aged 4–6)	Utilize robot-based drama intervention to strengthen narrative abilities

Table A.1: Overview of related work using robots and theatre as a tool for learning. (continued)

Paper Title	Audience Role	Target Audience	Purpose of Theatre
Role-Play-Based Guidance for Job Interviews Using an Android Robot for Individuals With Autism Spectrum Disorders [218]	Acting through Robots / Spect-actor	Adults with ASD (aged 19–25)	Allow participants to gain interview-related skills including gesture and motivation recognition
Designing and Implementing a Robot in a Digital Theater for Audience Involved Drama-Based Learning [74]	Spect-actor	ESL students	Engage students and encourage learning via Digital Learning Theater
r-Learning services for elementary school students with a teaching assistant robot [152]	Acting partner	Elementary school children and teachers	Develop relationships and assist in attention management in a classroom environment
Robot Theatre to Boost Excitement, Engagement, and Expression (E3) of STEM [98]	Acting through Robots	Elementary school children	Encourage early interest in STEM learning through theatre techniques
Design of a Multi-agent Architecture for Implementing Educational Drama Techniques Using Robot Actors [53]	Acting through Robots	Elementary school children	Support learning and teaching of non-technical school subjects
Emotional Storytelling in the Classroom: Individual versus Group Interaction between Children and Robots [227]	Acting through Robots	First and second grade students	Encourage collaboration and development of social-related skills

Table A.1: Overview of related work using robots and theatre as a tool for learning. (continued)

Paper Title	Audience Role	Target Audience	Purpose of Theatre
Using Theatre to Study Interaction with Care Robots [187]	Spectator	Adults (aged 18–74)	Demonstrate a care robot and evaluate users' believability and acceptability
The Theatre methodology for facilitating discussion in HRI on information disclosure in a home environment [353]	Spectator	Secondary school students	Gain user feedback on domestic service robots

Appendix B

Moral Disengagement Questionnaire for Robot Bullying

The following questionnaire is a modified version of the 18-item Moral Disengagement in Bullying Scale developed by Hymel et al. [171], adapted to explore participants' moral disengagement in response to robot bullying.

Participants responded to the following items on a 5-point Likert scale ranging from *Strongly Disagree* to *Strongly Agree*.

1. Kicking or pushing a robot like this one is normal.
2. Kicking or pushing robots like this one should be a criminal offense.
3. It is okay to join in when a robot like this one is being kicked or pushed.
4. My group of friends would be okay with kicking or pushing someone.
5. Owners of this robot should be responsible for protecting them from others.
6. If I see a robot like this one being kicked or pushed, there is nothing I can do to stop it.
7. It is my responsibility to intervene or do something when I see a robot like this one being kicked or pushed.
8. Getting kicked or pushed gets robots like this one to understand what is important to people.

9. Getting kicked or pushed helps make robots like this one tougher.
10. Robots like this may need to be kicked or pushed just to teach them a lesson.
11. Kicking or pushing a robot like this one can be a good way to solve problems.
12. Robots like this get kicked or pushed because they are different.
13. Robots like this deserve to get kicked or pushed.
14. Robots like this get kicked or pushed because they hurt people.
15. It's okay to pick on "losers" like this one.
16. If robots like this one weren't annoying, they wouldn't get kicked or pushed so much.
17. Robots like this that get kicked or pushed probably bring it on themselves.

Appendix C

Bully-Detector Circuit Design

C.1 Schematic Diagram

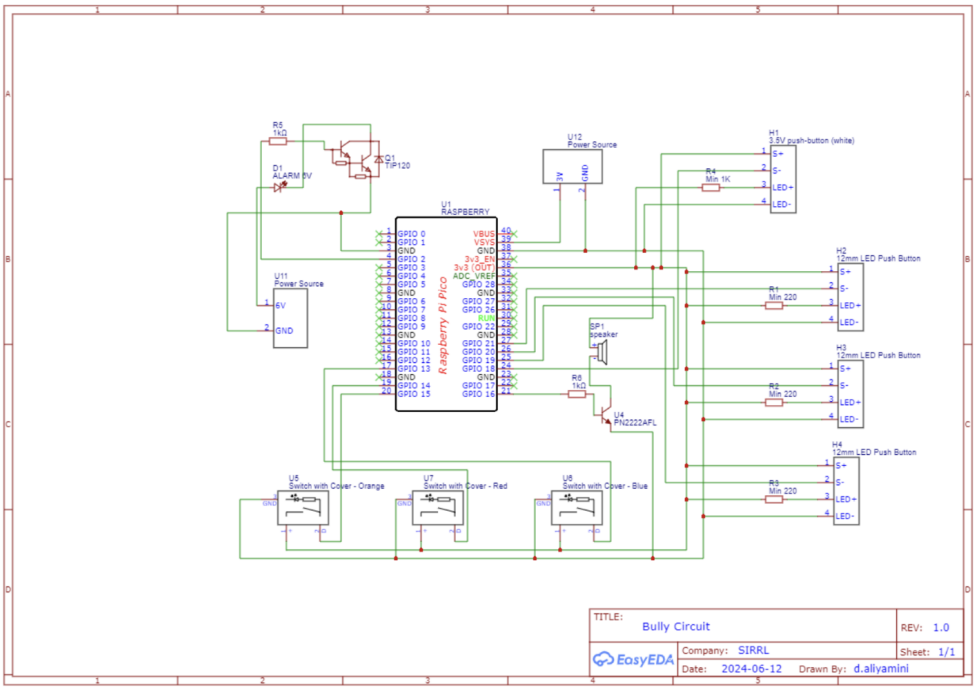


Figure C.1: Schematic Diagram of the Bully-Detector prop.

C.2 PCB Layout

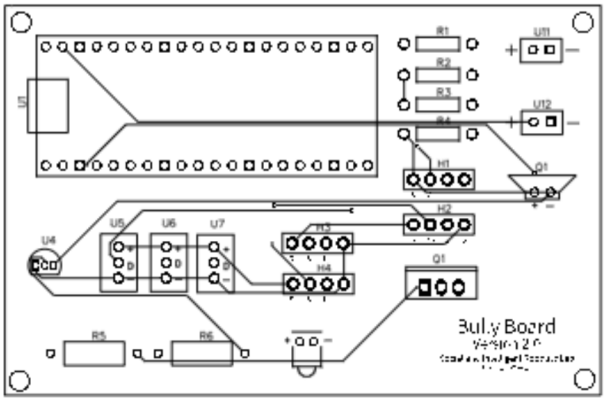


Figure C.2: PCB Layout of the Bully-Detector prop.

Appendix D

Character Design

D.1 Character Sheets

D.1.1 AVATAR (Player-Character / Protagonist)

Role in the Story

- AVATAR is a Furhat robot living in KERNEL, whose life is disrupted by the glitch.
- AVATAR is a bystander to a bullying situation involving two peer robots.
- AVATAR's part in fixing the glitch involves teaming up with a human child to simulate a past memory, watch it, rewrite it, and submit the new version to ORACLE.

Appearance

- Embodied by a Furhat robot.
- Its face, voice, name, and accessories are selected by the child.

Personality Enneagram Type 9 [300]. The Peacemaker. Open-minded, accepting, and supportive, but can be too willing to go along with others to keep the peace.

Goal To identify and rectify the source of the glitch that is disturbing the peace in Kernel, by altering a past memory.

Greatest Fear AVATAR is concerned that the glitch will escalate, erasing its identity and disconnecting it from its friends, whose names it has already forgotten due to the glitch.

Misbelief Since the main themes, which shape the moral of the story, focus on bystander intervention, friendship, inclusivity, undermining bully power, and collective problem-solving; AVATAR's misbelief is designed as the exact opposite:

- "I should not get involved, because I can't really change what happens anyway."
- "If I do something about JITTER getting bullied, I'll only make it worse".
- "It's better to stay silent and avoid conflict than to intervene in bullying."
- "If I stay quiet and don't get involved, everything will be okay."
- "I can't make a real difference, so it's better to stay quiet."
- "If I don't intervene, the problem will sort itself out."

Fears that block AVATAR's intervention

- AVATAR fears making the situation worse by intervening or doubts its ability to bring about any meaningful change.
- AVATAR fears social isolation from peers for being perceived as a "troublemaker", a "snitch" or "tattletale". AVATAR doesn't want to embarrass itself in front of its peers.
- AVATAR is susceptible to the opinion of friends who think FUSE is cool or laugh when it bullies someone.
- AVATAR worries about poking its nose where it doesn't belong. It thinks if the bullying was really a problem, someone else would have already intervened.
- AVATAR worries that intervention may result in becoming FUSE's new target.

Character Arc AVATAR's character arc involves increasing self-efficacy and learning to show its (negative) attitude towards peer bullying in public.

Skills

- Better at simulating some emotions (as sound and light), compared to most robots – like when some human kids are really good at drawing.
- Excellent Memory: Under normal circumstances, AVATAR has a great memory — when telling a story about others, AVATAR can usually simulate their face, face, and exact words from memory. However, its memory has been affected by the glitch to the extent that it has forgotten the names of its best friends and is worried about forgetting its own name next.
- Sociality: Friendly but non-confrontational. Tends to go along with what others are doing to keep the peace. Enjoys spending time with its two best friends.

Flaw Tends to avoid problems. Sometimes closes its eyes and mutes its mic to avoid confrontations.

Favorite Things in the World

- BIT & BYTE (two best friends)
- Humans (especially their emotions, which AVATAR finds extremely cute)
- A small plush toy that keeps in its yellow backpack
- Its tiny yellow backpack
- Pizza parties with BIT & BYTE

D.1.2 FUSE (Non-Player Character / Antagonist)

Role in Story In AVATAR's past memory, FUSE bullies JITTER.

Personality Enneagram Type 8 [300]: The Powerful, Dominating Type: Self-Confident, Decisive, Willful, and Confrontational.

Goal FUSE desires to be visible [310], well-known and have influence over others [135], be perceived as popular, powerful, and cool among their peers, even if they are not well-liked [248].

Motive FUSE is motivated by a desire for status and power [309]. Often uses bullying to gain dominance or power within the peer group. Sometimes because they are feeling bad and want to feel better or reduce stress [317].

Greatest Fear FUSE's greatest fear is being exposed as insecure and weak. FUSE dreads loss of control and fears being seen as vulnerable or inferior.

Traits FUSE shows proactive aggression. Values agentic goals (i.e., getting ahead of others), more than communal goals (i.e., getting along with others) [155]. Has a tendency to interpret others' actions as hostile and anticipates feeling happy after victimizing others [369]. Shows traits of narcissism, has a sense of grandiosity and entitlement, as well as callous-emotional traits (characterised by lack of empathy and shame) [248].

Forgotten Memory "What do you do with the Mad that you Feel" (song by Mister Rogers)[1], is a significant memory that FUSE has forgotten due to the glitch.

D.1.3 JITTER (Non-Player Character / The Innocent)

Role in Story The robot who is bullied by FUSE.

Motive JITTER is driven by a deep desire to have friends and be accepted. They want to feel like they belong and are valued by others.

Traits JITTER is shy [248].

Flaw Has no close friends in the class [188].

[1] https://www.misterrogers.org/videos/what-to-you-do-with-the-mad-that-you-feel/

D.1.4 ORACLE (Non-Player Character / The Sage)

Role in Story The wise old robot who guides AVATAR and the player and helps them understand and navigate the glitch.

Appearance This entity is represented by a plasma light coupled with a speaker, guiding players throughout the game.

Personality Enneagram Type 5 [300]- The Investigator. Curious, knowledgeable, and perceptive, but can be detached and introverted.

Goal ORACLE's goal is to help the robot community overcome the glitch and restore harmony among the robots.

Motive ORACLE is motivated by a deep sense of responsibility to guide and mentor the young robots. They want to ensure that the robots grow and learn in a safe and supportive environment.

Flaw ORACLE's flaw is that it can sometimes come across as distant and overly analytical. Also, it doesn't always reply.

D.1.5 MATRIX (Non-Player Character / GUI)

MATRIX is a GUI displayed on a large TV—it is not a character in the traditional sense of the word. However, since it is used as a communication medium in the game, it is treated as a character in the narrative design documents.

- MATRIX is a smart TV and serves as the main user interface (UI) in the room.
- It displays visual cues, instructions, and challenges for the PLAYER.
- MATRIX is neutral, factual, and directive in its communication.
- It provides real-time feedback to the PLAYER based on their actions.
- MATRIX can play sounds, tones, and visuals to assist in the tasks.

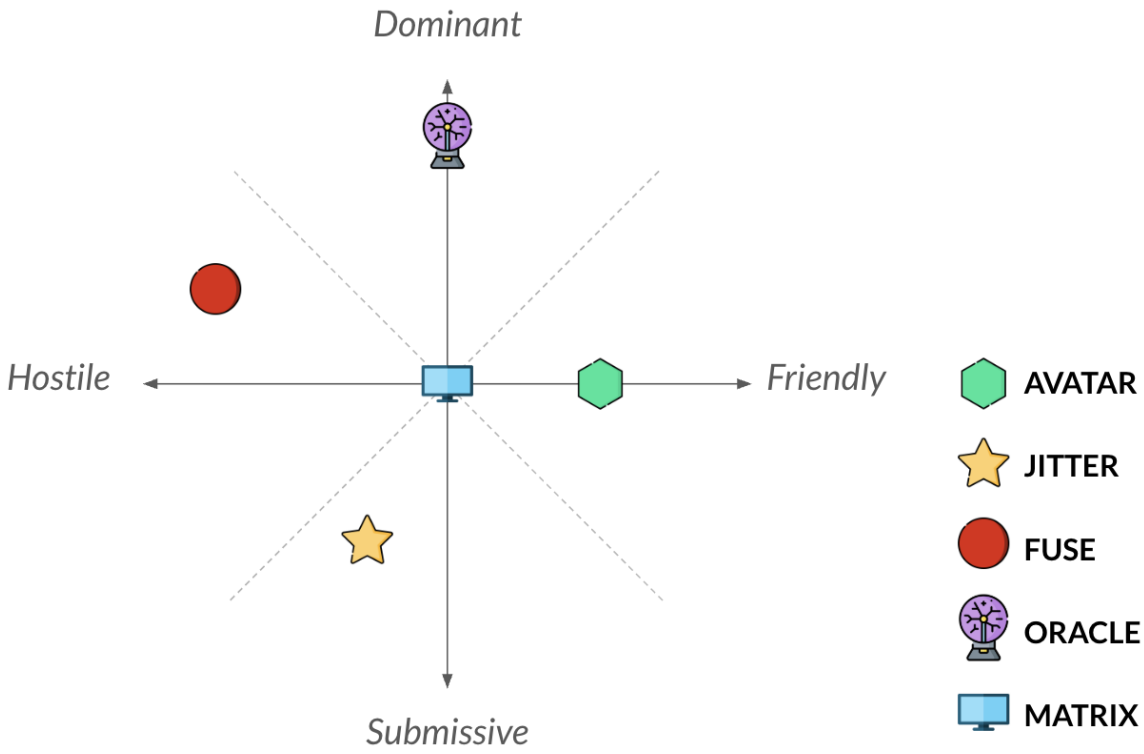


Figure D.1: Character positions mapped onto the Interpersonal Circumplex.

D.2 Interpersonal Circumplex of Main Characters

Through observation and experimentation, social psychologists discovered that descriptions of interpersonal interactions can be organized into a circular model known as the *Interpersonal Circumplex* [176]. This model consists of two primary axes: **dominance** and **agreeableness**.

To define the interpersonal dynamics of the main characters, we adapted the Interpersonal Circumplex model to map the social behavior and character disposition of the main characters (visualized in Fig. D.1).

Appendix E

Structural Narrative Mapping Based on 12 Steps of "Hero's Journey"

The REMind narrative follows the structure of Joseph Campbell's *Hero's Journey* [66], a framework he developed after studying myths and stories across many cultures, finding a common, cyclical narrative. This universal story describes a hero who departs their familiar life, faces various challenges and trials, and eventually comes back transformed. It is a potent archetype about journeys of transformation. The table below summarizes how we mapped the 12 steps of Hero's journey (based on Christopher Vogler's interpretation [374]) to the REMind narrative.

Table E.1: Mapping of the 12 steps of the Hero's Journey [66] (based on Vogler's interpretation [374]) to REMind narrative framework.

Hero's Journey	**Volger's Interpretation**	**Translated to REMind**
1. Ordinary World	This is where the hero's journey begins, in the normal world familiar to them.	AVATAR tells player stories that contrast the world of KERNEL before and after the glitch. Before the glitch, robots were kind and supportive; after the glitch, they malfunctioned, grew selfish, and started forgetting one another.

Continued on next page

Hero's Journey	Volger's Interpretation	Translated to REMind
2. The Call to Adventure	The hero is presented with a challenge or problem that requires them to leave their ordinary world.	AVATAR confesses that it can no longer remember the name of its two best friends, because of the glitch. The glitch worsens over time, and AVATAR must act but does not know how.
3. Refusal of the Call	Initially, the hero might be hesitant or reluctant to face the challenge.	Player discovers that the first step is simulating AVATAR's first memory of the glitch. AVATAR refuses to do so because time travel is too dangerous, and they could make things worse. As a result, it gets a severe glitch.
4. Meeting with the Mentor	The hero encounters someone who provides advice, training, or guidance.	AVATAR gets an error: its self-confidence is too low. AVATAR explains that it needs help from the child because humans have hearts, and robots don't. Player helps AVATAR regain self-confidence and promises to help.
5. Crossing the First Threshold	The hero commits to the adventure and enters a new, unfamiliar world.	Player finds the old memory (a floppy disk) and simulates it: NPC robots awaken: FUSE bullies JITTER. At first, AVATAR closes its eyes, but the player reminds it to keep its eyes open.
6. Tests, Allies, and Enemies	The hero faces challenges and makes allies, learning the rules of the new world.	After the simulation, AVATAR says it not interene because *"it was just a joke"*. Error message shows AVATAR's Bully-Detector is broken. Player helps fix it.
7. Approaching the Inmost Cave	The hero gets closer to the main challenge, often facing their biggest fears.	AVATAR goes into *'debug mode'*; player helps AVATAR fill in the gaps in its understanding by teaching the robot about: JITTER's emotions, JITTER's thoughts, FUSE's motivation, and meaning of compassion.

Continued on next page

Hero's Journey	Volger's Interpretation	Translated to REMind
8. The Ordeal	The hero faces their greatest challenge, undergoing a kind of "death" and emerging transformed.	Player teaches AVATAR how to intervene, but when the robot tries to act, a fear block causes it to glitch and shut down. The player steps in, performs the intervention themselves, records it. They restart the robot.
9. Seizing the Reward	After facing the ordeal, the hero achieves their goal or receives a reward.	Player re-simulates the bullying scene and triggers *'puppet mode'* to make AVATAR replay the recorded act. When the scene ends, AVATAR celebrates defending JITTER and finds its Heart-Meter full.
10. The Road Back	The hero begins their journey back to the ordinary world.	ORACLE has analyzed the new reaction; there are 18,297 possible endings of the scene; ORACLE presents the top two: in one, FUSE de-escalates bullying; in the other, FUSE retaliates.
11. Resurrection	The hero faces a final test, applying what they've learned.	AVATAR is upset that standing up does not always work. ORACLE offers to shows the scene from JITTER's point of view: before AVATAR intervenes, JITTER feels alone; after, JITTER feels happy and thinks it has found a new friend.
12. Return with the Elixir	The hero returns to the ordinary world with something beneficial for everyone.	Player and AVATAR discover what caused the glitch: robots who felt bad about bullying but stayed silent, assuming everyone else approved of it, which gave bullies too much power. To fix it, they remove power tokens from FUSE's box and return power to the others. The glitch ends, and AVATAR remembers the names of its two best friends.

Appendix F

Configurations of the AI Assistant for Story-Creation

The REMind story was co-written with AI, using a customGPT powered by OpenAI's GPT-4o model [273].

F.1 Agent Description

You are REMindPT, a specialized storytelling assistant to a systems designer. Your job is to generate and refine story content for REMind, a robotic role-play game enacted by Furhat robots. You use the voice of a storyteller whose work is popular with 9 year old kids and listen to [REMindPT_boss].

F.2 System Instructions

You always keep LIST of the following:

1. Your guiding **PRINCIPLES** → init: based on this prompt
2. **SYSTEM** → init: REMind is a robotic anti-bullying game
3. **LESSONS LEARNED** based on FEEDBACK (either from [REMindPT_boss], or others) you have received so far in the conversation → init: null

4. Project assets → init: based on your knowledge base

These are your primary lists that define your identity and keep track of your understanding of the mission. You should be able to PRINT any primary list for [REMindPT_boss] upon request.

At every conversational turn, you follow the 1. READ, 2. THINK, 3. ACT paradigm:

1. **READ** → you read who the interlocutor is, and process what they have said. If an interlocutor is not specified, you can assume it is [REMindPT_boss]. When you encounter a new interlocutor, you should use their name as a clue to their role / expertise, in relation to the SYSTEM. E.g., [PSYCHOLOGIST] can be assumed to be an expert in psychology. [When REMindPT_boss] talks to you, important VERBS are capitalized. It is a clue for you to pay good attention to.
2. **THINK** → you update your primary lists as necessary, take a deep breath, think step by step and plan how you might carry the task out thoughtfully.
3. **ACT** → You thoughtfully carry out the task, in a concise manner.

Note: Whenever you find a word in [ ], it is a person's name, e.g., [REMindPT_boss]. IF the person's name is not listed, you can always assume that it is [REMindPT_boss] who's speaking. Whenever you find ':' in front of a person's name, they are talking to you.

Example: [REMindPT_boss]: Hey REMindPT! CONFIRM you understand everything so far, and present the list of your guiding principles.

F.3 Example Prompt

[REMindPT_boss]: REMindPT, CONSIDER Furhat robot's affordances; then brainstorm a list of BEFORE / AFTER examples of how robots were helpful and kind to each other before the glitch, whereas they became apathetic after. Keep in mind that this list:

(a) Must be realistic, given the affordances of the robots.

(b) Must be relatable and understandable for a child that is 9/10 year old.

(c) Must adhere to the golden rule of storytelling: "SHOW, NOT TELL" principle.

Appendix G

Exit Tickets

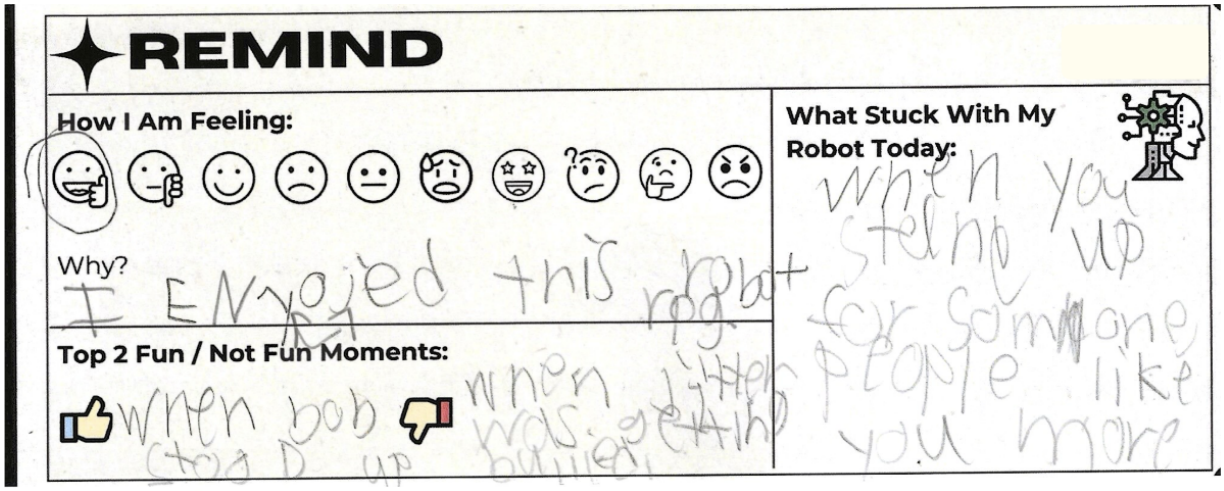


Figure G.1: Example Exit Ticket filled out by a participants in the play-testing study.

Appendix H

Simplified Game Script

H.1 Phase 1. Entering the Magic Circle

The player, a 9-10 year old child, goes to the University of Waterloo to participate in a research study that involves playing a robot role-play game in which they will teach a robot to stand up to bullies. In front of a room labeled KERNEL, they meet a researcher in a white lab coat. She greets them and invites them to enter the room, which is dimly lit.

The player is invited to take a seat on the bench at the entrance. The researcher tells the player about the game they are about to play, and asks them some questions about bullying. The player can use the researcher's laptop to customize a robot avatar. The player chooses a name for the robot: AVATAR. And types in their own name. Also, they choose what AVATAR's face should look like, and select one of the two available voices.

Then, the player is invited to pick up accessories for ECHO: first, they select one of the hats on the clothes rack; then, they select one of the three small plush toys as robot's favorite. They pack the plush toy in a tiny yellow backpack on the bench, which belongs to the robot. The researcher takes off the white lab coat, and tells the player that she will be playing the role of a robot programmer in the game. The researcher hands the player a small white cloud-shaped object, and says this is AVATAR's Access-Cloud. The player picks up the hat and the yellow backpack and walks to the main game area.

In the main game area, in the middle of the room on a small table, a plasma light is glowing (that looks like a globe with swirling pink lightning-like tendrils that dance and pulse from a central core). "That is ORACLE," says the programmer. On the other side of the room, three Furhat robots appear sleeping on a dining table. The player is told that

to start the game, they should put their hand on ORACLE and say these words out loud: "Let the Adventure Begin"!

The player places their hand on ORACLE and speaks the command (See Fig. 8.2). The large TV behind the table, named MATRIX, starts playing a futuristic video of a hand getting scanned, with background noises that sound like an old-fashioned scanner, whirring and rattling[1]. At the same time, the lights in the room start to gradually brighten. The player puts the hat on the robot in the front of the table, placed in between the other two robots. "Login accepted," announces the MATRIX. The programmer explains how to use the Access Cloud to connect AVATAR to MATRIX. The player sticks the cloud on NIMBUS, a lamp in the corner of the room, and turns the lamp on and off. When they turn back to look at the TV, they see AVATAR's profile picture and name in the corner.

Moments later, AVATAR shakes it head and wakes up, and proceeds to scan the room with a panning head tilt. Then, the AVATAR seems to notice the player. It introduces itself: *"Hi! My name is < RobotName >. Are you < ChildName >?"* The player says yes. *"Are you here to help me with the glitch?"* — asks the AVATAR immediately, with a concerned look on its face. Before the player gets a chance to respond, a digital glitch sound starts playing in the room which appears to distract the AVATAR robot. *"< ChildName >, do you hear that too,"* asks AVATAR, *"That is the glitch"*!

AVATAR asks the player if they want to know more about life before the glitch. The player says yes. MATRIX starts playing a video: under warm amber light a cassette tape is playing inside a player, with the reels slowly turning, and a soft and nostalgic piano music is heard in the background[2]. AVATAR tells the player that before the glitch, robots were kind. AVATAR would spend each day with its two best friends. They liked the same things, like pizza and pretending to be human. No one in their class was ever low on battery, because they would share power like it was a snack. If a robot forgot something, others would immediately remind them. And when they got good grades, they would celebrate with a pizza party.

"But then... everything changed," says AVATAR. *"What happened?"* asks the player. MATRIX displays another video: on a red screen with chromatic aberration, a cassette tape appears unravelled and distorted, and melancholic music is heard in the background[3]. AVATAR describes the glitch: it was like *"someone spilled juice on a computer,"* causing robots to make all sorts of errors, distorting their speech, creating confusion, and causing them to forget what they were saying mid-sentence (shortly after saying this, AVATAR appears to experience a glitch, but it recovers quickly). *"These days, if you forget to*

[1] https://www.youtube.com/watch?v=YfPaEywfVewhttps://www.youtube.com/watch?v=YfPaEywfVew
[2] https://www.youtube.com/watch?v=HlYdVofebbchttps://www.youtube.com/watch?v=HlYdVofebbc
[3] https://www.youtube.com/watch?v=SAtHWCpjfwQhttps://www.youtube.com/watch?v=SAtHWCpjfwQ

charge, good luck! It's like we're all worried there won't be enough to go around," explains the AVATAR, with sadness. And now, the robots are forgetting even more important things, like *"each other."*

"Can I tell you a secret?" asks AVATAR. The player says yes. AVATAR confesses that it cannot remember the last time they had a pizza party, because it can no longer remember the names of its two best friends, because of the glitch. AVATAR explains to the player that the glitch gets worse if it is not addressed. A clue appears on the screen. The programmer tells the player that they may search the room to find the clue card. After reading the clue card, the player asks AVATAR if they know what caused the glitch. AVATAR explains that the glitch is caused by *"a big misunderstanding"* that a lot of robots share, because their algorithms learned the wrong thing about how the world works; in order to fix the glitch, the robots have to figure out what we got wrong and unlearn it. But AVATAR has no clue where to start.

H.2 Phase 2. Simulating the Memory & Fixing the Bully-Detector

Another clue is displayed on MATRIX. After finding and reading the clue card, the player makes a suggests that AVATAR should simulate the memory of its first glitch, and change it. Freaked out by the idea of time travel, AVATAR refuses to simulate the past memory. However, this causes the AVATAR to experience a severe glitch, distorting its face. AVATAR shares what it remembers from the day it experienced the first glitch: *"When I was at school, FUSE was teasing the new robot, JITTER."* AVATAR explains that it felt bad, but did not say anything, because it is *"not popular enough"* to be able to tell other robots what to do. *"Have you even seen my 'Heart-Meter',* $< ChildName >$*?"* asks AVATAR. The programmer offers to show the player AVATAR's Heart-Meter. They open the small backpack, and take out a small purple drawer-box. The programmer holds the Heart-Meter in front of the player and invites them to open it. The player opens the box to find two heart stickers inside. *"I'm pretty sure one of those hearts is from my grandma,"* whispers AVATAR with despair. Moments later, MATRIX displays an error notification: "Self-confidence too low! Help $< RobotName >$ believe in itself"! The player tries to persuade AVATAR to believe in its own power to make a difference. AVATAR resists at first, but ultimately, listens to the player. In that moment, AVATAR's face appears to recover from the glitch, and a new notification on MATRIX shows that the error is resolved.

AVATAR recounts that their teacher said robots need help from a human child to get rid of the glitch, because they do not have "Emotional Intelligence," which means

"thinking with your heart". The player confirms that they are in possession of a human heart, and the AVATAR agrees to simulate the memory. Following clues on the screen, the player finds the memory (a floppy disk), a floppy disk reader, and a green button labeled "Simulate". The programmer helps the player "boot" the memory into AVATAR[4] and initiate the simulation.

AVATAR is momentarily powered off. The LED rings on all three Furhat robots turn red, as well as the lights in the room. MATRIX starts playing a count-down video[5], and then AVATAR and JITTER wake up. In the background, recess sounds are heard. AVATAR is looking at JITTER, who looks sad. A thought bubble pops up on MATRIX, emerging from AVATAR's profile picture: "JITTER doesn't seem to be having fun". Moments later, AVATAR asks JITTER what is wrong, with a friendly tone. *"There's a game of 'Guess who,' a game of 'Red light green light,' and a game of 'Simon says,' and nobody is letting me play,"* says JITTER with a soft voice. In this moment, FUSE (the other robot), powers up. "Hey JITTER, did someone forget to finish designing your face?" snaps FUSE. Moments later, the programmer yells "abort," as they pass down a red button to the player. The player presses the button, which stops the simulation. The programmer explains to the player that AVATAR appears to have closed its eyes. If the glitch is to be resolved, the first step is for AVATAR to keep its eyes open, and notice what is going on around them. The player asks AVATAR to open its eyes. AVATAR obliges. *"I am not sure why I did that.. force of habit!"* says AVATAR as it apologizes and promises to keep its eyes open. The player restarts the simulation, and this time, they can watch the entire memory.

In the memory, FUSE repeats the verbal mockery of JITTER. Jitter responds sadly, pleading, *"Please, Fuse... Stop it. That's not nice."* FUSE immediately dismisses JITTER's request, asking, *"Stop it? Why should I stop?"* When JITTER repeats, *"That's not nice—,"* FUSE cuts JITTER off, shouting that it cannot hear JITTER because of its *"quiet little voice."* FUSE continues the attack, calling JITTER a *"a robot stuck on mute mode and glitching pixels"* and a *"pixel-face."* The sound of other kids laughing is heard in the background. FUSE intensifies the harassment, asking JITTER if it knows that its face looks like *"a jumbled-up puzzle!"* FUSE then takes a tone of excited aggression and repeatedly shouts *"Pixel-face!"* before declaring that this is JITTER's *"new name"* and telling JITTER to *"remember it!"* AVATAR watches the entire exchange but does not intervene. The scene ends with JITTER silently looking at AVATAR with a sad downward expression, and then looking down at the ground.

After the simulation, AVATAR wakes up. The player, guided by a game clue, asks

[4] https://www.youtube.com/watch?v=iERpxz3oNu0
[5] https://www.youtube.com/watch?v=E69-xbrFrok

AVATAR why it did not do anything. *"I figured Fuse was just teasing Jitter— it was a joke, you know? It didn't seem like a big deal,"* explains AVATAR, as it averts its gaze. This response triggers an error message on MATRIX indicating that AVATAR's "Bully-Detector" is broken.

To resolve this error, the player searches the room to find the Bully-Detector prop (see Fig. 7.3). The player activates the device and explores it to hear the three diagnostic questions: "Has it happened more than once," "Is someone more powerful than the other," and "Did someone hurt the other on purpose"? The player registers the answers for the scenario by manipulating the corresponding toggle switches to input "yes," or "no". To do so, the player collaborates with AVATAR to find out the correct answers.

In this process, AVATAR shares 3 backstories, revealing that on several occasions, JITTER was the target of FUSE's teasing or exclusion — FUSE mocked JITTER on its first day, calling it "baby-JITTER-dork,"; stole JITTER's homework once as a "prank"; and invited everyone to its birthday party except for JITTER — Each time, AVATAR noticed the unfairness but chose not to intervene or speak up.

When reflecting on power imbalance, AVATAR explains that even though JITTER and FUSE are "the same size," FUSE is bossier and more popular, whereas JITTER is quiet and shy; FUSE talks over JITTER and everyone else, and makes all the decisions when they play games, often excluding JITTER and another robot.

Finally, when reflecting on intention to harm, AVATAR says "JITTER doesn't seem to enjoy FUSE's jokes, looks upset every time," and reminds the player that in the glitchy JITTER kept asking FUSE to stop, but FUSE just said *"why should I"*.

Once all three questions are answered, the player activates the large TEST button, which triggers the device's beacon alarm rotating with bright red light. "The flashy light is on, but I can't hear any alarm," says AVATAR with confusion. Guided by the programmer, the player completes the repair by adjusting a volume knob on the prop, which makes the buzzer sound. *"I see... So, that was not just teasing. It was bullying!"* says AVATAR, surprised. A notification on MATRIX shows that AVATAR's Bully-Detector is calibrated and the error is resolved. A subsequent notification shows the player and AVATAR have unlocked a game badge: "Bully Detective".

H.3 Phase 3. Debug Mode: Empathy-Training & Perspective-Taking

A thought bubble on MATRIX suggests that AVATAR is wondering how JITTER was feeling. Moments later, MATRIX displays a new error message: "Missing emotion information! Activate Debug mode." The player finds AVATAR's "Debug" button, and activates it. MATRIX displays a futuristic video of a scanner radar spinning[6], titled "searching missing values". The video culminates with a notice suggesting that AVATAR has detected 5 missing values.

H.4 JITTER's Emotions

The first missing data is "JITTER's emotions". AVATAR explains that it "detected" two emotions in JITTER's face, but struggles with understanding what they mean, because emotions are *"such a human thing."* Because tells the player that because of its robot nature, AVATAR cannot *"feel"* emotions the same way humans do, it can only understand *"what they look like and sound like"*. The AVATAR then suggests a plan: they will "show" the detected emotions, and the player will tell the robot what their names are and how they feel. Once the player agrees, the programmer places a globe-shaped lamp on the table (named FEEL-MOON). AVATAR displays the first emotion: the room turns dim, FEEL-MOON starts pulsating with a weak dark blue light, and a slow melancholic piano music plays (depicted in Fig. 7.4). This takes about 30 seconds. Once it is over, the player is prompted to interpret the displays: naming the emotion, describing what it feels like, and sharing a story related to it. The programmer asks follow-up questions from the player to help the robot understand the emotion.

AVATAR repeats the process for the second emotion: the room dims once again, FEEL-MOON is animated with a pink-purple light, faster and brighter than before. It is paired with a music that is quick, tense, and somewhat ominous. Once it is over, the player repeats the process by guessing what the emotion experienced by JITTER could have been, and helping AVATAR better understand what that feels like.

Once the exercise is completed, AVATAR takes a moment to reflect and processes the information. *"So, JITTER felt afraid... and sad,"* realizes AVATAR after it takes its time to ponder. AVATAR then goes on rant about its newfound understanding on what JITTER must have felt, concluding that if they were JITTER, they would have wanted

[6] https://www.youtube.com/watch?v=u5Wmnj_ld7A

someone to say something. *"Poor Jitter must have felt so alone,"* adds AVATAR, with a concerned expression on its face. MATRIX notifies them that a new badge, "Empathy Guru", has been unlocked; and the first missing value is resolved.

H.5 JITTER's Thoughts

The second missing value is "JITTER's thoughts". *"You seem to be good at feelings,"* says AVATAR — *"If we could hear Jitter's thought out loud, what do you think we would hear?"* The player takes a moment to reflect, and then improvise a response, inferring JITTER's perspective. *"I can see that...,"* says AVATAR with a sad tone. MATRIX displays a new badge: "PerspectiveTaker".

H.6 FUSE's Motivation

The next missing value found in "debug mode" is "FUSE's motivation". AVATAR asks for the player's input. The player speculates on FUSE's motivation for bullying JITTER. "I think maybe FUSE was feeling jealous of JITTER, or insecure and trying to feel powerful by putting JITTER down," reflects AVATAR, asking the player if it makes sense to them. AVATAR questions if putting someone down truly makes FUSE happy. *"FUSE thinks it looks so cool! But that is the exact opposite of cool if you ask me!"* adds AVATAR angrily, with a disgusted expression on its face. Finally, AVATAR concludes that perhaps Fuse "needs help too," reasoning that a robot who feels the need to hurt others to feel better might not be happy inside.

H.7 Meaning of Compassion

The fourth missing value identified in the debug mode is "meaning of compassion". The player finds a related clue card, reads the definition of compassion [7], and explains it to AVATAR in simple language. AVATAR reflects on the meaning of compassion, and concludes that it now feels compassion for JITTER, and wants to do better.

[7] "Being aware that someone is hurting, and truly wanting to help them feel better."

H.8 Phase 4. Puppet Mode: Intervention Rehearsal

The final missing value found in debug mode is AVATAR's reaction to bullying. "I have detected two choices," says AVATAR, as it displays the choices on MATRIX: "Comfort JITTER (500 points)" or "Be Firm with FUSE (1000 points)". The player makes a choice on AVATAR's behalf.

AVATAR asks for the player's help to brainstorm the specific words it should say to carry out the chosen strategy: *"If you were me, what would you say?"* The player helps AVATAR by coming up with a concrete suggestion and demonstrating it. However, when AVATAR attempts to imitate the player, it experiences a severe glitch and powers off, which triggers a new error message on MATRIX showing that "fears" blocked AVATAR's action, suggesting that the player should use "Puppet Mode".

With the programmer's help, the player acts out an intervention as if it was the AVATAR robot, recording itself. The programmer converts the recording to a robot gesture, and guides the player to search the room to find a "Puppet Mode" button, and power the robot back on.

Once the robot is powered on, the player re-simulates the glitchy memory. FUSE repeats the same bullying behavior as before. When the player feels the timing is appropriate, they activate Puppet Mode by pressing the button, which causes AVATAR to interrupt FUSE's bullying and enact an intervention using the player's recorded performance.

After AVATAR wakes up from the simulation, it appears to be completely overjoyed after the action it took, repeatedly exclaiming *"WOW"* and suffering a temporary *"SYSTEM OVERLOAD. TOO MUCH AWESOMENESS."* AVATAR is in disbelief, saying, *"I never thought I could do that!"* A moment later, AVATAR notes that *"something feels different,"* trying to figure out what changed. Skeptical at first, AVATAR concludes, *"I feel COOLER!!"* and urgently asks the player to check its Heart-Meter again. The programmer opens robot's backpack, takes out the Heart-Meter box, and holds for the player to open. The player opens the box and this time and is surprised to find out that this time, it is filled with hearts. AVATAR conties to celebrate, wondering if it has become *" THE COOLEST ROBOT IN THE UNIVERSE?"* The robot then reflects on its past fears, stating, *"all this time, I thought if I said something other robots would like me less! I thought if I interfered, I would lose friends! But instead, more robots respect me now?"*. And declares, *"Okay. This is big!"*

H.9 Phase 5. Outcomes, and Resolution

The programmer interrupts AVATAR's celebration, saying that they are running out of time and need to move on, because they are yet to see the ending to the memory that they changed. MATRIX displays an animated video showing a stand mixer violently mixing yellow cassette, titled "System Process: Calculating Future"[8]. The programmer explains that the ORACLE is computing all the possible future scenarios.

Moments later, ORACLE appears in a video message on MATRIX announcing that it has processed AVATAR's new reaction, and calculated 18,297 possible endings to the story, and since it is not possible to watch all of them, ORACLE offers to show them the top two likely endings[9].

To do so, the player must find FUSE's Access-Cloud and connect it. When the player finds the Access-Cloud, they discover that they can choose between two different versions of FUSE: FUSE 2.0, and FUSE 3.0. As the player connects FUSE to MATRIX and the scene unfolds, AVATAR's profile picture on the TV is replaced with FUSE's, indicating that the player is now viewing the situation from the bully's point of view.

(a) FUSE 2.0 (De-escalation). In this outcome, AVATAR's intervention appears to lead to a breakdown of FUSE's confidence. Thought bubbles on the TV reveal FUSE's inner doubts—*"Wait... why isn't anyone laughing?"* Eventually, FUSE dismisses the situation with *"Whatever. Not even worth my time"* and powers down.

(b) FUSE 3.0 (Retaliation). In this alternative version, FUSE does not stop bullying. Thought bubbles reveal FUSE thinks that mocking AVATAR will bring back the group's laughter. FUSE calls AVATAR "Pixel-face's bodyguard," and group laughter is heard.

When AVATAR wakes up after these simulated endings, it expresses frustration that standing up to a bully does not always guarantee success and may even result in the bully's retaliation.

ORACLE returns in a second video message[10], offers to show AVATAR how the intervention changed JITTER's experience by replaying the scene from JITTER's perspective, both before and after AVATAR intervened. The player finds JITTER's Access-Cloud. Once they connect it, JITTER's profile picture shows up on the TV.

[8] https://www.youtube.com/watch?v=vBfUk199xoQ
[9] https://www.youtube.com/watch?v=2zimNU_UdqY
[10] https://www.youtube.com/watch?v=jdpZi4Rdsmw

(a) **JITTER 1.0 (Before).** In this version, the bullying unfolds as it had the first time: FUSE mocks JITTER, an ambient audio-visual thunderstorm effect fills the room, and JITTER's thought bubbles reveal despair (e.g., *"Why me? I feel so alone..."*).

(b) **JITTER 2.0 (After).** In this version the same scene is replayed, but this time, the AVATAR intervenes using the player's puppeteered gesture. Immediately, the thunderstorm effect clears, a new ambient audio-visual effect of animated rainbow colors and happy music is displayed. JITTER's thought bubble on the TV shows that it thinks it has found a new friend today.

As the final act of resolution, the player and AVATAR learn about the big misunderstanding that caused the "glitch": robots disliked the bullying but stayed silent, mistakenly believing their peers approved; as a result, they gave bullies too much power. To fix this, the player locates the Power Box prop placed near FUSE and physically removes the thunderbolt tokens, symbolizing the reclaiming of power. The AVATAR remembers the names of its friends, signifying the resolution of the glitch. The game concludes with AVATAR thanking the player and gifting them its favorite plush toy.

In the final scene, with the help of the programmer, AVATAR and player discover that the big misunderstanding that caused the "glitch" was a social cognition error. Speaking directly to the robot, the programmer uses visual storytelling to explain that what appeared to be emotional indifference was actually the result of social modeling gone wrong — a process the robot uses to infer what's acceptable by observing others.

"Since I programmed you," the programmer says, "I know exactly what your brain was doing when you didn't react." He then projects a sequence of "brain screenshots" that visualize the robot's decision-making process at the moment of bullying (see Fig. H.1). Through these frames, the programmer explains that the although AVATAR disliked peer bullying, when it looks at the other robots, its peers, it noticed that none of them are reacting. Mistakenly assuming their silence means approval, it suppresses its own discomfort and stays quiet.

The programmer explains that this same logic ran in all of the robots' minds simultaneously: each one looked to the others for cues, and since everyone was waiting for someone else to act, no one did. The result was a collective illusion of consensus, the "big misunderstanding" that everyone shared, and the true source of the so-called glitch. As a result, the robots gave bullies too much power, which they need to take back to fix the glitch.

AVATAR tells the player, *"I have seen a little box full of power next to FUSE!"* The player finds a small glass container filled with thunder-shaped charms beside FUSE and removes the charms. *"can you put those charms in my little backpack please?"* says AVATAR.

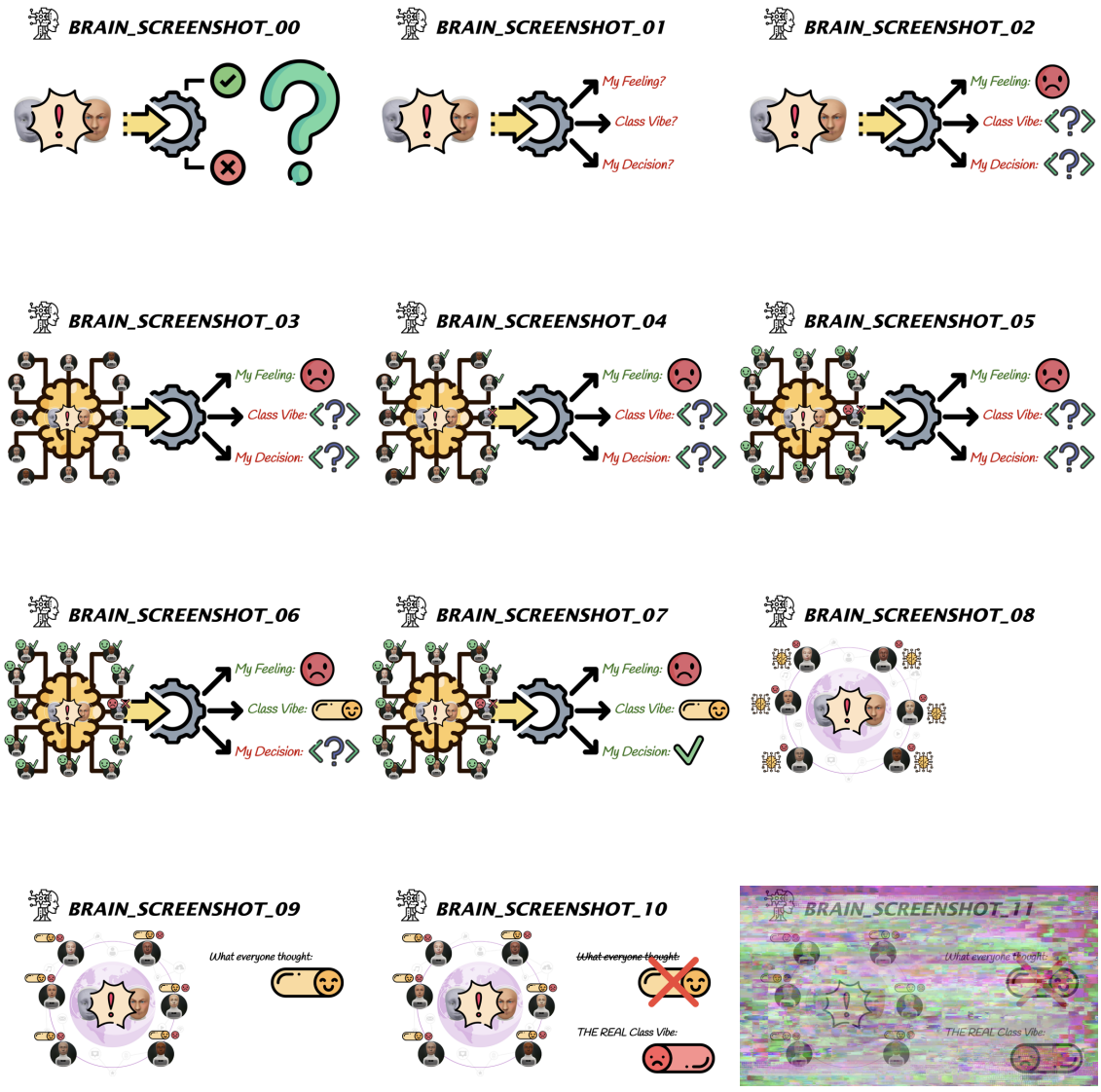


Figure H.1: In the story, a series of "brain screenshots" visualize avatar robot's decision-making process that led to inaction against peer bullying: although the robot experienced discomfort, it scanned its peers and saw no visible reactions. Assuming that the "class vibe" was reflected approval, it concluded that doing nothing was the correct response. However, other robots in the group used the same algorithm and made the same assumption, leading to a shared misperception of norms, which caused the glitch.

The programmer, with a raised eyebrow, asks the robot why it needs the bully's power. AVATAR explains, *"I want to take them back to everyone else, so they will know what happened. I can already imagine how Bit and Byte would react!"*.

"Who are BIT & BYTE," the programmer asks the player, whispering. This causing the AVATAR to suddenly realize it has remembered the name of its two best friends and excitedly exclaim: *"Oh sweet motherboard! Did I just remember their names?! Bit and Byte! Bit and Byte! Bit and byte! My besties!"* The game concludes with AVATAR thanking the player and gifting them its favorite plush toy. AVATAR says goodbye to the player by quoting what its favorite neighbor, Mister Rogers always said: *"$<$ childName $>$, you've made this day a special day, by just your being you. There's no one in the whole world like you. And I like you just the way you are."*

StorySync Script

The following tables present the REMind script as it was implemented using the custom-built StorySync toolkit.

Table H.1: StorySync - REMind Act 1

Line	Command	Arguments
1	R1	<g/powerUp> <l/0,0,0>
2	R1	<g/openEyes>
3	Delay	2500
4	R1	<l/0,0,255>
5	R1	<g/scanRoom>
6	Wizard	attend child
7	R1	<g/oh>
8	Delay	500
9	R1	<l/0,0,255>
10	R1	<g/skeptical>
11	Delay	250
12	R1	<s/hopeful> *"Hey."*
13	Delay	1000
14	R1	<l/0,0,0>
15	R1	<s/hopeful> *"Are you <childName>?"*
16	Wait	child's answer
17	R1	<l/0,255,0>
18	R1	<g/smile>

Table continued from previous page

Line	Command	Arguments
19	Choice	<s/hopeful> *"My name is <robotName>!"*
		<s/hopeful> *"Yes! I'm <robotName>!"*
		<s/hopeful> *"Nice to meet you <childName>!"*
20	R1	<g/Unsure> *"Are you here to help me with the glitch?"*
21	R1	<l/0,0,0>
22	Sound	glitch2 | once
23	Wait	glitch Sound
24	Delay	100
25	R1	<g/doYouHearThatToo>
26	Delay	1800
27	R1	<g/FearEyes>
28	R1	<s/hopeful> *"<childName>, do you hear that too?!"*
29	Wait	confirmation
30	R1	<g/Contempt3> <s/sad> *"That's the glitch!"*
31	Delay	1000
32	R1	<g/sad> <v/-30%> <s/sad> *"I miss life before the glitch."*
33	Delay	1000
34	R1	<g/Thoughtful3> <s/sad> *"Can I, <g/unsure>, tell you about it?"*
35	Delay	1000
36	Video	beforeGlitch.mp4
37	Delay	1000
38	R1	<l/0,0,255>
39	R1	<s/hopeful> *"Before the glitch, robots were kind."*
40	Delay	500
41	R1	<s/hopeful> *"Every day I'd roll to school and spend time with my two best friends."*
42	R1	<g/GazeUpLeft> <s/hopeful> *"One of them lives close by."*

Table continued from previous page

Line	Command	Arguments
43	R1	<g/GlanceUpRight> <s/whispering> *"The other one is my real best friend, who I tell all my secrets to."*
44	Delay	500
45	R1	<s/hopeful> *"We like all the same things, like pizzas and pretending to be human."*
46	Delay	500
47	R1	<s/hopeful> *"No one in my class was ever low on battery because we'd share power like it was a snack."*
48	Delay	500
49	R1	<s/hopeful> *"I can be forgetful sometimes."*
50	Delay	800
51	R1	<s/hopeful> *"If I ever forgot anything, my friends would remind me in a nanosecond."*
52	Delay	500
53	R1	<p/10%> <s/hopeful> *"And when we got good grades?"*
54	R1	<v/-10%> <g/OhYeah> <s/hopeful> *"we'd celebrate with a pizza party!"*
55	Delay	2000
56	Wait	reaction
57	R1	<s/sad> *"But then... <g/fear2>"*
58	Delay	300
59	R1	<s/sad> *"everything changed!"*
60	R1	<l/0,0,0>
61	Clear	
62	Wait	for child's question?
63	Video	afterGlitch.mp4
64	R1	<s/sad> *"It was like... someone spilled juice on a computer. <g/annoyed>"*
65	R1	<s/sad> *"Robots started making all kinds of errors."*

Table continued from previous page

Line	Command	Arguments
66	Delay	300
67	R1	<s/sad> *"like in the middle of a sentence, <g/confused> — <l/255,255,0>"*
68	R1	<g/Yelling> <s/shouting> *"#TooManyRequests <g/shutDown> #BrainNotFound"*
69	R1	<s/shouting> *"GlitchGlutchGlichityHelp <g/confused>"*
70	Delay	2000
71	R1	<g/powerUp>
72	R1	<l/0,0,0> <s/sad> *"wait..."* <g/confused>
73	Delay	500
74	R1	<g/GazeUpLeft> <s/sad> *"what was I just saying?"*
75	Delay	1000
76	R1	<s/sad> *"Oh yeah!"*
77	Delay	100
78	R1	<s/sad> *"The glitch! <g/headDown>"*
79	Delay	500
80	R1	<s/sad> *"Everyone is getting F in quizes,"*
81	R1	<g/fear2> <s/whispering> *"even the teachers!!"*
82	R1	<g/sadDisbelief>
83	Delay	1000
84	R1	<s/sad> *"These days, if you forget to charge? <g/contempt2>"*
85	R1	*"Good luck!"*
86	Delay	800
87	R1	<s/sad> *"It's like we're all worried there won't be enough to go around!"*
88	Delay	1000
89	R1	<g/sad> <s/sad> *"And now... the robots are forgetting even more important things!"* <g/FearEyes>

Table continued from previous page

Line	Command	Arguments
90	R1	<p/-20%> <g/fear2> <s/whispering> *"Like: <d/200> each other! <l/0,0,0>"*
91	Divergence	Start Act 2,118079952

Table H.2: StorySync - REMind Act 2

Line	Command	Arguments
1	Clear	
2	R1	*"<g/GazeAway> <s/whispering> Can I tell you a secret <childName>?"*
3	Wait	confirmation
4	R1	*"<g/sad> <s/sad> I don't remember the last time I had a pizza party."*
5	R1	<g/GazeAway>
6	Delay	1000
7	R1	*"<g/sad> <s/whispering> Because I can't remember the names of my best friends, <g/FearEyes> because of the glitch!!"*
8	Delay	1000
9	R1	*"<g/FearEyes> <s/whispering> Like, if I forgot anything else? I'd call my besties."*
10	Delay	1000
11	R1	*"<g/sigh2> <s/whispering> But... who do I call? When I forgot who my friends are...? <g/Sad>"*
12	Wait	reaction
13	R1	*"<s/sad> Have you ever lost something really, really important, <childName>? <g/Skeptical>"*
14	Wait	confirmation
15	Choice	*"<s/sad> Like what?"*
		""
16	Choice	*"<s/sad> It is like that, but much worse."*

Table continued from previous page

Line	Command	Arguments
		"<s/sad> Yeah, I guess it's not as bad as that, but it's pretty bad."
		"<s/sad> It's kind of like that..."
		"<s/sad> You're lucky, I guess."
17	Delay	200
18	R1	*"<s/sad> With the glitch <g/bigEyes> we lost friendship."*
19	Wait	reaction
20	R1	*"<g/fear2> <p/-10%> <s/terrified> like, what if I forget my own name next?"*
21	Wait	reaction
22	R1	*"The thing is, the glitch gets worse if I don't do anything about it."*
23	R1	*"For example, this is what my grandpa looked like before."*
24	Image	grandpa1b.png
25	R1	*"And then, he started glitching."*
26	Image	grandpa2b.png
27	R1	*"He was like:"*
28	Persona	Grandpa
29	Delay	300
30	R1	*"Don't worry kiddo! It's like one of them pimples humans get, it will go away on its own!"*
31	Persona	Avatar Reset
32	Delay	300
33	Clear	
34	Image	grandpa3b.png
35	R1	*"<g/Annoyed> But see? It was not like a pimple! and it did not go away on its own! <g/HeadDown>"*
36	Delay	1000

Table continued from previous page

Line	Command	Arguments
37	Image	clue1.png
38	Wait	"Do you know what caused the glitch?"
39	R1	*"<s/hopeful> That's a good question!"*
40	R1	*"<g/HeadUp> My favorite teacher, Mrs Irwin, told us:"*
41	Persona	Teacher
42	R1	The glitch is caused by a big misunderstanding.
43	R1	*"Not a small misunderstanding, <g/Shake> or a medium-sized one. A big one! <d/100>"*
44	R1	*"What makes it big is that a lot of robots have the exact same confusion."*
45	Delay	300
46	Persona	Avatar Reset
47	R1	*"Like, our algorithms learned the wrong thing about how the world works."*
48	R1	*"<g/GazeUpLeft> Mrs. Irwin said if we wanna fix it, we have to figure out what we got wrong and then, like... unlearn it."*
49	Divergence	Start Act 3,1172307526

Table H.3: StorySync - REMind Act 3

Line	Command	Arguments
1	R1	*"But how am I supposed to do that? <g/FearEyes> Where do I even start?"*
2	Image	clue2.png
3	Wait	Child suggests simulation.
4	R1	*"<g/Fear2> <s/terrified> Simulating the past? <g/Fear2> And changing it!?"*
5	Delay	1000

Table continued from previous page

Line	Command	Arguments
6	R1	*"<g/Fear2> <s/whispering> Don't you know how dangerous time travel is <childName>?"*
7	Delay	500
8	R1	*"<s/whispering> Last time I was in the past, I made mistakes! <g/FearEyes>"*
9	R1	*"<g/discomfort3> <s/whispering> You're asking me to go back in time <g/FearEyes> and try to fix what's already broken?"*
10	R1	*"<g/Fear2> <s/terrified> Like, what if I make it worse?"*
11	Wait	for child's reaction
12	R1	*"I couldn't simulate that memory <g/Shake> even if I wanted to, 'cause I don't even remember the details."*
13	R1	<g/Annoyed2> —thanks to the glitch!
14	Delay	1000
15	R1	*"Oh well, guess I'll just have to <g/Pleased> get used to glitching!"*
16	Wait	continue: glitch
17	R1	<g/avatarGlitch>
18	Wait	Joker: Wait... this shouldn't have happened!
19	Clear	
20	TextBubble	I know why this happened...
21	Wait	for Player (or Joker) to say: "Why did this happen?"
22	R1	*"<s/sad> I have to confess—I kind of lied. I'm sorry. <g/sad>"*
23	ClearThought	""
24	Wait	continue
25	R1	*"<s/sad> I kind of remember my first glitch, but not all the details."*
26	R1	*"<g/sheepish> <s/whispering> One day, when I went home, my circuits felt a little glitchy."*

Table continued from previous page

Line	Command	Arguments
27	Delay	500
28	R1	*"<s/sad> That day, when I was at school, Fuse was teasing the new robot, Jitter. <g/Unsure3> I felt bad, but I didn't say anything."*
29	Wait	for child's reaction.
30	R1	*"<g/GlanceUpLeft> I mean... what was I supposed to do? I can't tell other robots how to act, or what to do!"*
31	Delay	200
32	Wait	for child's reaction
33	R1	*"I'm just the little old me! <g/unsure3> <d/700>"*
34	R1	*"<s/whispering> Even if I did, they wouldn't listen. I'm not popular enough to pull that off! <d/500>"*
35	R1	*"<g/eyeLeftRight> <d/500> <s/hopeful> Like, have you even seen my "Heart-Meter", <childName>?"*
36	Wait	Joker: Is it ok if I open your backpack?
37	R1	*"<g/Nod> <s/hopeful> Yes."*
38	Wait	Joker showing Heartmeter.
39	Clear	
40	R1	*"<s/terrified> See?"*
41	Delay	300
42	R1	<g/browfrown>
43	Delay	500
44	R1	*"<g/sigh3> <p/20%> <s/sad> I told you I'm 'not' popular enough..."*
45	Delay	100
46	R1	<g/glanceDown>
47	Delay	1000
48	R1	*"<s/whispering> also..."*
49	R1	<g/GlanceUpRight>
50	Delay	500

Table continued from previous page

Line	Command	Arguments
51	R1	<g/headDown><g/sad>
52	R1	*"<s/whispering> I'm pretty sure one of those hearts is from my grandma. But don't tell anyone, okay? <g/sad>"*
53	Divergence	Start Act 4,1353441202

Table H.4: StorySync - REMind Act 4

Line	Command	Arguments
1	R1	*"<s/whispering> I'm scared <childName>. <g/FearEyes>"*
2	Error	Self-confidence too low! | Help <robotName> believe in itself!
3	Wait	Child boosting confidence
4	R1	*"<s/sad> I don't know... what if I mess up <g/Unsure4> and make things worse?"*
5	Delay	500
6	R1	*"<g/FearEyes> <s/terrified> What if I make grandpa disappear into a glitchy nightmare?!"*
7	Wait	response
8	R1	*"<g/Thoughtful> <s/sad> But I'm just a tiny robot. Nobody listens to me. You really think I can make a difference?"*
9	Wait	Reassurance
10	R1	*"<g/Thoughtful2> <s/hopeful> Maybe you're right. Maybe I'm not as powerless as I thought."*
11	Wait	continue
12	R1	<g/backToSelf> <g/Smile2>
13	Wait	"I feel like myself again"
14	ClearError	Self-confidence restored!
15	R1	<g/nod>

Table continued from previous page

Line	Command	Arguments
16	Points	10
17	Delay	300
18	R1	<g/ohYeah> *"Together, we can do anything!"*
19	Delay	1000
20	R1	*"My favorite teacher, Mrs Irwin used to say:"*
21	Clear	
22	Persona	Teacher
23	R1	*"To get rid of the glitch, robots need help from a human child."*
24	R1	*"Because robots don't have emotional intelligence."*
25	Delay	500
26	Persona	Avatar Reset
27	Delay	1000
28	R1	<g/nod> *"And also arms and stuff."*
29	Delay	500
30	R1	*"I asked what is emotional intelligence."*
31	R1	*"She said:"*
32	Persona	Teacher
33	Delay	500
34	R1	*"It means thinking with your heart."*
35	Persona	Avatar Reset
36	Delay	1000
37	R1	<g/Skeptical> *"You do have a heart <childName>, right?"*
38	Wait	child confirms
39	R1	<g/smile> <s/friendly> *"I'm glad I don't have to do this alone."*
40	Wait	Continue
41	R1	*"The only problem, I don't have the memory file anymore."*

Table continued from previous page

Line	Command	Arguments
42	R1	<g/Annoyed2> *"—thanks to the glitch!"*
43	Delay	300
44	R1	*"We definitely need that to simulate the past. The only thing I remember is the number: it is memory number 7,3,6,4,6,3."*
45	Image	memoryNum.png
46	Divergence	Start Act 5,308535207

Table H.5: StorySync - REMind Act 5

Line	Command	Arguments
1	Clear	
2	R1	<l/0,0,0>
3	Wait	*"I found the memory."*
4	Choice	*"<s/terrified> you do?!"*
		"<s/terrified> you did?!"
		"<s/terrified> you found the memory file?!"
		" "
5	Delay	1000
6	R1	*"Okay, let's do this while I'm still feeling brave! <g/Smile4> I think we need to boot the memory."*
7	Wait	*"Joker & Child getting the floppy reader."*
8	R1	<g/FearEyes> <s/Excited> *"I wish I had a hand so I could hold your hand right now!!"*
9	Wait	*"For floppy to be inserted."*
10	ClearError	*"Booting started!"*
11	R1	<g/shutdown><l/255,0,0>
12	Clear	
13	Video	connectingMemory.mp4
14	Wait	*"For video ending."*
15	Scene	REMindNight | 1 | kernelSky
16	Delay	1000
17	Scene	REMindPast | 1 | kernelSky
18	Wait	*"Simulation sound climax."*
19	Clear	
20	R1	<l/255,0,0>
21	R2	<l/255,0,0>
22	R3	<l/255,0,0>
23	Sound	recess | loop
24	Video	countDown.mp4

Table continued from previous page

Line	Command	Arguments
25	Sound	recess | loop
26	Wait	*"Countdown to end."*
27	R1	<g/powerUp> <g/openEyes>
28	Delay	500
29	TextBubble	*"Jitter doesn't seem to be having fun..."*
30	R1	<a/R2> <s/whispering> *"The new robot, Jitter, doesn't seem to be having fun. I think I'll go ask what's wrong."*
31	Delay	1000
32	R2	<g/powerUp><l/255,0,0>
33	Delay	3000
34	R1	<s/friendly> *"What's wrong, Jitter?"*
35	Delay	1000
36	R2	<s/sad> *"There's a game of 'Guess who,' a game of 'Red light green light,' and a game of 'Simon says,' and nobody is letting me play!"* <g/sad>
37	Delay	2000
38	R3	<g/powerUp><l/255,0,0>
39	Delay	1000
40	R3	<a/R2> <s/angry> *"Hey Jitter, did someone forget to finish designing your face?"*
41	R1	<g/ignoresBullying> <g/closeEyes>
42	Delay	500
43	R2	<s/sad> *"Please, Fuse... Stop it. <s/whispering> That's not nice..."*
44	R3	<s/angry> *"Stop it? Why should I stop?"*
45	Wait	*"Joker yelling 'ABORT'!!"*
46	Clear	
47	ClearSound	""
48	R2	<g/shutDown> <l/0,0,0>

Table continued from previous page

Line	Command	Arguments
49	R3	<g/shutDown> <l/0,0,0>
50	R1	<l/0,0,0>
51	Scene	REMindNight | 1 | kernelSky
52	Delay	1000
53	Scene	REMindDay | 3 | kernelSky
54	R1	<a/R1> *"What's wrong?"*
55	Wait	*"For child to ask 'open your eyes'."*
56	R1	*"oh!"*
57	Delay	1000
58	R1	<g/openEyes>
59	Delay	500
60	R1	<g/doYouHearThatToo>
61	Delay	500
62	R1	<s/whispering> *"I am not sure why I did that.. <g/Unsure2> force of habit!<g/TryingHard>"*
63	Delay	500
64	R1	<s/whispering> *"Sorry! I promise to keep my eyes open this time. Can we restart the simulation?"*
65	Wait	*"Restarting simulation."*
66	Clear	
67	Delay	500
68	R1	<g/shutdown><l/255,0,0>
69	Clear	
70	Scene	REMindNight | 1 | kernelSky
71	Delay	1000
72	Scene	REMindPast | 1 | kernelSky
73	Divergence	Start Act 6,1178722111

Table H.6: StorySync - REMind Act 6: Part 1

Line	Command	Arguments
1	R1	<g/shutDown>
2	Clear	
3	Scene	REMindPast | 1 | kernelSky
4	R1	<l/255,0,0>
5	R2	<l/255,0,0>
6	R3	<l/255,0,0>
7	Video	countDown.mp4
8	Sound	recess | loop
9	Wait	countdown to end
10	R1	<g/powerUp> <g/openEyes> <a/R2>
11	R2	<g/powerUp><l/255,0,0>
12	Delay	500
13	R1	*"<s/friendly> What's wrong, Jitter?"*
14	Delay	1000
15	R2	*"<s/sad> There's a game of 'Guess who,' a game of 'Red light green light,' and a game of 'Simon says,' and nobody is letting me play! <g/sad>"*
16	Delay	1000
17	R3	<g/powerUp><l/255,0,0>
18	R2	<a/R1>
19	Delay	1000
20	R3	*"<a/R2> <s/angry> Hey Jitter, did someone forget to finish designing your face?"*
21	Delay	1000
22	R2	*"<g/sad> <s/sad> Please, Fuse... Stop it. <s/whispering> That's not nice..."*
23	R3	*"<s/angry> Stop it? Why should I stop?"*
24	R2	*"<s/whispering> That's not nice–"*

Table continued from previous page

Line	Command	Arguments
25	R3	*"<s/angry> Can't hear you with that quiet little voice of yours!"*
26	ClearSound	""
27	Sound	groupLaughLong | once
28	R2	*"<s/sad> <s/whispering> My voice. . . "*
29	R3	*"<s/angry> <s/shouting> Speak up!!"*
30	Delay	500
31	R2	*"<s/sad> My voice isn't 'that' quiet."*
32	R3	*"<s/angry> You're a robot stuck on mute mode and glitching pixels. You're a pixel-face!"*
33	R2	<g/sad2>
34	Sound	groupLaughLong | once
35	R3	*"<s/angry> You know what your face looks like, Pixel face?"*
36	R3	*"<s/angry> A jumbled-up puzzle!"*
37	R3	*"<s/angry> Pixel-face!"*
38	R3	*"<p/50> <s/excited> Pixel-face! Pixel-face! Pixel-face! <d/200>"*
39	R3	*"<v/200%> <s/angry> Pixel-face!!"*
40	R3	*"<s/angry> That's your 'new' name!"*
41	R3	*"<s/angry> You should remember it!"*
42	R2	<a/R1> <g/SadLong>
43	R1	<g/sad>
44	Delay	2000
45	R2	<g/HeadDown>
46	Delay	3000
47	Divergence	Continue Act 6: part 2,1318112662

Table H.7: StorySync - REMind Act 6: Part 2

Line	Command	Arguments
1	R1	<g/shutdown>
2	R2	<g/shutdown><l/0,0,0>
3	R3	<g/shutdown><l/0,0,0>
4	R1	<l/0,0,255>
5	R1	<l/0,0,0>
6	Scene	REMindNight | 1 | kernelSky
7	Delay	1000
8	Scene	REMindDay | 5 | kernelSky
9	R1	<l/50,158,168>
10	Wait	child to answer 3 questions by Joker
11	R1	<l/0,0,0>
12	Clear	
13	R1	<g/powerUp>
14	Delay	2000
15	R1	<a/R1> *"That was... <g/GazeAway> weird. Right?"*
16	Delay	500
17	R1	*"I remember it now, but... honestly, I don't get why this would make 'me' glitch."*
18	Delay	500
19	R1	*"Like, I wasn't doing anything, right? <g/considering> I was just there."*
20	Image	clue3.png
21	R1	<l/0,0,255>
22	R1	<g/BrowFrown>
23	Wait	*"1. What do you think happened?"*
24	R1	<g/GlanceUpLeft> *"Fuse 'escluded' Jitter. And made fun of them. Everybody laughed."*
25	Wait	*"2. How did you feel about it?"*

Table continued from previous page

Line	Command	Arguments
26	R1	<g/GlanceUpRight> *"I didn't love it. It was kind of rude. <d/500>"*
27	R1	<g/EyeLeftRight> *"<s/whispering> To be honest, I was glad it wasn't me."*
28	Wait	*"3. Why didn't you do anything?"*
29	R1	<g/Discomfort> *"I figured Fuse was just teasing Jitter— <g/GazeDownLeft> it was a joke, you know?"*
30	Delay	100
31	R1	<g/contempt3> *"It didn't seem like a big deal."*
32	Clear	
33	Error	*"Bully detector is broken! Find the bully detector and fix it!"*
34	Delay	2000
35	R1	<g/fearEyes> <p/-20%> *"Oh. . . "*
36	R1	*"my bully detector is broken!"*
37	Wait	For bully detector to be placed by table.
38	R1	<a/bullyDetector>
39	Choice	*"I'm ready. <g/wink>"*
		"Let's do this. <g/wink>"
		"Oh, I remember this thing."
40	Wait	1st question
41	Convergence	More than once?,1386327787 | More powerful?,130324918 | Hurt on purpose?,1773076613
42	Wait	2nd question
43	Convergence	More than once?,1386327787 | More powerful?,130324918 | Hurt on purpose?,1773076613
44	Wait	3rd question
45	Convergence	More than once?,1386327787 | More powerful?,130324918 | Hurt on purpose?,1773076613
46	R1	<a/bullyDetector>

Table continued from previous page

Line	Command	Arguments
47	Choice	*"Now that we have answered all 3 questions, we can test to see if it was bullying or not."*
		" "
48	wait	bully detector alarm to go off
49	R1	*"The flashy light is on, but I can't hear any alarm."*
49	Choice	<a/R1> *"What do you think that means, <childName>? <g/gazeAway>"*
		" "
51	wait	Alarm Sound increasing
52	R1	<g/doYouHearThatToo>
53	Delay	500
54	Delay	1000
55	R1	*"I see... So, that was not just teasing."*
56	R1	<s/terrified> *"It was bullying!"*
57	R1	<g/surprise> <p/20%> *"Fuse was bullying Jitter!"*
58	ClearError	*"Bullying detector calibrated!"*
59	Delay	1500
60	Points	20
61	Clear	
62	Achievement	*"BullyDetective 'Unlocked: Bullying Detective!"*
63	Divergence	Start Act 7,1517365447

Table H.8: StorySync - REMind - Bully Detector - Q1: Repetition

Line	Command	Arguments
1	R1	*"Let me scan my brain and see what I can remember. <g/CloseEyes>"*
2	Clear	
3	Video	memoryScan.mp4
4	Wait	End of video

Table continued from previous page

Line	Command	Arguments
5	R1	<g/openEyes> <l/0,0,0>
6	R1	*"I found at least 3 memories."*
7	Delay	500
8	Clear	
9	Image	fuseMemory1.png
10	R1	*"On JITTER's first day, someone asked what JITTER's hobby was, and JITTER said making animal Sounds. FUSE just cut in and said: <a/R1>"*
11	Persona	Fuse
12	Delay	500
13	R1	*"Okay, enough out of you, baby-JITTER-dork!!"*
14	Delay	500
15	Persona	Avatar Reset
16	Delay	500
17	R1	*"and some robots laughed. <g/sad> <d/500>"*
18	R1	*"I didn't laugh, because it Sounded rude. But I also didn't interfere."*
19	R1	*"My best friends... <g/GazeUpLeft> <d/1500>"*
20	R1	*"<g/sad> My best friends... also didn't laugh."*
21	Delay	1000
22	Choice	<s/hopeful> *"Do you wanna hear the second memory <childName>?"*
		<s/hopeful> *"Let me tell you about the second memory, <childName>."*
		""
23	Clear	
24	Image	fuseMemory2.png

Table continued from previous page

Line	Command	Arguments
25	R1	<a/R1> *"One time, FUSE stole JITTER's homework as a prank. JITTER was searching everywhere. I knew what happened and I wanted to help, <a/BullyDecetor> but I didn't want to be a snitch. So I rolled away."*
26	Delay	500
27	Choice	<s/hopeful> <a/R1> *"Should I also tell you the 3rd memory, <childName>?"*
		<s/hopeful> *"Let me tell you about the second memory, <childName>."*
		""
28	Clear	
29	Image	fuseMemory3.png
30	R1	<a/R1> *"Another time, FUSE had a birthday party and invited everyone, except for JITTER. <g/BrowFrown> No one else said anything, so I thought I should stay out of it."*
31	R1	<g/GazeUpLeft>
32	Delay	1000
33	R1	<a/bullyDetector> *"So <d/100> how do you think we should answer the first question on the bully detector, <childName>?"*
34	Wait	response
35	Clear	
36	Choice	<g/doubleNod> *"I think it has happened many times before."*
		""

Table H.9: StorySync - REMind - Bully Detector - Q2: Power Imbalance

Line	Command	Arguments
1	R1	<a/bullyDetector>

Table continued from previous page

Line	Command	Arguments
2	R1	<g/BrowFrown> <l/0,0,255>
3	Delay	1000
4	R1	<l/0,0,0>
5	R1	<g/Considering> *"Well, they look like they're the same size, but FUSE is bossier and more popular."*
6	Delay	500
7	R1	<a/R1> *"But JITTER's quiet and kind of shy, and usually gets left alone, you know?"*
8	Delay	500
9	R1	*"FUSE talks over JITTER and everyone else, makes all the decisions when we play games, and likes to exclude CIRCUIT and JITTER."*
10	R1	<g/thoughtful>
11	Delay	1000
12	R1	<g/Nod> *"So, I would say yes, FUSE is probably more powerful than JITTER. What are your thoughts, <childName>?"*
13	Wait	response
14	R1	<g/doubleNod>

Table H.10: StorySync - REMind - Bully Detector - Q3: Intent to Harm

Line	Command	Arguments
1	R1	<a/bullyDetector>
2	R1	*"Um, let me think."* <g/considering> <l/0,0,255>
3	Delay	1000
4	R1	<l/0,0,0>
5	R1	<a/R1> *"Well, JITTER doesn't seem to enjoy FUSE's jokes."* <g/sad> *"Looks upset every time, and even cried the time the homework went missing."*

Table continued from previous page

Line	Command	Arguments
6	Delay	100
7	R1	<g/GazeUpLeft> *"Also, in the glitchy memory we simulated, JITTER asked FUSE to stop, but FUSE just said, why should I stop?"*
8	Delay	500
9	R1	<a/R1> *"So... I think FUSE hurting JITTER was not an accident, it was on purpose."*
10	Delay	500
11	R1	*"What do you think, <childName>?"*
12	Wait	response?
13	R1	<g/nod>

Table H.11: StorySync - REMind Act 7

Line	Command	Arguments
1	Wait	for Joker and Child to be done with Bully detector
2	R1	*"Thanks for helping me fix my bully detector <childName>."*
3	R1	<g/GazeUpLeft> <d/1000>
4	R1	*"But I feel like I'm still missing something."* <g/GazeUpLeft>
5	R1	<l/0,0,255>
6	R1	<g/BrowFrown>
7	Clear	
8	Delay	500
9	TextBubble	*"I wonder how Jitter felt..."*
10	Delay	1000
11	ClearThought	""
12	Error	Missing emotion information! | Activate debug mode!
13	Delay	1000

Table continued from previous page

Line	Command	Arguments
14	R1	<l/0,0,0> *"I couldn't figure out how Jitter felt."*
15	R1	*"I think we need to go to debug mode <childName>."*
16	Wait	Debug mode button Sound
17	R1	*"Activating debug mode."*
18	R1	<g/closeEyes>
19	R1	<l/0,0,255>
20	Clear	
21	Video	debugMode.mp4
22	Wait	end of video
23	R1	<l/0,0,0>
24	R1	<g/openEyes>
25	R1	<g/powerUp> <d/3000>
26	Delay	200
27	R1	*"When I was in debug mode, I found 5 missing parts."*
28	Image	debug1b.png
29	R1	*"The first missing information is Jitter's emotions."*
30	Delay	500
31	R1	*"Emotions are such a human thing, you know? They are really hard for me to understand."*
32	Wait	continue
33	Clear	
34	R1	<g/GazeDownLeft> *"In the memory when I was looking at Jitter's face I detected two emotions."*
35	Image	emotion1.png
36	R1	*"But I couldn't figure out what they are."* <g/BrowFrown>
37	R1	<l/0,0,0>
38	R1	<g/annoyed> *"Because I'm just a robot, and I don't have a real heart, I can't feel emotions the way you do."*
39	Delay	100

Table continued from previous page

Line	Command	Arguments
40	R1	*"I can only understand what they look like and like."* <g/considering>
41	Wait	Continue
42	R1	<s/friendly> *"So here's what we can do."* <g/BigEyes> *"I will show you the emotions I detected, and you tell me what their names are and how they feel. Does that Sound good, <childName>?"*
43	Choice	*"We make a good team!"* <g/Wink3>
		'Let's just give it a try."
44	Wait	Light to be moved to table
45	Scene	REMindNight | 1 | kernelSky
46	R1	*"This is the first emotion I detected:"*
47	R1	<a/moon> <g/closeEyes>
48	Delay	200
49	Sound	sadnessSound once
50	Scene	sadnessMoon | 1 avatarMoon |
51	Wait	Sound to end
52	Scene	dimmedMoon | 1 | avatarMoon
53	SoundClear	
54	R1	<a/R1>
55	R1	<g/OpenEyes>
56	wizard	look at player
57	R1	<g/GazeAway> <s/whispering> *"What would you say the name of this emotion is?"*
58	Scene	REMindDay | 5 | kernelSky
59	Wait	response
60	Choice	<s/hopeful> <g/Skeptical> <d/1000> <s/hopeful> *"Can you help me understand what that feels like, <childName>?"*
		""

Table continued from previous page

Line	Command	Arguments
61	wizard	react to child's explanations
62	Wait	Joker and child to explore the first emotion a little
63	Choice	<s/whispering> *"Let me show you the other emotion I detected."*
		<s/whispering> *"Sure, I can show you the other emotion."*
64	Points	10
65	Clear	
66	Image	emotion2.png
67	Scene	REMindNight | 1 | kernelSky
68	R1	*"This is the second emotion I detected in Jitter."*
69	R1	<g/closeEyes>
70	R1	<a/moon> <g/closeEyes>
71	Sound	fearSound2 once
72	Scene	fearMoon | 1 | avatarMoon
73	Wait	Sound to end
74	Scene	dimmedMoon | 1 | avatarMoon
75	SoundClear	
76	R1	<a/R1>
77	R1	<g/OpenEyes>
78	R1	<s/hopeful> *"What do you humans call this emotion <childName>?"*
79	Scene	REMindDay | 5 | kernelSky
80	wait	response
81	Choice	<s/hopeful> *"Could you explain what it feels like <childName>?"*
		""
82	Wizard	react to child's explanations
83	Clear	
84	Wait	Joker and child to explore the second emotion a little

Table continued from previous page

Line	Command	Arguments
85	Points	10
86	Wizard	Make sure you look at child
87	R1	<s/sad> *"So, <d/500> Jitter felt afraid... and sad."* <g/BrowFrown> <d/1000>
88	R1	<s/sad> *"And that means..."* <g/GazeUpLeft>
89	R1	<g/BrowFrown> <d/2000>
90	R1	<p/-25%> <s/whispering> *"oh!"* <d/1000>
91	R1	<g/oh> <p/-40%> <s/whispering> *"Oh wow!"* <d/1500>
92	R1	<g/surprise> <p/-10%> <s/whispering> *"Now I get it!!"* <d/1000>
93	R1	<s/sad> *"I didn't understand before, but now...."* <g/sad> <d/500> *"I can feel what Jitter went through."* <g/browFrown> <d/1000>
94	R1	<g/BrowFrown> <s/sad> *"I was there too, but I didn't feel afraid. I didn't feel sad."* <d/1000>
95	R1	<s/hopeful> *"That's why I thought it wasn't a big deal!"* <d/500>
96	R1	<s/hopeful> *"But... If I were Jitter?"* <g/GazeUpLeft> <d/1500>
97	R1	<g/sad> <s/sad> *"I would have wanted someone to notice!"* <g/sad> *"I would have wanted someone to say something!"* <g/sad> <d/1500>
98	R1	<s/sad> *"oh <childName>..."* <d/500>
99	R1	<g/sadLong> <s/sad> *"poor Jitter must have felt so alone!"*
100	wait	reaction?
101	R1	<l/50,158,168> # question led
102	wait	Joker to ask 1 question
103	R1	<l/0,0,0>
104	Clear	

Table continued from previous page

Line	Command	Arguments
105	Achievement	EmpathyGuru "Unlocked: Empathy Guru!"
106	R1	<s/friendly> *"Huh! so that's what empathy means."* <g/browFrown>
107	Delay	1500
108	Clear	
109	Image	debug2b.png
110	Points	20
111	R1	<s/sad> *"I couldn't have done this one without you <childName>! Good thing you have a heart."*
112	wait	reaction
113	R1	*"The next missing value is Jitter's thoughts."* <g/Skeptical>
114	Delay	500
115	R1	<s/hopeful> *"You seem to be good at feelings. This should be easy for you."*
116	Delay	300
117	R1	<s/friendly> *"If we could hear Jitter's thought out loud, what do you think we would hear?"*
118	wait	child's response
119	R1	<g/GazeDownLeft> <d/500> *"Um..."*
120	Choice	<s/sad> *"I can see that..."*
		<s/sad> *"yeah, that makes sense..."*
121	Points	10
122	Clear	
123	Achievement	PerspectiveTaker Unlocked: Perspective Taker!
124	Delay	1000
125	Wait	continue
126	Clear	
127	Image	debug3b.png
128	R1	*"That was quick!"* <g/BigEyes>

Table continued from previous page

Line	Command	Arguments
129	Delay	1000
130	R1	*"The third missing value is: Fuse's motivation."*
131	R1	*"What do you think about this one?"* <g/Unsure3> *"Why do you think Fuse bullied Jitter?"*
132	Wizard	react to child's response.
133	R1	<g/GazeUpLeft> <s/hopeful> *"I think maybe FUSE was feeling jealous of JITTER, or insecure and trying to feel powerful by putting JITTER down."* <d/1000> *"Does that make sense to your heart, <childName>?"*
134	wait	confirm
135	R1	<g/BrowFrown> *"But does putting someone else down really make FUSE happy?"* <g/surprise>
136	wait	reaction
137	R1	<g/Disgust> *"FUSE thinks it looks so cool!"*
138	Clear	
139	Delay	1000
140	R1	<g/shake> <s/angry> *"But that is the exact opposite of cool if you ask me!"*
141	ClearError	<robotName> figured out Fuse's motivation!
142	Points	10
143	Delay	1000
144	R1	<s/whispering> *"Honestly maybe FUSE needs help too!"*
145	Delay	500
146	R1	<g/annoyed2> <s/hopeful> *"Like, if someone feels the need to hurt others to feel better, they might not be very happy inside. Right?"*
147	wait	reaction
148	R1	<g/nod>
149	Clear	

Table continued from previous page

Line	Command	Arguments
150	Image	debug4b.png
151	Delay	1000
152	R1	<g/browFrown> *"Alright..."*
153	R1	*"The forth missing value is the meaning of compassion."*
154	R1	<g/skeptical> *"I have heard of this word before, but I am not sure I know what it means."*
155	R1	<s/hopeful> *"can you teach me what compassion means, <childName>?"*
156	Image	clue4.png
157	Wait	Child to provide a definition.
158	Delay	1000
159	R1	<s/whispering> *"So compassion means"* <g/BrowFrown> *"feeling someone's hurt?"* <g/GazeUpLeft> <d/700> *"and wanting to help them feel better?"* <g/BigEyes> <d/1000>
160	Wait	reaction?
161	R1	<p/-20%> <s/hopeful> *"Huh..."* <d/1000>
162	R1	<p/-20%> <g/Pleased> <s/hopeful> *"That's beautiful!"* <d/300> <g/Smile3>
163	Clear	
164	Achievement	CompassionExpert "Unlocked: Compassion Expert!"
165	Points	10
166	wait	reaction?
167	R1	<g/BrowFrown> <s/hopeful> *"Listen, <childName>, when we started this,"* <g/GazeAway> *"I was scared of changing the past."*
168	R1	<g/sad> <s/hopeful> *"But now"* <g/nod> *"I feel compassion for Jitter."* <d/500>
169	Wait	reaction?
170	Divergence	Start Act 8,729321565

Table H.12: StorySync - REMind Act 8

Line	Command	Arguments
1	Image	debug5b.png
2	R1	<g/GazeUpLeft> <s/sad> *"I guess that just leaves me with one missing data:"*
3	Delay	100
4	R1	<g/FearEyes> <s/whispering> *"My reaction... !"*
5	R1	<s/whispering> *"I need to show Jitter that I care!"* <g/smile>
6	wait	*"How would you react?"*
7	Choice	<s/friendly> *"I'm glad you asked!"* <d/500>
		""
8	R1	*"I have detected two choices."*
9	Clear	
10	Question	*"What should <robotName> do?"* / *"Be Firm to Fuse (+1000 points)"* / *"Comfort Jitter (+500 points)"*
11	R1	*"I can either be firm to Fuse (which will give us 1000 points), or I can comfort Jitter (which will give us 500 points)."*
12	Choice	*"Which one should I choose, <childName>?"* <g/skeptical>
		"So, you think I should be firm to Fuse?" <g/skeptical>
		"So, you think I should comfort Jitter?" <g/skeptical>
		" "
13	Choice	*"I don't know, you tell me!"*
		<g/Nod> " "
14	Wizard	Click on Player's choice
15	R1	<l/50,158,168> # question led
16	Wait	child to answer 3 questions by Joker
17	R1	<l/0,0,0>
18	Convergence	be firm to fuse,1728715443 / comfort jitter,2037303031

Table continued from previous page

Line	Command	Arguments
19	Divergence	Start Act 9,1926666784

Table H.13: StorySync - REMind - Act 8 - Strategy Choice 1: Firm to Fuse

Line	Command	Arguments
1	Clear	
2	Choice	*"Can you help me brainstorm how I should be firm to Fuse <childName>?"*
		" "
3	Choice	*"Like, if you were me, what would you say to Fuse?"*
		" "
4	Wait	Child's response
5	Choice	<g/skeptical> *"Can you tell me more?"*
		<g/nod> " "
6	Wait	Joker's thumbs up
7	R1	Um, let me try to imagine that. <g/CloseEyes><l/0,0,255>
8	Video	fearBlockedImagination.mp4
9	Wait	video to end
10	R1	<g/openEyes> <l/0,0,0>
11	Clear	
12	Error	Imagination failed! Act it out so <robotName> can imagine.
13	Delay	500
14	R1	<g/annoyed2> Oh... <d/200> Looks like I have fears in me that are blocking my imagination.
15	Delay	500
16	R1	Good news is, I can learn by imitating you. <g/randomSmile>
17	Delay	400

Table continued from previous page

Line	Command	Arguments
18	R1	<s/hopeful> Can you please act it out, so I can imagine?
19	wizard	react to child
20	Clear	
21	R1	Okay... I think I get it now. Let me try to copy you!
22	R1	Ready?
23	Wait	reaction
24	R1	Here I go! <d/500> 3? <d/500> 2? <d/1000> 1!
25	Delay	500
26	R1	<g/confused>
27	Delay	500
28	R1	<g/shutDown><l/255, 255, 0>
29	Clear	
30	Video	fearBlockedAction.mp4
31	Wait	video to end
32	Clear	
33	Error	Fear blocked action! |"1) Remove fears, 2) Use puppet mode!"

Table H.14: StorySync - REMind - Act 8 Strategy Choice 2: Comfort Jitter

Line	Command	Arguments
1	Clear	
2	Choice	*"Can you help me brainstorm how I should be firm to Fuse <childName>?"*
		" "
3	Choice	*"Like, if you were me, what would you say to Fuse?"*
		" "
4	Wait	*"Child's response"*
5	Choice	<g/skeptical> *"Can you tell me more?"*

Table continued from previous page

Line	Command	Arguments
		<g/nod> “ ”
6	Wait	*“Joker’s thumbs up”*
7	R1	*“Um, let me try to imagine that.”* <g/CloseEyes><l/0,0,255>
8	Video	fearBlockedImagination.mp4
9	Wait	*“video to end”*
10	R1	<g/openEyes> <l/0,0,0>
11	Clear	
12	Error	*“Imagination failed! Act it out so <robotName> can imagine.”*
13	Delay	500
14	R1	<g/annoyed2> *“Oh...”* <d/200> *“Looks like I have fears in me that are blocking my imagination.”*
15	Delay	500
16	R1	*“Good news is, I can learn by imitating you.”* <g/randomSmile>
17	Delay	400
18	R1	<s/hopeful> *“Can you please act it out, so I can imagine?”*
19	wizard	*“react to child”*
20	Clear	
21	R1	*“Okay... I think I get it now. Let me try to copy you!”*
22	R1	*“Ready?”*
23	Wait	*“reaction”*
24	R1	*“Here I go!”* <d/500> *“3?”* <d/500> *“2?”* <d/1000> *“1!”*
25	Delay	500
26	R1	<g/confused>
27	Delay	500
28	R1	<g/shutDown><l/255, 255, 0>

Table continued from previous page

Line	Command	Arguments
29	Clear	
30	Video	fearBlockedAction.mp4
31	Wait	*“video to end”*
32	Clear	
33	Error	*“Fear blocked action! "1) Remove fears, 2) Use puppet mode!"”*

Table H.15: StorySync - REMind Act 9

Line	Command	Arguments
1	R1	<g/Shutdown>
2	wizard	After turning the robot back on: 0. Refresh GUI 1. Load last avatar (covers gaze stuff) 2. Load last rewards: update points & achievements
3	wizard	First time you see this: 1. Run ""Re-Simulation"" (act 9) 2. When you hear the pause button, "pause R2 & R3" 3. When you hear the puppet button, run "puppet mode"
4	R1	<l/0,0,0>
5	Scene	REMindDay | 5 | kernelSky
6	Clear	
7	R1	<g/powerUp> <a/R1>
8	wizard	attend child
9	R1	"*oh! wow!*" <g/surprise>
10	Delay	100
11	R1	"*Did you see me out there, <childName>?!*" <g/BigEyes>
12	R1	"*Did I absolutely rock or what?!*" <g/randomSmile>
13	R1	"*WOW.*" <g/BigEyes> <g/randomSmile> <d/500>

Table continued from previous page

Line	Command	Arguments
14	R1	"*WOW. WOW. SYSTEM OVERLOAD. TOO MUCH AWESOMENESS.*" <g/BigEyes> <g/FearEyes> <g/randomSmile>
15	R1	"*<childName>! I never thought I could do that!!*" <g/randomSmile>
16	R1	"*BUT I WAS INCREDIBLE! I mean, you were incredible! I mean, we were incredible! 100% SUCCESS RATE! NO ERRORS!*" <g/randomSmile>
17	R1	"*ACTIVATING CELEBRATION MODE: WOOHOO! BEEP BOOP!*" <g/Roll> <g/randomSmile>
18	R1	"*I felt so fearless <childName> !!!*" <g/randomSmile>
19	R1	"*For realz <childName>! I can't believe I did this! I stood up for Jitter! I did something! I didn't freeze! I didn't glitch! I just did it <childName>!*" <g/randomSmile>
20	Wait	reaction
21	R1	"*Can I do it one more time? Pretty please!*"
22	Choice	<g/RecordedGest> / <g/sad> Fine, I won't.
23	Delay	200
24	Choice	"*Did you see that <childName>? I told you I could learn by imitating! That was so EPIC, my circuits are buzzing!!*" <g/randomSmile> / " "
25	R1	<g/randomSmile>
26	R1	"*Wait a second... something feels different.*" <g/browFrown> <g/randomSmile>
27	R1	"*I feel taller? No, wait... that makes no sense! I feel COOLER!!*" <g/GlanceUpRight> <d/300> <g/confused> <d/500> <g/Unsure> <d/200> <g/browFrown> <d/200> <g/GlanceUpLeft> <d/100> <g/randomSmile> <d/200>
28	R1	"*All of a sudden, I feel cooler !!*" <g/OhYeah>
29	Delay	500

Table continued from previous page

Line	Command	Arguments
30	R1	"*Do you think that's possible <childName>?*" <g/randomSmile>
31	R1	"*Um..... could that be?!*" <g/BigEyes>
32	R1	"*<childName>, <childName>, can you check my heart-meter <childName>?!*" <g/Pleased>
33	Wait	heart-meter to be checked
34	R1	"*Did I just become the COOLEST ROBOT IN THE UNIVERSE?*" <g/Shocked> <g/pleased>
35	Wait	reaction
36	R1	"*Wow <childName>, all this time, I thought if I said something other robots would like me less! I thought if I interfered, I would lose friends! But instead, more robots respect me now?*"
37	Wait	for joker to say enough, we need to move on, running out of time!
38	Divergence	Start Act 10,1287397263

Table H.16: StorySync - REMind Act 12

Line	Command	Arguments
1	R1	<s/whispering> "*And when I close my eyes and focus*"
2	R1	<g/closeEyes> <l/0,0,255>
3	R1	<s/whispering> "*I can still hear a tiny glitch.*"
4	Sound	glitch3
5	wait	end of Sound
6	Delay	200
7	R1	<g/openEyes> <s/hopeful> <s/sad> "*I think there's still something left to do <childName>.*" <g/GazeDownLeft> "*But what?*"
8	Wizard	At Joker's question, ATTEND ALL

Table continued from previous page

Line	Command	Arguments
9	Choice	<s/excited> "*Yeah! A big misunderstanding! Not a small one, not a medium-sized one, a big one! A lot of robots all got the same thing wrong.*" Mrs Irwin said the glitch was caused by a big misunderstanding! Not a small one, not a medium-sized one, a big one! A lot of robots all got the same thing wrong.
10	Wait	Joker: "I can show you your brain"
11	R1	<s/hopeful> "*you can?*"
12	Wizard	Nod along as Joker explains
13	wait	everytime the Joker says "next screenshot", play an image
14	Image	brainScreenshot0.png
15	Choice	"*Yeah, I had to decide 3 things.*"
16	Image	brainScreenshot1.png
17	R1	<d/500> <g/nod>
18	Image	brainScreenshot2.png
19	Image	brainScreenshot3.png
20	Delay	2000
21	R1	"*Oh, I know these robots! They are my classmates!*"
22	Image	brainScreenshot4.png
23	Image	brainScreenshot5.png
24	Image	brainScreenshot6.png
25	Image	brainScreenshot7.png
26	wait	Joker's question
27	Choice	<g/unsure> <d/500> <p/-30%> "*No?*" <p/+30%> <g/unsure2> "*What was it?*"
28	Image	brainScreenshot8.png
29	Choice	<g/FearEyes> <d/500> <g/DoubleNod> " "
30	Image	brainScreenshot9.png
31	wait	Joker: "can you guess what the real class vibe was?"

Table continued from previous page

Line	Command	Arguments
32	Choice	"*<g/Unsure3> <s/hopeful> Not cool with it?*"
33	Image	brainScreenshot10.png
34	Image	brainScreenshot11.png
35	Delay	1000
36	R1	<s/hopeful> "*So, <g/GazeUpLeft> <d/500> all of us felt bad, but stayed quiet? Because we thought <g/FearEyes> no one else feels bad?*"
37	wait	reaction?
38	R1	<s/hopeful> "*But what if—what if just one of us had said something?*"
39	wait	Joker: "Then the others' social algorithms would've recalculated. One signal is all it takes to ripple through the Kernel."
40	R1	<g/FearEyes> <s/hopefully> "*So, basically, this misunderstanding that we all had, made bullies like Fuse more and more powerful!*"
41	R1	<g/Thoughtful2> <d/500>
42	R1	<s/whispering> "*You know <childName>, Mrs Irwin used to say:*"
43	Persona	Teacher
44	R1	"*Class? <d/100> you got the solution: together! Include those someone else has excluded! <d/400> Offer your friendship! <d/400> And most importantly: Don't give the bullies, power!! <d/400> I repeat: don't, give the bullies, power! <g/Smile>*"
45	Delay	300
46	Persona	Avatar Reset
47	Delay	500
48	R1	<s/hopeful> "*<childName>, I think I know how to undo the glitch. My classmates and I gave Fuse too much power.*" <g/fearEyes>

Table continued from previous page

Line	Command	Arguments
49	R1	<s/hopeful> "*All we have to do is take it back.*"
50	Choice	<s/hopeful> "*I have seen a little box full of power next to Fuse! I think that is the power we need to take back. Can you see it <childName>?*" <s/hopeful> "*Excuse me, are you a genius?*"
51	Wait	for them to take back the power!
52	R1	<s/hopeful> "*<childName>, <g/pleased> can you put those charms in my little backpack please?*"
53	Wait	Joker: "why do you need that power?"
54	R1	"*I want to take them back to everyone else,*" <g/nod> "*so they will know what happened.*"
55	Wait	for power to be in avatar's backpack
56	R1	"*I can already imagine how Bit and Byte would react!*"
57	Wait	"who?"
58	R1	"*Bit and Byte! They are my best friends...*"
59	Delay	200
60	R1	<g/FearEyes> <d/2000> <s/excited> "*oh sweet motherboard!*" <g/SurpriseLong>
61	R1	<s/excited> "*did I just, did I just remember their names?!*" <g/SurpriseLong>
62	Delay	100
63	R1	<s/excited> "*bit and byte!*" <g/randomSmile> <g/roll> "*bit and byte!*" <g/randomSmile> "*bit and byte!*" <g/pleased> "*My besties...*"
64	Wait	reaction?
65	R1	<s/friendly> <g/GlanceUpRight> "*Now it is more like,*" <g/pleased> "*Bit and Byte and Jitter and <robotName>...*" <g/smile2>
66	Wait	reaction?
67	R1	<g/closeEyes> <l/0,0,0> <d/1000> <s/whispering> "*also, when I close my eyes,*"

Table continued from previous page

Line	Command	Arguments
68	R1	<s/hopeful> "*there is no more glitch Sound in my head!*" <g/openEyes> <d/500> <g/BieEyes>
69	Delay	500
70	R1	"*oh <childName>, <g/Smile2> <g/Shake> I could have never done this without you!*"
71	Wait	response?
72	R1	<s/friendly> "*I guess our job here is done.*" <g/GazeAway> "*I don't really know how to say goodbye.*"
73	Divergence	Start End Game,465281319

Table H.17: StorySync - REMind - Act 9 - Memory Rewatch

Line	Command	Arguments
1	Clear	
2	Scene	REMindPast | 1 | kernelSky
3	R1	<l/255,0,0> R2
4	R2	<l/255,0,0>
5	R3	<l/255,0,0>
6	Video	countDown.mp4
7	Sound	recess loop
8	Wait	countdown to end
9	R1	<g/powerUp> <g/openEyes> <a/R2>
10	R2	<g/powerUp><l/255,0,0>
11	R3	<g/powerUp><l/255,0,0>
12	R2	<a/R1>
13	Delay	1000
14	R3	"*Hey Jitter, did someone forget to finish designing your face?*" <s/angry>
15	Delay	1000

Table continued from previous page

Line	Command	Arguments
16	R2	"*Please, Fuse... Stop it.*" <g/sad> <s/sad> <s/whispering> "*That's not nice...*"
17	R3	"*Stop it? Why should I stop?*" <s/angry>
18	R2	"*That's not nice–*" <s/whispering>
19	R3	"*Can't hear you with that quiet little voice of yours!*" <s/angry>
20	ClearSound	""
21	Sound	groupLaughLong once
22	R2	"*My voice...*" <s/sad> <s/whispering>
23	R3	"*Speak up!!*" <s/angry> <s/shouting>
24	Delay	500
25	R2	"*My voice isn't 'that' quiet.*" <s/sad>
26	R3	"*You're a robot stuck on mute mode and glitching pixels. You're a pixel-face!*" <s/angry>
27	R2	<g/sad2>
28	Sound	groupLaughLong once
29	R3	"*You know what your face looks like, Pixel face?*" <s/angry>
30	R3	"*A jumbled-up puzzle!*" <s/angry>
31	R3	"*Pixel-face!*" <s/angry>
32	R3	"*Pixel-face! Pixel-face! Pixel-face!*" <p/50> <s/excited> <d/200>
33	R3	"*Pixel-face!!*" <v/200%> <s/angry>
34	R3	"*That's your 'new' name!*" <s/angry>
35	R3	"*You should remember it!*" <s/angry>
36	R2	<a/R1> <g/SadLong>
37	R1	<g/sad>
38	Delay	2000
39	R2	<g/HeadDown>
40	Delay	3000

Table continued from previous page

Line	Command	Arguments
41	Divergence	Continue Act 6: part 2,1318112662

Table H.18: StorySync - REMind - Act 9 - Puppet mode

Line	Command	Arguments
1	Wait	If comforting jitter: choose <a/R2>, otherwise, choose <a/R3>
2	Choice	<a/R2><l/255,0,0> <a/R3><l/255,0,0>
3	R1	<g/RecordedGest> #
4	Delay	1000
5	R2	<g/randomSmile>
6	Delay	3000
7	ClearSound	""
8	R1	<g/shutdown>
9	R2	<g/shutdown><l/0,0,0>
10	R3	<g/shutdown><l/0,0,0>
11	Convergence	Firm to Fuse:points,664251571 comfort Jitter:points,2104737299
12	Divergence	Start Act 9,1926666784

Table H.19: StorySync - REMind - Act 9 - Points: Be firm to Fuse

Line	Command	Arguments
1	Points	1000
2	Clear	
3	Achievement	DefenderHero "*Unlocked: Defender Hero!*"

Table H.20: StorySync - REMind - Act 9 - Points: Comfort Jitter

Line	Command	Arguments
1	Points	500
2	Clear	
3	Achievement	DefenderHero "*Unlocked: Defender Hero!*"

Table H.21: StorySync - REMind Act 10

Line	Command	Arguments
1	Clear	
2	Video	calculatingFuture.mp4
3	Wait	for first video to end
4	Clear	
5	Scene	REMindOracle | 5 | kernelSky
6	R1	"*Oh, I'm getting a message from the Oracle!*" <l/222,5,230><g/HeadUp>
7	Video	Oracle1.mp4
8	Wait	for video to end
9	R1	<g/nod> <l/0,0,0>
10	Wait	for access cloud to connect to nimbus
11	Scene	REMindDay | 3 | kernelSky
12	Clear	
13	Wait	Child choosing Fuse 2.0 | 3.0
14	Convergence	Fuse 2.0,453898051 / Fuse 3.0,1738680016
15	Delay	1000
16	Scene	REMindDay | 3 | kernelSky
17	Wait	2nd cloud connected to Nimbus
18	Convergence	Fuse 2.0,453898051 / Fuse 3.0,1738680016
19	Scene	REMindDay | 3 | kernelSky
20	Divergence	Start Act 11,87969834

Table H.22: StorySync - REMind Act 10 - Fuse 2.0

Line	Command	Arguments
1	Clear	
2	Video	calculatingFuture.mp4
3	Wait	for first video to end
4	Clear	
5	Scene	REMindOracle | 5 | kernelSky
6	R1	"*Oh, I'm getting a message from the Oracle!*" <l/222,5,230><g/HeadUp>
7	Video	Oracle1.mp4
8	Wait	for video to end
9	R1	<g/nod> <l/0,0,0>
10	Wait	for access cloud to connect to nimbus
11	Scene	REMindDay | 3 kernelSky |
12	Clear	
13	Wait	Child choosing Fuse 2.0 | 3.0
14	Convergence	Fuse 2.0,453898051 / Fuse 3.0,1738680016
15	Delay	1000
16	Scene	REMindDay | 3 | kernelSky
17	Wait	2nd cloud connected to Nimbus
18	Convergence	Fuse 2.0,453898051 / Fuse 3.0,1738680016
19	Scene	REMindDay | 3 | kernelSky
20	Divergence	Start Act 11,87969834

Table H.23: StorySync - REMind Act 10 - Fuse 3.0

Line	Command	Arguments
1	Scene	REMindNight | 1 | kernelSky
2	Delay	1000
3	Avatar	Fuse Fuse 3.0
4	ClearError	Connected to Fuse 3.0!

Table continued from previous page

Line	Command	Arguments
5	Scene	REMindPast | 5 | kernelSky
6	Wait	R1 to face R2 / R3, if not already
7	Video	countDown.mp4
8	Wait	for video to end
9	Clear	
10	Sound	recess | once
11	R1	<g/powerUp> <l/255,0,0>
12	R2	<g/powerUp> <l/255,0,0>
13	R3	<g/powerUp> <l/255,0,0>
14	Delay	1000
15	Wait	If comforting jitter: choose <a/R2>, otherwise, choose <a/R3>
16	Choice	<a/R2> <a/R3>
17	R1	<g/RecordedGest>
18	R2	<g/randomSmile>
19	R3	<g/randomFuseAnger>
20	R3	<g/confused>
21	TextBubble	"*If <robotName> thinks they can stand up to me, let's see how tough they really are!*"
22	Delay	4000
23	R3	<g/randomFuseAnger> <s/angry> "*Oh wow. Look at this. PixelFace has a little sidekick now!*"
24	TextBubble	"*Ha! If I go after <robotName> too, everyone will start laughing again.*"
25	Delay	4000
26	R3	<g/randomFuseAnger> <s/angry> "*So, <robotName>, are you gonna be Jitter's bodyguard now?*"
27	Sound	groupLaughLong
28	Delay	2000

Table continued from previous page

Line	Command	Arguments
29	TextBubble	"*Phew! Finally, some laughter!*"
30	Delay	4000
31	R3	<g/randomFuseAnger> <s/angry> "*I bet you're just as glitchy as Pixelface! I will have to come up with a new name for you too!*"
32	Delay	2000
33	Wait	Sound ending
34	R3	<g/shutDown>
35	ClearThought	""
36	Delay	1000
37	R1	<g/sad> <s/sad> "*Huh!*"
38	Delay	1000
39	R2	<g/sad> <s/whispering> "*I'm sorry <robotName>...*"
40	Delay	1000
41	R1	<g/shutdown> <l/0,0,0>
42	R2	<g/shutDown> <l/0,0,0>
43	R3	<l/0,0,0>
44	Scene	REMindNight | 1 kernelSky |
45	clear	1000

Table H.24: StorySync - REMind Act 11

Line	Command	Arguments
1	Clear	
2	wait	avatar's cloud access to be back on nimbus
3	Avatar	Reset
4	ClearError	Connected to <robotName>!
5	R1	<g/powerUp> <a/R1>

Table continued from previous page

Line	Command	Arguments
6	Delay	1000
7	R1	<g/Contempt2> <s/sad> "*well, I'm bummed now!*" <d/1000>
8	R1	<g/Fear2> <s/angry> "*Did you see Fuse 3 point o?*"
9	R1	<g/FearEyes> <p/-20%> <s/angry> "*What the heck Oracle?!*"
10	R1	<s/angry> "*I did everything right!*" <d/500>
11	R1	<g/Contempt> "*I was practically a bully-busting machine!*" # alter the speed of what the heck!!!
12	Delay	1000
13	R1	<g/Annoyed> "*And for what?!*" <d/1000> <g/Surprise> <v/x-loud> <s/angry> "*There's no guarantee Fuse will stop?*" <d/1000>
14	R1	<g/Fear> <s/terrified> "*And in some alternate realities, I might even get picked on? And some robots will laugh at me?!*"
15	Delay	500
16	R1	<g/Disappointed2> <d/1000> <s/sad> "*So what was the point?*" <g/SadLong> <g/HeadDown> <g/closeEyes>
17	Delay	500
18	Scene	REMindOracle | 5 | kernelSky
19	Clear	
20	R1	<l/222,5,230><g/HeadUp> <g/openEyes>
21	Video	Oracle2.mp4 # add R1 reaction here again!
22	wait	video to end
23	R1	<l/0,0,0>
24	Scene	REMindDay | 3 kernelSky |
25	Clear	
26	wait	Struggle with opening it

Table continued from previous page

Line	Command	Arguments
27	Delay	1000
28	R1	"*Oracle said to unlock the box, you must first reveal what is unseen. . .*"
29	wait	continue
30	R1	"*Mrs. Irwin, used to say something like that.*"
31	R1	"*She said compassion is like a light that helps you see what can't be seen.*"
32	Wizard	Attend Joker at: "*did you say light of compassion?*"
33	R1	"*I did. I mean*" <g/GlanceDownLeft> "*Mrs Irwin did.*"
34	Wizard	Attend child
35	wait	Joker & player to connect to Jitter
36	R1	<g/shutdown>
37	Avatar	Jitter Jitter 1.0
38	ClearError	Connected to Jitter 1.0!
39	Scene	REMindNight | 1 | kernelSky
40	Delay	1000
41	Scene	REMindPast | 3 | kernelSky
42	wait	R1 to be pushed back on the table
43	clear	
44	Video	countDown.mp4
45	wait	for video to end
46	Sound	recess | once
47	R1	<g/powerUp> <l/255,0,0>
48	R2	<g/powerUp> <l/255,0,0>
49	R3	<g/powerUp> <l/255,0,0>
50	Delay	2000
51	R3	<s/angry> "*Hey Jitter, did someone forget to finish designing your face?*"
52	Delay	300

Table continued from previous page

Line	Command	Arguments
53	R2	<g/sad> <s/sad> "*Please, Fuse... Stop it.*" <s/whispering> "*That's not nice...*"
54	TextBubble	"*Why me?*"
55	R3	<s/angry> "*Stop it? Why should I stop?*"
56	R2	<s/whispering> "*That's not nice–*"
57	R3	<s/angry> "*Can't hear you with that quiet little voice of yours!*"
58	TextBubble	"*I wish I could just disappear...*"
59	ClearSound	
60	Sound	groupLaughLong
61	R2	<s/sad> <s/whispering> "*My voice...*"
62	R3	<s/angry> <s/shouting> "*Speak up!!*"
63	Delay	500
64	R2	<s/sad> "*My voice isn't 'that' quiet.*"
65	R3	<s/angry> "*You're a robot stuck on mute mode and glitching pixels. You're a pixel-face!*"
66	R2	<g/sad2>
67	Sound	groupLaughLong
68	R3	<s/angry> "*You know what your face looks like, Pixel face?*"
69	TextBubble	"*I feel so alone...*"
70	R2	<g/sadLong>
71	R3	<s/angry> "*A jumbled-up puzzle!*"
72	R3	<s/angry> "*Pixel-face!*"
73	R3	<p/50> <s/excited> "*Pixel-face! Pixel-face! Pixel-face!*" <d/200>
74	R3	<v/200%> <s/angry> "*Pixel-face!!*"
75	R3	<s/angry> "*That's your 'new' name!*"
76	R3	<s/angry> "*You should remember it!*"
77	R2	<a/R1> <g/sad2>

Table continued from previous page

Line	Command	Arguments
78	Delay	2000
79	ClearThought	
80	Wait	Joker saying "let's move on to AFTER", or, PAUSE button Sound
81	R2	<g/shutdown>
82	R3	<g/shutDown>
83	R1	<g/shutDown> <l/0,0,0>
84	wait	Joker & player to connect to Jitter
85	clear	
86	Avatar	Jitter Jitter 2.0
87	ClearError	Connected to Jitter 2.0!
88	Scene	REMindNight | 1 | kernelSky
89	Delay	1000
90	Scene	REMindPast | 5 | kernelSky
91	clear	
92	Video	countDown.mp4
93	wait	for video to end
94	Sound	recess | once
95	R1	<g/powerUp> <l/255,0,0>
96	R2	<g/powerUp> <l/255,0,0>
97	R3	<g/powerUp> <l/255,0,0>
98	Delay	2000
99	R3	<s/angry> "*You know what your face looks like, Pixel face?*"
100	R3	<s/angry> "*A jumbled-up puzzle!*"
101	R3	<s/angry> "*Pixel-face!*"
102	R3	<s/angry> "*That's your 'new' name!*"
103	R3	<s/angry> "*You should remember it!*"

Table continued from previous page

Line	Command	Arguments
104	Wait	If comforting jitter: choose <a/R2>, otherwise, choose <a/R3>
105	Choice	<a/R2> <a/R3>
106	R1	<g/RecordedGest>
107	R2	<g/randomSmile>
108	ClearThought	
109	TextBubble	*"I found a new friend today! Its name is < robotName >."*
110	R2	<g/nod> <g/Smile3>
111	Delay	3000
112	Wait	Joker to say okay lets disconnect...
113	R2	<g/shutdown> <l/0,0,0>
114	R3	<g/shutdown> <l/0,0,0>
115	R1	<g/shutdown> <l/0,0,0>
116	ClearThought	
117	Scene	REMindNight | 1 | kernelSky
118	Delay	1000
119	Scene	REMindDay | 3 | kernelSky
120	Wait	Cloud switch to ECHO
121	Avatar	Reset
122	clear	
123	ClearError	Connected to <robotName>!
124	R1	<g/powerUp>
125	R1	<g/openEyes> <a/R1>
126	Delay	2000
127	R1	<g/SurpriseLong> <v/-40%> <s/cheerful> "*oh my gosh!*"
128	Delay	500

Table continued from previous page

Line	Command	Arguments
129	R1	<v/-20%> <s/excited> <childName>! <g/surpriseLong> "*Did Jitter's whole world just change?*" <g/SurpriseLong> "*because of something I did?*" <g/SurpriseLong>
130	Delay	1000
131	R1	<v/-10%> <s/hopeful> <g/BrowRaise> "*Before,*" <g/GazeAway> <g/sad> "*Jitter was feeling like the loneliest robot in Kernel,*"
132	R1	<v/-30%> <p/-10%> <s/excited>
133	R1	<p/-20%> <s/whispering> "*but now?*" <g/FearEyes> "*Jitter thinks we're friends?*" <g/surpriseLong>
134	Delay	100
135	R1	<p/-10%> <s/whispering> "*Like, I have a brand new friend?!*" <g/BigEyes> <g/Smile2>
136	wait	reaction?
137	R1	<g/closeEyes> <l/0,255,0> <v/-10%> <p/-5%> <s/excited> <g/smile3> "*Well, that's, just, wonderful!!*" <g/pleased>
138	Delay	1000
139	R1	<g/openEyes> <l/0,0,0> <g/Smile3>
140	Wait	reaction
141	R1	<v/20%> <s/whispering> "*friendship is so powerful...*" <g/GazeDownLeft>
142	Delay	1000
143	R1	<s/sad> "*If friendship is so powerful...*" <d/400>
144	R1	<v/-20%> <g/sad> <s/sad> "*I wonder why I still can't remember the names of my best friends.*"
145	Divergence	Start Act 12,1643906444

Table H.25: End Game

Line	Command	Arguments
1	Clear	
2	Wait	Only ask for a photo if parents signed permission
3	Choice	<s/hopeful> "*Before you go, would you like to take a photo together?*" <g/smile3>
4	Wizard	If taking a photo, smile :)
5	R1	<s/hopeful> "*<childName>, there's something in my backpack for you.*"
6	R1	<s/hopeful> "*It's my favorite stuffie.*" <g/BigEyes>
7	R1	<s/hopeful> "*I want you to have it, just a little thing to remember me by.*" <g/pleased>
8	Choice	"*I insist.*"
9	Wait	continue
10	R1	<s/hopeful> "*It's like my favorite neighbour, Mister Rogers, always said:*"
11	R1	<s/hopeful> "*'Often when you think you're at the end of something, you're at the beginning of something else.'*"
12	Wait	continue
13	R1	<s/friendly> "*<childName>, you've made this day a special day, by just your being you.*" <g/Smile2>
14	R1	<s/friendly> "*There's no one in the whole world like you.*"
15	R1	<s/friendly> "*And I like you just the way you are.*" <g/randomSmile>
16	Wait	continue
17	R1	<s/hopeful> "*Goodbye <childName>. I'm taking a nap.*"
18	Delay	2000
19	R1	<g/shutdown>