Elements and Patterns of Virtual Contested Space:

Understanding the Spatial Anatomy of Competitive Multiplayer First-Person Shooter Video Game Maps

By

Meizhu (Julie) Niu

A thesis

presented to the University of Waterloo

in fulfilment of the

thesis requirement for the degree of

Master of Architecture

Waterloo, Ontario, Canada 2024

© Meizhu (Julie) Niu 2024

Author's Declaration

I hereby declare that I am the sole author of this 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.

Abstract

The spatial anatomy of video game spaces present a valuable opportunity for architectural research. As the virtual increasingly becomes a prevalent medium for the experience of space, it is important for architects to understand the limitations and possibilities presented within the pixelated landscape. Presently, principles for virtual spaces and their utility are still developing due to their relative novelty. This thesis posits that the field of video gaming, particularly first-person shooter (FPS) games, offers fertile ground for precedents in virtual environment design. Virtual spaces, especially in video games, challenge traditional perceptions of space and offer new ways of seeing and navigating. FPS games, with their immersive first-person perspective, exemplify this by providing dynamic environments where spatial awareness and strategic decision-making are crucial. The design of FPS maps, reminiscent to mazes, creates spaces of contest where players vie for victory through spatial control.

This thesis investigates the spatial anatomy of competitive multiplayer FPS video game environments, with a specific focus on maps retrieved from *Valorant* (2020), one of the most successful titles in the genre. The study identifies key spatial elements within these maps, cataloging these elements into a hierarchical taxonomy, and analyzing how they interact to form patterns that dictate gameplay modalities. This reveals how game designers utilize spatial configurations to achieve specific objectives such as directing player flow, creating tension, and balancing competitive play. By applying *space syntax* and *pattern theory*, informed by the works of Bill Hillier, Julienne Hanson, and Christopher Alexander, the deconstruction of FPS maps provides an investigative strategy for understanding how virtual architectural elements influence player behavior and gameplay dynamics.

Through this analysis, the aim is to broaden the understanding of digitized space through its use and augmentations in video game environments. This thesis illustrates the significance of FPS video game architecture as artifacts of virtual space and its potential contributions for designing animated, engaging, and purposeful virtual environments as we collectively move towards digitality.

Acknowledgements

I would like to express my deepest gratitude to everyone who has supported and guided me throughout the journey of completing my thesis. First and foremost, I extend heartfelt thanks to my co-supervisors, **David T. Fortin** and **Fiona Lim Tung**, for their invaluable knowledge and for helping channel my passion for video games into an architectural exploration. I am also grateful to my committee member, **Terri Boake**, for her insightful feedback and for identifying critical gaps in my research. My sincere appreciation goes to my internal and external readers, **James Clarke-Hicks** and **Luke Pearson**, for their thoughtful comments, sharing their expertise and experience, and for engaging in exciting and meaningful discussions that enriched my work.

A special thanks goes to **David Correa**, whose guidance helped shape the initial scope and arguments of this research.

I am also immensely thankful to my friends, housemates, and peers for their constant support and for engaging in many stimulating conversations about gaming, architecture, and virtual space. To **Meghan Won** and **Yannik Sigouin**—it has been truly wonderful to have spent our undergraduate years together, living in the same house, and now finishing our theses in the same year. To **Shannon Kennelly**, **Ethan Zhang**, and M**agdalena Kaczmarczyk**, thank you for reading my work, deeply engaging with the material, and offering your feedback.

To my parents, **Jing Wang** and **Wan Quan Zhao**, who have been unwavering in their love and encouragement—thank you from the bottom of my heart.

To my partner **Phil Carr-Harris**, thank you for not only supporting me and sharing the love of video games, but for joining me in writing a thesis alongside eachother. Your companionship made this challenge much more meaningful.

Lastly, to **RKTech Gaming**, thank you for sharing countless hours of gameplay with me. Your camaraderie has been a joyful and essential part of this journey.

Land Acknowledgements

This thesis was written at the University of Waterloo School of Architecture which is located on the traditional territory of the Neutral, Anishinaabeg and Haudenosaunee peoples. The University is situated on the Haldimand Tract, the land promised to the Six Nations that includes 10 kilometres on each side of the Grand River.

TABLE OF CONTENTS

Author's Declaration iii

Abstract v

Acknowledgements vii

Land Acknowledgements ix

List of Figures xv

Introduction 1

Virtual Space 2

Game Spaces 7

Valorant (2020) and First-Person Shooter (FPS) Video Games 10

The Map and The Maze 16

A Note on Violence 21

Aim and Relevance 25

Context 29

A History of Space Representation in Video Games 30

Environmental Storytelling Through Visual Aesthetics 37

Movement, Rhythm, and Flow 42

Linear and Nonlinear Gameplay: Singleplayer vs. Multiplayer 46

Types of Maps and Emerging Play 50

The Minds Behind the Maps 53

Applying Space Syntax and Pattern Theory to FPS Maps 56

State of the Art 61

Drawing Video Game Spaces 62

Taxonomy of Game Elements 63

Pattern Templates in Video Game Design 65

Method Overview 73

Illustrative Overview of Valorant Maps 81

Ascent 84

Split 88

Sunset 92

Breeze 96

Bind 100

Spatial Anatomy of FPS Game Maps 105

Gameplay 108

Circulation and Layout 112

Nodes and Collision Points 114

Illustrated Taxonomy of Spatial Elements 120

Hierarchy of Elements in FPS Maps 122

Rudimentary Elements 122

Intermediate Elements 123

Sophisticated Elements 124

Spatial and Non-Spatial Classification of Elements 127

Scale and Size Types of Elements 132

Description of Rudimentary and Intermediate Elements 135

Spawn 136

Main (Paths) 138

Site 140

Middle 142

Links 144

Choke Point 146

Cover 148

Interactive Elements 150

Split Levels 152

Function of Elements: Affording and Breaking Lines of Sight 154

Arrangement of Elements: Pacing and Flow 156

Spatial Patterns in FPS Maps 159

Establishing a Stronghold 160
Creating Spaces of Anticipation 164
Situations of Positional Advantage 168
Creating Flank Opportunities 172
Creating a Large Scale Combat Arena 176

Discussion 181

Discussion of Elements and Patterns 183

Limitations 184

Conclusion 187

Outlook 191

Final Remarks 193

Bibliography 194

Appendix 204

Pattern Templates in Game Design 205

Map Circulation and and Pre-Round Boundaries 209

Glossary 223

LIST OF FIGURES

Fig. 1 Screencapture of Valorant 10
Screenshot of Valorant, IP of Riot Games.

Fig. 3 Screenshot of DnD (video game) 30
Retrieved from Wikipedia Commons. Public domain.

Fig. 4 Screenshot of PONG! 31
Retrieved from Wikipedia Commons. Public domain.

Fig. 5 Image of *Pac Man* 31
Retrieved from Wikipedia Commons. Liscensed under CC0.

Fig. 6 Screenshot of Super Mario Bros 32
Retrieved from Wikipedia Commons. IP of Nintendo.

Fig. 7 Screenshot of Berserk 32
Retrieved from Wikipedia Commons. IP of Stern Electronics.

Fig. 8 Screenshot of Night Driver 33
Retrieved from Wikipedia Commons. IP of Atari Inc.

Fig. 9 Screenshot of Double Dragon 33
Retrieved from Moby Games. IP of Technos Japan.

Fig. 10 Screenshot of Zaxxon 34
Retrieved from Moby Games. IP of Sega.

Fig. 11 Screenshot of Myst 34
Retrieved from Moby Games. IP of Broderbund.

Fig. 12 In game capture of the disrupted architecture in 'Ascent' 41
Screenshot of Valorant, IP of Riot Games.

Fig. 13 In game capture of abandoned pizza in 'Ascent' 41
Screenshot of Valorant, IP of Riot Games.

Fig. 14 Linear progression 46
Diagram by author.

Fig. 15 Non-linear progression 47
Diagram by author.

Fig. 16 Symmetric Map Layout 50
Diagram by author.

Fig. 17 Asymmetric Map Layout 50
Diagram by author.

Fig. 18 Three lane layout 51
Diagram by author.

Fig. 19 Two lane layout 51
Diagram by author.

Fig. 20 Passage 64
Diagrams by author with reference to the work of Yiou Wang and Yujie Wang.

Fig. 21 Corner 64
Diagrams by author with reference to the work of Yiou Wang and Yujie Wang.

Fig. 22 Junction 64
Diagrams by author with reference to the work of Yiou Wang and Yujie Wang.

Fig. 23 Dead End 64
Diagrams by author with reference to the work of Yiou Wang and Yujie Wang.

Fig. 24 'Haven' map, sites indicated in red 74
Images retrieved from https://valoplant.gg/
Annotated by author.

Fig. 25 'Fracture' map, spawns indicated in red 74
Images retrieved from https://valoplant.gg/
Annotated by author.

Fig. 26 Bird-eye Perspective of 'Ascent' 84
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 27 Illustration of Map 'Ascent' 85
Illustration by author.

Fig. 28 Ground Plane Conditions of 'Ascent' 86
Image by author, 3D model by author.

Fig. 29 Illustration of In-Game Map 'Ascent' 86
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

Fig. 30 In-game capture of 'Ascent' Site B 87
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 31 In-game capture of 'Ascent' outside of Attacker Spawn 87
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 32 In-game capture of 'Ascent' near Middle 87
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 33 Bird-eye Perspective of 'Split' 88
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 34 Illustration of Map 'Split' 89
Illustration by author.

Fig. 35 Ground Plane Conditions of 'Split' 90
Image by author, 3D model by author.

Fig. 36 Illustration of In-Game Map 'Split' 90
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

Fig. 37 In-game capture of 'Split' near attacker spawn 91
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 38 In-game capture of 'Split' outside of B Main 91
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 39 In-game capture of 'Split' near defender spawn 91
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 40 Bird-eye Perspective of 'Sunset' 92
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 41 Illustration of Map 'Sunset' 93
Illustration by author.

Fig. 42 Ground Plane Conditions of 'Sunset' 94
Image by author, 3D model by author.

Fig. 43 Illustration of In-Game Map 'Sunset' 94
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

Fig. 44 In-game capture of 'Sunset' Site A 95
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 45 In-game capture of 'Sunset' outside of A Main 95
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 46 In-game capture of 'Sunset' near Middle 95
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 47 Bird-eye Perspective of 'Breeze' 96
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 48 Illustration of Map 'Breeze' 97
Illustration by author.

Fig. 49 Ground Plane Conditions of 'Breeze' 98
Image by author, 3D model by author.

Fig. 50 Illustration of In-Game Map 'Breeze' 98
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

Fig. 51 In-game capture of 'Breeze' Site A 99
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 52 In-game capture of 'Breeze' in Hallway above Middle and A Site 99
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 53 In-game capture of 'Breeze' near Middle 99
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 54 Bird-eye Perspective of 'Bind' 100
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 55 Illustration of Map 'Bind' 101
Illustration by author.

Fig. 56 Ground Plane Conditions of 'Bind' 102
Image by author, 3D model by author.

Fig. 57 Illustration of In-Game Map 'Bind' 102
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

Fig. 58 In-game capture of 'Bind' near attacker spawn 103
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 59 In-game capture of 'Bind' at the entry of site A through A short 103
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 60 In-game capture of 'Bind' at the entry of site B through B short 103
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Fig. 61 Timeline of gameplay in Valorant 109
Image by author.

Fig. 62 Three primary lanes 112
Image by author.

Fig. 63 Links established for connectivity 113
Image by author.

Fig. 64 Further connections resulting in a four square layout 113
Image by author.

Fig. 65 Intersections in the four-square layout become nodes. 113
Image by author.

Fig. 66 Traditional three lane layout 115
Image by author.

Fig. 67 Intersecting paths connecting three lanes to create nodes 115
Image by author.

Fig. 68 Nodes then become collision points 115
Image by author.

Fig. 69 Paths of convergence in 'Ascent' 118
Image by author.

Fig. 70 Taxonomy of FPS game elements found in Valorant 121
Image by author.

Fig. 71 Diagram of how rudimentary elements form the map 122
Image by author.

Fig. 72 Diagram of intermediate elements adding connection and complexity 123
Image by author.

Fig. 73 Diagram of sophisticated elements introducing varaibility 124
Image by author.

Fig. 74 Elements defined by their expansive openness 128
Image by author.

Fig. 75 Elements defined by their spatial confinement 129
Image by author.

Fig. 76 Elements defined as object in space 130
Image by author.

Fig. 77 Elements that can not be defined spatially 131
Image by author.

Fig. 78 Narrow Space 132
Images by author.

Fig. 79 Intimate Space 132
Image by author.

Fig. 80 Prospect Space 132
Image by author.

Fig. 81 Diagram of elements arranged on scale of small to large spaces 134
Image by author.

Fig. 82 Axon diagram of Spawn element 136
Image by author.

Fig. 84 Plan diagram of spawn 136
Image by author.

Fig. 85 Section diagram of spawn 136
Image by author.

Fig. 83 Location of Spawns on the four-square 136
Image by author.

Fig. 86 Ascent: pre-round barrier boundaries and team spawn areas 137
Image by author.

Fig. 87 Ascent: Attacker Spawn 137
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 88 Axon diagram of Main element 138
Image by author.

Fig. 90 Plan diagram of main 138
Image by author.

Fig. 91 Section diagram of main and its possible sub-elements 138
Image by author.

Fig. 89 Location of Mains on the four-square 138
Image by author.

Fig. 92 Ascent: Mains 139
Image by author.

Fig. 93 Ascent: Main leading to entry of B Site 139
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 94 Axon diagram of Site element 140
Image by author.

Fig. 96 Plan diagram of Site element 140
Image by author.

Fig. 97 Section diagram of Site element 140
Image by author.

Fig. 95 Location of Sites on the four-square 140
Image by author.

Fig. 98 Ascent: Site 141
Image by author.

Fig. 99 Ascent: Site A 141
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 100 Axon diagram of Middle element 142
Image by author.

Fig. 102 Plan diagram of Middle element 142
Image by author.

Fig. 103 Section diagram of Middle element 142
Image by author.

Fig. 101 Location of Middle on the four-square 142
Image by author.

Fig. 104 Ascent: Middle 143
Image by author.

Fig. 105 Ascent: Middle 143
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 106 Axon diagram of Link element 144
Image by author.

Fig. 108 Plan diagram of Link 144
Image by author.

Fig. 109 Section diagram of Link 144
Image by author.

Fig. 107 Location of Links on the four-square 144
Image by author.

Fig. 110 Ascent: Links 145
Image by author.

Fig. 111 Ascent: Link from Middle to Site A 145
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 112 Axon diagram of Choke Point element 146
Image by author.

Fig. 113 Location of Choke Points on the four-square 146
Image by author.

Fig. 114 Plan diagram of Choke Point 146
Image by author.

Fig. 115 Section diagram of Choke Point 146
Image by author.

Fig. 116 Ascent: Choke Points 147
Image by author.

Fig. 117 Ascent: Choke Point at entry of A Site 147
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 118 Axon diagram of Cover element 148
Image by author.

Fig. 119 Plan diagram of Cover 148
Image by author.

Fig. 120 Section diagram of Cover 148
Image by author.

Fig. 121 Ascent: Cover 149
Image by author.

Fig. 122 Ascent: Cover on site B 149
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 123 Axon diagram of Interactive element 150
Image by author.

Fig. 124 Ascent: Garage Door on A site 150
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 125 Ascent: Interactive elements 151
Image by author.

Fig. 126 Ascent: Garage Door on B site 151
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 129 Axon diagram of Split Levels element 152
Image by author.

Fig. 127 Plan diagram of Split Levels 152
Image by author.

Fig. 128 Section diagram of Split Levels 152
Image by author.

Fig. 130 Ascent: Split Levels 153
Image by author.

Fig. 131 Ascent: Split Levels on B site 153
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Fig. 132 Player blue sees player green, player green does not see player blue 154
Image by author.

Fig. 133 Player green sees player blue, player blue does not see player green 154
Image by author.

Fig. 134 Close-range combat 155
Image by author.

Fig. 135 Mid-range combat 155
Image by author.

Fig. 136 Large-range combat 155
Image by author.

Fig. 137 Concept Diagram of a Stronghold 161
Image by author.

Fig. 138 Schematic Diagram of a Stronghold 161
Image by author.

Fig. 139 Example of a Stronghold on Ascent Site A 162
Image by author.

Fig. 140 Example of a Stronghold on Ascent Site A 162
Screencapture of Valorant, IP of Riot Games.

Fig. 141 Stronghold patterns on Ascent 163
Image by author.

Fig. 142 Concept Diagram of a Space of Anticipation 165
Image by author.

Fig. 143 Schematic Diagram of a Space of Anticipation 165
Image by author.

Fig. 144 Example of a space of anticipation in B Main of Ascent 166
Image by author.

Fig. 145 Example of a space of anticipation in B Main of Ascent 166
Screencapture of Valorant, IP of Riot Games.

Fig. 146 Space of Anticipation patterns on Ascent 167
Image by author.

Fig. 147 Concept Diagram of a Positional Advantage Situation 169
Image by author.

Fig. 148 Schematic Diagram of a Positional Advantage Situation 169
Image by author.

Fig. 149 Example of a Positional Advantage situation in Middle of Ascent 170
Image by author.

Fig. 150 Screenshot example of a Positional Advantage situation in Middle of Ascent 170
Screencapture of Valorant, IP of Riot Games.

Fig. 151 Positional Advantage patterns on Ascent 171
Image by author.

Fig. 152 Concept Diagram of a Flank Opportunity 173
Image by author.

Fig. 153 Schematic Diagram of a Flank Opportunity 173
Image by author.

Fig. 154 Example of a Flank Opportunity on A site side of Ascent 174
Image by author.

Fig. 155 Screenshot example of a a Flank Opportunity on A site side of Ascent 174
Screencapture of Valorant, IP of Riot Games.

Fig. 156 Flank Opportunity patterns on Ascent 175
Image by author.

Fig. 157 Concept Diagram of a Large Scale Combat Arena 177
Image by author.

Fig. 158 Schematic Diagram of a Large Scale Combat Arena 177
Image by author.

Fig. 159 Example of a Large Scale Combat Arena in Middle of Ascent 178
Image by author.

Fig. 160 Screenshot example of a Large Scale Combat Arena in Middle of Ascent 178
Screencapture of Valorant, IP of Riot Games.

Fig. 161 Large Scale Combat Arena patterns on Ascent 179
Image by author.

Fig. 163 Summary of research and analysis of FPS game maps 182
Image by author.

01

INTRODUCTION

Virtual Space

The design of the built environment pertains to more than aesthetics or functionality; it reflects the values, beliefs, and social behaviours of its particular culture and society. Since architecture progresses in step with society, it is a discipline continuously challenged and evolving in relation to changes in politics, environment, technology, and more. With the advancements made possible by the era of digitality, the notion of architecture has extended into the immaterial spaces of virtual reality.[1] James Corner,[2] in "Agency of Mapping," encapsulates the dynamic nature of space, noting that:

> *[Space] is remade continuously every time it is encountered by different people, every time it is represented through another medium, every time its surroundings change, every time new affiliations are forged.*[3]

The advent of computer-generated spaces has made them ubiquitous in our daily lives, from virtual chat rooms to online gaming worlds. Despite being assembled through pixels and data — disjoint from conventional space — virtual space is undoubtedly architectural in nature. These synthetic 3D spaces replicate many of the features of the real world and can engage the user's senses of sight, orientation and perception, as well as influence emotions. This intersection of digital technology and spatial experience presents new challenges and opportunities for architects. Lukas Feireiss,[4] in "New Babylon Reloaded," highlights these challenges:

> *Developments in technology and the media have not failed to influence our ideas and perceptions of space and time. Global networking, the application of electronic and digital media in all spheres of life and the establishment of virtual worlds of simultaneous information exchange in the last decade of the 20th century confront architects today with unimagined challenges in terms of creating space that extends far beyond the traditional horizons of their discipline.*[5]

One of the most significant impacts of virtual space on architecture is how it has changed how people experience environments; it challenges the notions of space and offers alternative ways of seeing and navigating. These novel interactions manipulate digital representations of buildings and spaces in ways that are not possible in the physical

1 Gregory Martin Whistance-Smith, "Spatial Communication in Videogame Environments: Exploring, Enacting, Perceiving" (MA Thesis, Alberta, Canada, University of Alberta, 2019).

2 Landscape architect and theorist.

3 James Corner, "The Agency of Mapping: Speculation, Critique and Invention," in *Mappings, Critical Views* (London: Reaktion books, 1999), 227.

4 Curator, writer, and educator focused on intersections between disciplines.

5 Lukas Feireiss, "New Babylon Reloaded," in *Space Time Play* (Basel: Birkhäuser, 2007), 219.

world, such as being able to explore and experience a building or space before it is built or accessing areas that are not accessible in the physical world. These interactions with immaterial architecture are made possible due to fundamental differences in the way space is experienced in physical and virtual realities—in non-mediated and mediated worlds.[6] One of these critical differences lies in the fact that physical architecture must conform to the laws of the natural world and the standards of the practice. Physical architecture is intended to serve practical purposes, such as providing shelter, facilitating activities, and supporting societal needs; they respond to their environment and landscape, possessing both an interior and exterior that influence each other; and must adhere to rules and regulation such as zoning, site constraints, and structural integrity.

In contrast, virtual spaces are not constrained by these factors. Yiou Wang,[7] in "Minotaur plays Ludius Loci," uses video game spaces as a lens to analyze the complex relationship between virtual and real spaces:

> *When architecture deviates from shelter, comfort or function, its relationships are modified. The architecture of play may not at all times be human serving, but it serves foremost the play experience, the emergence of indeterminate interactions, ambiguity and mental stimulation.*[8]

Yiou points out that the experience of architecture in virtual settings is modified compared to the real world. This divergence from traditional architecture is exemplified in video games, where spaces can be physically impossible but virtually accessible. Michael Nitsche,[9] in *Video Game Spaces*, further explains how video games create these *impossible spaces:*[10]

> *Other examples of physically impossible and virtually accessible spaces include mismatched interior and exterior of 3D structures: a virtual building's interior architecture can be larger or smaller, or it can suggest a different shape than the exterior form indicates. These spaces can also alter spatial interconnections: stepping through the same door twice might not lead to the same virtual space, turning around might not lead back into the space the character just came from.*[11]

6 Michael Nitsche, *Video Game Spaces: Image, Play, and Structure in 3D Game Worlds* (Cambridge: The MIT Press, 2008), 3.

7 Artist in the field of media arts with prior training in architectural design.

8 Yiou Wang, "Minotaur Plays Ludius Loci," *On Site Review*, no. 44 (2024): 26.

9 Background in architecture, professor and researcher.

10 Impossible spaces refer to "space which can not be justified as existing wholly within the diegesis." Edward Branigan, *Narrative Comprehension and Film*, 1st edition, Sightlines (London ; Routledge, 1992), 44, https://doi.org/10.4324/9781315003108.

11 Nitsche, *Video Game Spaces*, 120.

Digital spaces also introduce a significant level of accessibility and inclusivity by allowing users to inhabit and explore environments independent of their physical bodies, creating dissociation between one's physical presence and their virtual interactions. This separation is facilitated through virtual avatars, which act as digital representations of users within these spaces. Virtual avatars give users online anonymity and pseudonymity, which magnifies the possibility for free expressive experimentation.[12] However, as Julie E. Cohen[13] highlights in "Cyberspace as/and Space," it is crucial not to view cyberspace as entirely separate from the physical world, as such assumption overlooks how digital and physical experiences are interconnected.[14] She asserts that each virtual world within video games is "a space neither separate from real space nor simply a continuation of it."[15]

James Gee,[16] in *What Video Games Have to Teach Us About Learning and Literacy*, identifies the "tripartite play of identities"[17] that occurs in games, where the player simultaneously navigates their real, virtual, and projective identities. First, there is the true identity of the player as their real-world self — who they exist as in the physical world. Then, there is the in-game representation of the player, which becomes their virtual identity. The third identity, projective identity, materializes from the projection of the true identity onto the virtual one.

Zach Waggoner[18] builds on this concept in *My Avatar, My Self*, positioning the projective identity as a liminal space where the real and virtual selves converge.[19] Waggoner likens Gee's projective identity to "the middle ground between the real-world identity and the virtual identity of the user: the avatar."[20] He suggests that avatars blur the boundaries between real and virtual spaces, enabling users to project aspects of their identity and presence into virtual environments while still being influenced by their physical selves. This interplay between identities reveals that while avatars allow users to transcend physical limitations, they remain connected to the user's psychological and emotional

12 Although this can have negative effects as anonymity and pseudonymity can also present opportunities for malice. David Post, "Pooling Intellectual Capital: Thoughts on Anonymity, Pseudonymity, and Limited Liability in Cyberspace," *University of Chicago Legal Forum* 1996, no. 1 (December 7, 2015), https://chicagounbound.uchicago.edu/uclf/vol1996/iss1/5.

13 Legal scholar and professor.

14 Julie E. Cohen, "Cyberspace as/and Space," *Columbia Law Review* 107, no. 1 (2007): 213.

15 Ibid.

16 Linguist and researcher who has worked in psycholinguistics, discourse analysis, sociolinguistics, bilingual education, and literacy.

17 James Paul Gee, *What Video Games Have to Teach Us About Learning and Literacy*, 1st ed., Education (New York: Palgrave Macmillan, 2004), 54.

18 Professor and researcher with interests in videogame rhetoric, computers and writing, digital portfolios, and the rhetoric of gender in society.

19 Zach Waggoner, *My Avatar, My Self: Identity in Video Role-Playing Games* (Jefferson, N.C: McFarland & Co., 2009), 15.

20 Ibid.

attributes. Therefore, the nature of cyberspace is "both normative and performative."[21]

Navigating virtual spaces fundamentally relies on our real-world perceptions, particularly those related to sight and sound. This reliance is deeply rooted in immersion, a crucial element for the success of virtual experiences. Janet Murray,[22] in *Hamlet on the Holodeck: The Future of Narrative in Cyberspace,*[23] describes immersion as:

> *Immersion is a metaphorical term derived from the physical experience of being submerged in water. We seek the same feeling from a psychologically immersive experience that we do from a plunge in the ocean or swimming pool: the sensation of being surrounded by a completely other reality, as different as water is from air, that takes over all of our attention, our whole perceptual apparatus[.] In a participatory medium, immersion implies learning to swim, to do the things that the new environment makes possible [and turns] the enjoyment of immersion as a participatory activity.*[24]

Murray emphasizes that the concept of immersion depends on the user's perceptual apparatus being stimulated and engaged in a similar manner to real world experiences. For virtual spaces, immersion heavily relies on how technology enhances the player's sensory experience, made possible through finetuned visual fidelity, audio depth, and tactile feedback. Often, the degree of immersion directly correlates with the degree of realism within the medium. This mirroring of real-world sensory experiences allows users to navigate and interact with virtual environments in a natural and familiar manner, thereby enhancing the overall immersive experience.

This interconnectedness of real and virtual spaces suggests that digital environments are not entirely separate from the physical world. Instead, they exist on a continuum, allowing dissociation and association to occur simultaneously. The avatar becomes a tool for exploring this continuum, enabling users to transcend physical limitations and engage in a spatial experience that is both embodied and virtual. As Corner notes, the boundaries between different realities have blurred to the point where:

> *[I]t is practically impossible in a cyber-world to distinguish between what is information and what is concrete, what is fact and what is fiction, what is space and what is time.*[25]

■

21 Cohen, "Cyberspace as/and Space," 214.

22 Professor and researcher with interests in interactive design, interactive narrative, and the history and development of representational media.

23 Janet Murray, *Hamlet on the Holodeck: The Future of Narrative in Cyberspace* (Cambridge, Mass: The MIT Press, 2017).

24 Ibid., 98.

25 Corner, "The Agency of Mapping: Speculation, Critique and Invention," 226.

Video game environments, as navigable spaces offering a wide range of interactions,[26] exemplify this blurring of boundaries. Free from the constraints of physical architecture, video game spaces are designed with a focus on player experience. These spaces can be ephemeral and temporary, and dynamic in that they can be updated at any time to support new gameplay mechanics or features. Additionally, within the virtual world, users can manipulate these environments directly, altering their state by opening or closing paths and thus restricting or granting access to different areas.

While these spaces may differ from conventional architecture, they share the same fundamental goal: to create meaningful, engaging spaces[27] that shape behavior and communicate values.[28] In this way, video games offer valuable insights into how virtual architecture can influence user behavior and interactions, making them a rich field of study for architects and designers alike.

26 Nitsche, *Video Game Spaces, 3.*

27 Ernest Adams, "The Construction of Ludic Space," in *2003 DiGRA International Conference: Level Up*, vol. 2, 2003.

28 Whistance-Smith, "Spatial Communication in Videogame Environments: Exploring, Enacting, Perceiving," 1.

Game Spaces

In the twentieth century, with the invention of electronic computers and development of games for them, emerged the concept of designing digital spaces for gameplay.[29] At first, they were simple games; played through simple mechanics; and represented through simple graphics. But, as these games evolved, the spaces of video games have become incredibly immersive and compelling. Lianh Khong,[30] in "Unreal Cities," states that game environments "exert directional force,"[31] where architecture in video game spaces can serve as integral components of gameplay, and its spatial structure can directly impact the behavior of players. This is made possible by the inherent nature of game design, where the designer fabricates every corner of the environment. Khong notes that since, "a game's designer starts from nothing, the weather, atmosphere, and pull of gravity [all] must be questioned as the player advances across a city."[32] It is due to having such a far range of control within a game environment that every choice made in the design of the environment is to serve gameplay. This insistence on the careful design of digital play space emerged in the 2000's, where video game studies experienced a paradigmatic shift: the central component in the discussion of video games became its spatiality or spatial structure.[33] Stephan Gunzel,[34] in "The Space Image," documents this as:

> *In recent computer game research, a paradigmatic shift has been observed: Games today are first and foremost conceived as a new medium characterized by their status as an interactive image. The change in attention towards this aspect becomes apparent in a new approach that is, first and foremost, aware of the spatiality of games or their spatial structures.*[35]

Prior to this shift, video game environments were historically influenced by visual presentation methods similar to those in film. In cinema, the continuity and coherence of the world are maintained despite the fragmented nature of individual shots, achieved through the careful coordination of movement between the camera, setting, and audience.[36] In contrast to the experience of space in film, video games give "spatial

29 Christopher W. Totten, *An Architectural Approach to Level Design* (Florida: A K Peters/CRC Press, 2014), 30, https://doi.org/10.1201/b21989.

30 Writer and editor, with interests in the intersections of contemporary culture and politics.

31 En Liang Khong, "Unreal Cities: Urban Architecture in Video Games and Anime Films.," *TLS. Times Literary Supplement, no. 6149 (February 5, 2021): 14–16.*

32 Ibid.

33 Stephan Günzel, "The Space-Image. Interactivity and Spatiality of Computer Games," in *Conference Proceedings of the Philosophy of Computer Games* (University Press, 2008), 170.

34 Professor and researcher with interests in Media Theory, Game Studies, Practices of Space.

35 Günzel, "The Space-Image. Interactivity and Spatiality of Computer Games," 170.

36 Stephen Heath, "Narrative Space," *Screen* 17, no. 3 (October 1, 1976): 68–112, https://doi.org/10.1093/screen/17.3.68.

control back to the player,"[37] and allows space to manifest through action. While these play spaces "might have grown out of cinematic traditions, once interactivity was added, it reached the world of video games."[38]

> *If photographs are images, and films are moving images, then video games are actions. [...] They exist when enacted.*[39]

As video games are two-dimensional representations of three-dimensional spaces,[40] the design of spatial qualities in a computer or video game is inherently an architectural endeavour. Despite their two-dimensional nature, these virtual environments are designed to feel incredibly three-dimensional, immersing players in richly detailed, interactive, and ludic worlds.

> *[Game space is] an imaginary space; it is necessarily constructed by human beings and therefore may be thought of as the product of architectural design processes.*[41]

The concept of ludic space, ludic meaning of or relating to play, as derived from the Latin word *ludus*,[42] refers to game environments as playful and rule-bound spaces crafted specifically for engaging interaction and exploration. In the context of video games, ludic space is synonymous with video game space, as both are designed to facilitate play and interaction within a set of rules and mechanics. Through ludic space, video games question physical space as the primary architectural medium and its role in ordering human experience.[43] Video game spaces reach beyond the rules of classical building, where structural elements such as walls, floors, and openings can exist in a state of perpetual transformation, thus dissolving linear and hierarchical order.[44] As virtualized spatial environments, these computer-generated worlds are not localized or grounded topographically. They are spaces of no place, transcending social, geographical, political, physical, and temporal boundaries. Yet, they manifest through movement and forms.[45]

Over the past few decades, the video game industry has grown significantly, and video games have become an important and influential medium. This industry, its players, and the media content produced constantly generate new artifacts to analyze and learn

37 Nitsche, *Video Game Spaces*, 77.

38 Ibid., 76.

39 Alexander R. Galloway, *Gaming: Essays on Algorithmic Culture, Electronic Mediations 18* (Minneapolis: University of Minnesota Press, 2006).

40 Mark Grimshaw, "The Resonating Spaces of First-Person Shooter Games," in *Games Computing and Creative Technologies: Conference Papers* (UBIR: University of Bolton Institutional Repository, University of Bolton, 2007).

41 Adams, "The Construction of Ludic Space," 1.

42 Katie Salen and Eric Zimmerman, *Rules of Play: Game Design Fundamentals* (Cambridge, Mass: MIT Press, 2003), 303.

43 Feireiss, "New Babylon Reloaded," 219.

44 Ibid.

45 Ludger Hovestadt, preface to Steffen P. Walz, *Toward a Ludic Architecture. The Space of Play and Games (*ETC Press, 2010), vii, https://doi.org/10.1184/r1/6686981.v1.

from. Sophisticated video games have exceeded their purpose of entertainment and have become places for interaction.[46] Therefore, these game environments approximate architectural spaces and can serve as precedents for virtual space design, especially those that focus on interaction between multiple space users. In particular, First-person shooter (FPS) video games are especially suited for the study of interaction. Through their use of the first-person point of view, the player is immersed within the environment because of it's controllable and familiar field of vision.[47]

> *If there's a single genre that defines the video game, it might be the first-person shooter. There's just something pure about the concept. No on-screen avatar to jerk around like a puppet. Your monitor is your eyes. Your mouse, your rifle. The connection is direct and immediate.*[48]

Through the "direct and immediate"[49] connection of the physical body to the virtual avatar, FPS games foster a sense of embodied presence and agency with instantaneous feedback. This intimate connection between the player and the virtual environment necessitates a deeper exploration of its spatial qualities and design choices that shape the game world.

Architecture has long been about shaping the spaces people inhabit, and as technology advances, the boundaries of those spaces extend beyond the physical realm into the virtual. Video games, especially First-Person Shooter (FPS) maps, provide new paradigms for how architecture can be understood and designed. These environments, meticulously crafted to enhance player engagement, offer a model for interactive design where space is not static, but responsive, shaping and being shaped by the players who inhabit it. Video game architecture is not just an escape from reality, but an exploratory tool that forces us to rethink how space functions even in real-world contexts. Just as game designers use space to guide behavior, interaction, and strategy, architects might rethink cities, buildings, and public spaces as interactive environments, capable of responding to the people within them.

By dissecting game spaces, we uncover patterns of movement, engagement, and interaction that are just as applicable to real-world architecture. These insights challenge traditional architectural thinking and open the door to new possibilities, where interactivity is a core function, and where spaces adapt to their users. This thesis positions the architectural study of video games as a critical lens through which to explore the future of architecture—both virtual and real.

■

46 Dariusz Jacob Boron, "Infinite Regress: The Blurring of an Architectural Game-Space" (MA Thesis, Onatrio, Canada, Carleton University, 2006), 4, http://www.pqdtcn.com/thesisDetails/70B1F8F31C3B3FA97D0EC01209A61A9E.

47 Boron, "Infinite Regress."

48 K. Thor Jensen, "Knee Deep in the Dead: The History of First-Person Shooters," *PCMAG*, accessed February 27, 2024, https://www.pcmag.com/news/the-complete-history-of-first-person-shooters.

49 Ibid.

Valorant (2020) and First-Person Shooter (FPS) Video Games

> *The term first-person shooter refers to an independent computer game genre whose main characteristic is that it is played in the first-person perspective, with shooting as the main action of the game. The player moves his or her character in a three-dimensional world and perceives the digital environment through the eyes of this virtual character. A typical element within this genre is the virtual arm of the player, which remains in front at all times, and which represents the arm of the player reaching into virtual reality as a digital extension of his or her body. This virtual arm is attached to the character's head movements, which are controlled by computer mouse. No matter where the player looks, the arm holding the weapon stays at the lower right corner pointing toward the centre of the screen. It is, in fact, impossible to lower the arm.*[50]



Fig. 1 Screencapture of *Valorant*
Screenshot of Valorant, IP of Riot Games.

FPS games are characterized by their first-person viewpoint, which places players directly into the game world and offers an intimate spatial experience. This perspective emphasizes the importance of architecture in game space, as players must navigate these environments in real time, making decisions based on visual cues and spatial layout.

50 Aram Bartholl, "First Person Shooter: Everyday Counter-Strike," in *Space Time Play* (Basel, Berlin: Birkhäuser, 2007), 318.

FPS games, through their embedded point of view, "provide players with an unbroken exploration of space, allowing them to pan, tilt, track, and dolly through the space."[51] This immersive experience is enhanced by the on-screen representation of the player's arm,[52] typically holding their primary weapon in the bottom right or left corner, thereby reinforcing the player's connection to their avatar and enhancing the sense of physical presence within the game.

FPS games have evolved significantly since their inception, continuously learning from previous titles and innovating for the future. The genre is an evolutionary lineage of games, each building upon the successes and lessons of its predecessors and their many derivatives. This iterative process of learning and innovation drives the continuous advancement of FPS games, ensuring each new title offers fresh and engaging experiences while honouring the successful designs of the past.

The first FPS game is *Maze War*[53] (1973), a student project at its inception.[54] *Maze War* "pioneered many of the features that have become synonymous with first-person shooters,"[55] such as the first-person perspective, a basic set of goals, simple ludic activity (look, move, shoot, take damage), and maze-like levels.[56]

The FPS genre solidified with the release of *Wolfenstein 3D*[57] (1992), which stripped the genre from its previous alignment with RPG[58] gaming and established the characteristics of what a "straightforward shooter"[59] game should be.[60] The player begins with a basic set of weapons—a knife and a pistol—and eliminates enemies to acquire more potent weapons and to advance to the set stage.[61] Dan Pinchbeck[62] remarks on how *Wolfenstein 3D* differed in comparison to previous games:

51 Mark J. P. Wolf, "Space in the Video Game," in *The Medium of the Video Game* (University of Texas Press, 2001), 66, https://doi.org/10.7560/791480.

52 Catacomb 3-D is the first title to make character's animated hand fully visible on-screen, adding an additional layer of immersion in the first-person point-of-view.
Nicholas Straub, "What the First FPS Game REALLY Was (Not DOOM or Wolfenstein)," *ScreenRant* (blog), October 11, 2020, https://screenrant.com/first-fps-first-person-shooter-game-3d/.

53 Created by Steve Colley, Howard Palmer, and Greg Thompson (and other contributors) at the NASA Ames Research Center.
Dan Pinchbeck, *Doom: Scarydarkfast, Lanmark Video Games 3* (USA: University of Michigan Press, 2013), 6.

54 Straub, "What the First FPS Game Really Was."

55 Ibid.

56 Pinchbeck, *Doom, 6*.

57 Developed by id Software. Published by Apogee Software and FormGen. Released for PC. 1992.

58 Role Playing Games.

59 Pinchbeck, *Doom, 10*.

60 Titles following Maze War featured "predominantly RPG-flavored gameplay, based on complex controls, resource gathering, and stat management."
Ibid., 7.

61 Terry Hon-Tai Sin, "Architecture at Play: The Magic Circle and Flow in Video Game Spaces" (MA Thesis, Cambridge, ON, University of Waterloo, 2012), 28, http://hdl.handle.net/10012/6660.

62 Writer, (ex) creative director at The Chinese Room, and game developer.

> *Goodbye ghouls, healing potions, and crypts. Hello chainguns, pseudo-supernaturalized sci-fi, and, most important, [eliminating enemies]. Wolfenstein 3D offered a radical break from the normal deployment of first-person perspective in gaming [by removing RPG elements.] The FPS had arrived.*[63]

However, despite the titles previously released (including *Maze War* and *Wolfenstein 3D*), *Doom*[64] (1993) is often considered to be the origin of the FPS genre, as it popularized many of the conventions that define FPS games today. *Doom* was so successful that the FPS games released after it were frequently dubbed "*Doom* clones"[65] rather than standalone games, reflecting *Doom*'s immense influence. Supported by the growing number of "*Doom* clones", the FPS genre had definitively been established. Pinchbeck, on the pre-alpha[66] playthrough of *Doom,* acknowledges that, despite its incomplete condition, "the design ethos is all in place: twisting corridors open up into large split-level rooms, and exterior and interior sections allow for radically different senses of scale to exist within a single level."[67] The spaces of *Doom* were complex, giving players a real spatial experience for the first time in a video game. This complexity was achieved through modular design, using preset rooms with fixed dimensions where through stacking, connecting, and attaching, these fixed elements could be arranged to create intricate spaces.[68]

In the mid-1990s, games like *Duke Nukem 3D*[69] (1996) further established the groundwork for contemporary FPS titles by cranking up the visual fidelity and introducing more complex combat mechanics. Frederik Schreiber[70] notes, "In 1996 we released a game called *Duke Nukem 3D*, which is now one of the biggest genres in the world. *Fortnite, APEX*, *Call of Duty*, all these video games are FPS and without *Duke Nukem 3D* many of these games would most likely never have existed."[71]

Many FPS enthusiasts would agree that *Maze War* introduced the concept of FPS games, *Wolfenstein 3D* established the approach, *Doom* introduced the space, atmosphere, and setting, and *Duke Nukem 3D* provided the personality through further mechanic complexity. Established by these games, the FPS genre share a lineage of game rules,

63 Pinchbeck, *Doom, 9.*

64 Developed by id Software. Published by id Software. Released for PC. 1993.

65 Straub, "What the First FPS Game Really Was."

66 Meaning a prototype.

67 Pinchbeck, *Doom, 32.*

68 Lowood, H. E.. "Doom." Encyclopedia Britannica, September 2, 2024. https://www.britannica.com/topic/Doom.

69 Developed by 3D Realms. Published by FormGen. Released for PC. 1996.

70 Executive producer, partner, and Vice President at 3D Realms. Released games including Duke Nukem 3D and Ion Fury.

71 Andreea Burciu, "Information Architecture and User Experience in First-Person-Shooter (FPS) Video Games" (MA Thesis, Denmark, Aalborg University, 2019), 64.

functions, and spatial design. Even to the point of making some FPS games feel like copies of their predecessors, as Pinchbeck notes:

> *The contemporary first-person shooter* Crysis 2 *may look like an oil painting, but at heart, it's just first-person* Defender. *Lurking just below the dystopian musings on free will and capitalism that give* Bioshock *its unique flavor is* Wolfenstein 3D *with water and a wrench.*[72]

Due to this shared lineage, many FPS game environments possess similar spatial elements and types of arrangements across titles, often tracing back to earlier predecessors or standing out as innovative advancements. *Valorant*[73] *(2020),* one of the most popular current FPS, exemplifies this progression by adopting and refining the characteristics of *Counter-Strike:Global Offensive* (CSGO)[74] (2012).[75] *Counter-Strike* in turn was originally a mod[76] for *Half-Life*[77] (1998) that was later repackaged as a standalone game.[78]

Game analysts describe *Valorant* as "the culmination of everything developers have learned about the first-person shooter genre, from 1990s *Doom* until today's *CSGO*."[79] *Valorant* is a free-to-play multiplayer tactical[80] first-person shooter game developed and published by Riot Games for PC (Personal Computer) play. First teased under the codename "Project A" in October 2019, the game began a closed beta period with limited access on April 7, 2020, followed by official release on June 2, 2020.[81] *Valorant* is a zero-sum game; one team's victory always means the other team's defeat, leading to a high level of competition between teams. Currently, it is dominating the FPS genre and resides at the top of the leaderboard for most hours watched and live-streamed.[82] In contrast to many other multiplayer FPS games, *Valorant* is explicitly designed for multi-

72 Pinchbeck, *Doom, 2.*

73 Developed by Riot Games. Published by Riot Games. Released for PC. 2020.

74 Developed by Valve and Hidden Path Entertainment. Published by Valve. Released for PC, Playstation 3, and Xbox. 2012.

75 *Valorant*'s map design differs notably from CSGO. In CSGO, the maps are generally more open, with fewer corners to clear, reducing the likelihood of encountering hidden enemies. *Valorant,* on the other hand, features more sharp turns and cubbies, creating opportunities for ambushes and requiring players to be more vigilant.

76 "Mod" is short for "modification" and is the process of altering the original game by players. This can include retexturizing avatar skins, uploading new terrain to play in, and changing functionalities of the game such as overriding the maximum number of players in a game.

77 Developed by Valve. Published by Sierra Studios. Released for PC. 1998.

78 Alex Nichiporchik, "The Five Pillars of Emergent Gameplay," Games Industry, 2023, https://www.gamesindustry.biz/the-five-pillars-of-emergent-gameplay.

79 Matthew Du, "Valorant vs. CSGO Compared: Which One Is Better?," *Medium* (blog), May 2, 2023, https://mattkendu.medium.com/valorant-vs-csgo-compared-which-one-e432e65d7601.

80 A tactical FPS game means that they tend to simulate realistic situations and must be played carefully, where "stealth and cover assume a large role." This sets itself apart form other types of shooter games such as Shooting Gallery games, Rail-shooters, and Survival Horror.
Ernest Adams, *Fundamentals of Shooter Game Design* (California: New Riders, 2014).

81 "Valorant," in *Wikipedia*, April 1, 2024, https://en.wikipedia.org/w/index.php?title=Valorant&oldid=1216615758.

82 "FPS Games," accessed August 7, 2024, https://gamesight.io.

play and not as a single-player game with multi-player options.

Valorant's environments are meticulously designed to support various tactical scenarios. They feature multiple routes, verticality, and strategically-placed choke points that encourage team coordination and diverse tactical approaches. The design ensures that no single strategy dominates, promoting adaptability and creativity among players. Olivia from *Abios*[83] asserts that "while VALORANT's maps are not perfectly balanced, they are still more evenly balanced than most of CS: GO's maps,"[84] positioning *Valorant* as a title that has taken the spaces of its predecessor and made them even better. This emphasis on strategic gameplay is a significant advancement in the genre, offering a rich field for studying virtual architecture and its impact on player behaviour and game dynamics.

> *Map design and the significance of built environments continue to be inherently integral to gameplay within the realm of virtual worlds and video games, specifically in the genre of first-person shooters, and Riot Games' VALORANT is no exception to this. Defying former expectations of its predecessors within the tactical shooter genre, Riot continually endeavors to make fundamental changes to decades of old formulas that have been implemented in practice all these years.*[85]

While *Valorant* distinguishes itself through its tactical gameplay and intricate map design, it remains deeply rooted in the lineage of FPS games that prioritize combat-oriented space. Like its predecessors, *Valorant* relies heavily on the design of contested environments where player actions are influenced by spatial constraints that dictate engagement. What makes this significant is how the game's maps mirror the geopolitical landscapes of post-9/11 urban warfare, where cities are often depicted as sites of ruin, decay, and destruction. These spaces, while virtual, echo the tactical principles used in real-world conflict zones, where success is determined by control over the built environment.

In many ways, *Valorant* continues the tradition of militarized gameplay, reinforcing the power dynamics embedded in these spaces. The game's maps are designed not just for combat, but for the strategic manipulation of space—players must control nodes and chokepoints, much like military forces in urban warfare scenarios. This architectural

83 Abios is an esports data company that provides historical and live data, statistics and content visualizations, and probability calculations for the esports industry.

84 Olivia, "CS:GO vs. VALORANT: Which Game Is More Balanced?," *Abios Newsroom* (blog), 2023, https://abiosgaming.com/press/csgo-vs-valorant-which-game-is-more-balanced/.

85 Jullia Joson, "Map Design and Built Environments in Video Games: Exploring The World of VALORANT," ArchDaily, April 11, 2022, https://www.archdaily.com/979934/map-design-and-built-environments-in-video-games-exploring-the-world-of-valorant.

approach to game design speaks to a broader cultural fascination with territorial control and the logics of war, where space is not neutral but a highly contested arena shaped by conflict. The violence in *Valorant* is thus not only a game mechanic but a reflection of a broader political history that situates urban destruction and warfare as central themes in both virtual and real-world contexts.

Virtual contested spaces are not neutral; they are ideologically charged spaces that reflect and reinforce contemporary political struggles. When designing contested spaces, virtual architects, much like real-world ones, bear a social responsibility in shaping spaces that facilitate healthy interaction, fair competition, and community building. The potential ethical implication of designing contested spaces, especially when applied to non-gaming virtual environments, need to be carefully considered and deeply engaged with. This is not to say, however, that contested spaces of FPS games do not offer important lessons apart from moments of intense conflict.

Ultimately, *Valorant* situates itself off the back of a history of first-person gaming that stretches all the way to the inception of computer games as a medium, and from the very beginning the spaces of FPS games have directly challenged players with their spatial qualities. Modern FPS titles feature highly complex, expansive environments, but at a closer look, they do not deviate too far from the maze-like spatial characteristics of early titles. In *Maze War*, the game's architecture is literally a sprawling maze in which the player must traverse, explore, and confront enemies. Similarly, in *Wolfenstein 3D,* players are entangled within corridors that twist, turn, and branch in ways that are closely aligned to the spatial characteristics of the maze.

On this point, the significance of the maze in the context of FPS games cannot be overstated. The first FPS game featured the maze as its primary mode of space, setting a precedent for the spatial complexities that would become a staple of the genre. This archetypal maze structure has influenced the design of FPS game spaces, where intricate layouts challenge players and act as a place of contest.

The Map and The Maze

Maps have long served as direct and indirect translations of the world, bridging specific viewpoints with broader contexts.[86] Historically, maps varied in representation styles and orientation types, ranging from early cartography's symbolic and iconic imagery to the precise, data-driven visualizations of modern maps. Early maps offered a transcendent orientation, rich with symbols and metaphorical elements. In contrast, modern maps provide an immanent orientation, relying on concrete, measurable data to visualize relationships between numerical values, such as altitude and location. Maps have the unique capability to represent locations without resembling them, allowing for the depiction of places that do not yet exist simply by naming them.[87] This means maps can designate positions in space before they are experienced or even visited. Therefore, maps influence both mathematical and practical understandings of territory; changes to a map can alter the physical and geopolitical reality. In either case, maps serve as visualizations that convey specific knowledge about the world and should be conceived as diagrams as opposed to pictures.[88] Just like computer games, maps are virtual, abstract, and representative spaces.[89]

> *Mapping precipitates its most productive effects through a finding that is also a founding; its agency lies in neither reproduction nor imposition but rather in uncovering realities previously unseen or unimagined.*[90]

In video games, maps continue this tradition of varied representation, adapting these functions to virtual environments. In exploration games, the map[91] serves to orient the player within an expansive world, providing a navigational aid representing what is known about the game space. As players explore, new areas are uncovered and gradually revealed on the map, often transforming from hidden or greyed-out regions into detailed, accessible locations. This dynamic mapping process enhances the sense of discovery and progression.

However, the role of the map in multiplayer FPS games is distinctly different. In these games, the map is not just a tool for orientation but is the very ground on which gameplay occurs. The interaction in these games occurs entirely within the confines of the map, which defines explicit boundaries and structures the competitive environment.

86 Stephan Günzel, "'Eastern Europe, 2008' Maps and Geopolitics in Video Games," in *Space Time Play* (Basel, Berlin: Birkhäuser, 2007), 445.

87 Corner, "The Agency of Mapping: Speculation, Critique and Invention," 225.

88 Günzel, "'Eastern Europe, 2008' Maps and Geopolitics in Video Games," 445.

89 Walz, *Toward a Ludic Architecture*, 201.

90 Corner, "The Agency of Mapping: Speculation, Critique and Invention," 213.

91 Often presents as an interface you can toggle to display with a designated key, commonly 'M', or is featured as a small static map residing in one of the corners of the screen.

Here, the map is the game itself,[92] shaping player strategies, influencing movement patterns, and providing tactical advantages through its layout. In this case, the map is also considered as the *level*[93]—the spaces used for player interaction.[94] Unlike exploration games, where the map evolves with the player's journey, in multiplayer FPS games, the map is a constant, pre-designed battlefield where mastery of its intricacies can determine the outcome of the game. In this context, the map's role shifts significantly; it no longer functions as a source of orientation for an acting subject in space but rather as an agent that manifests possibilities for the player.

A brief analysis of FPS video game maps reveals that these maps exhibit similar characteristics to mazes. While not identical, FPS maps often incorporate intricate pathways, junctions, and strategic points that mirror traditional maze structures' complexity and navigational challenges. The maze is a reoccurring archetype of video game space[95] as it is a common architectural type for play,[96] serving as the foundational spatial structure in which the game takes place. The spatial logic of the maze is one of discovery, surprise, and challenge while fostering ambiguity as to where you are situated and where others are located.

It is important to note that while 'maze' has often been used interchangeably with 'labyrinth', as within gaming the "the general term for any intricate structure is labyrinth,"[97] the maze differs from the labyrinth "in its multicursality—having multiple paths, while a labyrinth is a unicursal structure."[98] Multicursal structures encompass more complex spatial relations and emergent scenarios[99] as the maze forces players to make choices, such as choosing between forking paths.[100] It acts as a "play-ground for non-linear play that seeks to disorient the player and requires spatial decision-making as a necessary condition of game progress."[101] FPS video games naturally "favor maze structures since navigating them already constitutes a challenge."[102]

92 Günzel, "'Eastern Europe, 2008' Maps and Geopolitics in Video Games," 446.

93 Some games feature progressing levels, where each new level contains harder challenges and often rewards players for completion, hence the term "level up," while other game has singular levels.

94 Johnathon Wilson, "Level Design: Understanding a Level," Game Developer, 2018, https://www.gamedeveloper.com/design/level-design-understanding-a-level.

95 Martin Nerurkar, "Archetypical Spaces, Part 3: The Maze," *Game Architecture* (blog), September 16, 2012, https://www.gamearch.com/2012/09/16/archetypical-spaces-part-3-the-maze/.

96 Yiou Wang and Yujie Wang, "Moving Architecture, Animated Maze: The Intertextuality Between Player and Environment Agents," in *Creativity and Cognition* (C&C '21: Creativity and Cognition, Virtual Event Italy: ACM, 2021), 1, https://doi.org/10.1145/3450741.3466806.

97 Clara Fernández-Vara, "Labyrinth and Maze: Video Game Navigation Challenges," in *Space Time Play* (Basel, Berlin: Birkhäuser, 2007), 74.

98 Wang, "Minotaur Plays Ludius Loci," 26.

99 Salen and Zimmerman, *Rules of Play,* 57.

100 Walz, *Toward a Ludic Architecture,* 191.

101 Ibid., 193.

102 Fernández-Vara, "Labyrinth and Maze: Video Game Navigation Challenges," 74.

> *The labyrinth is a play-ground best conceived as a spatial device for creating linear experiences that features some degree of disorientation, but doesn't require the player to make numerous choices in order for the game to progress (as does, for example, a narratively oriented game). A maze, on the other hand, is a play-ground for non-linear play that seeks to disorient the player and requires spatial decision-making as a necessary condition of game progress.*[103]

Mazes in video games often manifest as *challenge*[104] space and/or *contested*[105] space. As a challenge space, the maze presents itself as a puzzle for players to navigate and solve through finding their way out of it. As a contested space, the maze accommodates the presence of multiple players each vying for control or dominance within the maze, turning it into a battleground. Georgia Mcgregor,[106] in "Situations of Play: Patterns of Spatial Use in Videogames," lists six space-use patterns that describe the "majority of gameplay and game space interactions."[107] These prevalent patterns of spatial use are:[108]

> **Challenge Space:** *where the environment directly challenges the player and therefore forms gameplay.*[109]
>
> **Contested Space:** *where the environment is a setting for contests between entities therefore affects gameplay.*[110]
>
> **Nodal Space:** *where social patterns of spatial usage are imposed on the game environment to add structure and readability to the game therefore structures gameplay.*[111]
>
> **Codified Space:** *where elements of game space represent other non-spatial game components and therefore contains information in gameplay.*[112]
>
> **Creation Space:** *where the player constructs all or part of game space as part of gameplay therefore becomes gameplay.*[113]
>
> **Backdrops:** *where there is no direct interaction between the game space and the player and therefore is not part of gameplay.*

■

103 Walz, *Toward a Ludic Architecture,* 193.

104 Georgia Leigh Mcgregor, "Situations of Play: Patterns of Spatial Use in Videogames," in *Situated Play*, 2007, 539.

105 Ibid.

106 Writer and researcher with interests in how play is spatialized in video games.

107 Mcgregor, "Situations of Play: Patterns of Spatial Use in Videogames," 539.

108 Ibid.

109 For example, platform games or parkour games.

110 For example, FPS game maps.

111 For example, games that use architecture to organize activity into discrete zones such as going to the virtual shop in order to buy and sell items.

112 For example, user interface elements such as health indicators.

113 For example, building mechanics in Minecraft.

Multiplayer FPS games epitomize the contested space typology, where the environment is to be disputed and occupied by opposing groups of space-users. In this space, game space serves as the arena for conflict, and it *affects* gameplay,[114] rather than *forms* gameplay.[115] Players' battle to gain control and dominance over the entire game environment or sections of it.[116] Here, maps are designed to facilitate encounters between players, creating dynamic environments where spatial knowledge and strategic planning are crucial.

The layout of these maps often shares spatial attributes with mazes, such as intricate pathways, junctions, and (sometimes) dead ends,[117] creating areas that require players to be constantly aware and cautious of their surroundings and opponents' positions. Given the similarities in spatial logic, FPS maps can be understood as derivative presentations of mazes.[118] While not as convoluted as traditional mazes, FPS maps retain the core elements that make mazes challenging and engaging. The design of these maps appropriates some aspects of the maze while maintaining the essential features that drive strategic gameplay. Understanding the FPS map as a spatial metamorphosis of the maze allows us to recognize its inherent nature as a space of contest. This perspective enables the deconstruction of FPS maps into their fundamental components or elements, much like how a maze can be reduced into a set of non-subdividable elemental units.[119]

Yiou Wang and Yujie Wang, in *Moving Architecture, Animated Maze: The Intertextuality Between Player and Environment Agents*, comment on how "systemic complexities arise from the simplest parts. [The] maze, an ancient category of gamified architecture, greatly demonstrates this tenet by being a multi-route disorienting system whose subdivided parts are so simple and so regular that they couldn't be easier to understand."[120] They identify the maze as a configurational complex assembled through distinct elements: *passage*, *corner*, *junction*, or *dead end*.[121]

> *The maze system operates on generality and specificity: it can be deconstructed down to the same set of components at the fragment level, but the telling distinction is the node - whether it is a corner, a dead end, or a junction. To construct a maze means to construct the nodes, and merely fill in the rest with continuous passage.*[122]

■

114 Mcgregor, "Situations of Play: Patterns of Spatial Use in Videogames," 543.

115 Which would be the case for challenge space, where the game space directly challenges the player and the space itself forms gameplay. For example, parkour levels in video games.
Ibid.

116 Ibid., 540.

117 "Moving Maze," Yiou Wang, March 26, 2021, https://yiouwang.org/portfolio/moving-maze/.

118 Totten, *An Architectural Approach to Level Design*, 117.

119 "Moving Maze."

120 Ibid.

121 Wang and Wang, "Moving Architecture, Animated Maze."

122 Ibid.

In a similar fashion, this thesis posits that the spatial logic of FPS maps can be systematically deconstructed into hierarchical categories of spatial elements, beginning with general components that can be further subdivided into more specific sub-elements. However, where FPS maps diverge significantly from traditional maze constructs is in their philosophy of creating continuous and fluid gameplay spaces. This deviation is not merely a simplification, but a strategic design choice that reflects the dynamic and contested nature of multiplayer environments. Consequently, FPS map patterns employ elements that orchestrate unique spatial arrangements, diverging from those typically found in traditional mazes. These patterns provide critical insights into how FPS maps function as contested spaces and how different architectural configurations facilitate various forms of contest. For example, contesting a single enemy player through direct combat, contesting the entire enemy team through flanking, or contesting the game's objective by pushing through a chokepoint each requires different approaches due to the specific constraints embedded within the map's architecture. This perspective allows for a deeper understanding of the fundamental spatial typologies within virtual environments designed for critical encounters and play, as well as their implications for player interaction and strategy.

A Note on Violence

The issue of violence inevitably arises within the conversations surrounding video games, particularly the FPS genre. While it is true that FPS video games incorporate violent gestures in their games, it is essential to consider the spatial conditions that shape moments of contest beyond their role in violent narratives, as this provides an opportunity to uncover how virtual design influences player behaviours.

Yet, it is crucial to acknowledge the violence in FPS games as a reflection of deeper ideological structures embedded within the design of these virtual environments. These spaces, much like real-world militarized landscapes, are architecturally and ideologically designed for conflict. FPS maps do not simply facilitate gameplay but actively simulate scenarios where violence becomes a tool for territorial dominance and strategic advantage. The controlled and deliberate placement of sightlines, chokepoints, and collision points mirrors real-world tactics in urban warfare, where space is contested and violence is normalized as a necessary means of control.

Historically, the evolution of FPS games has been significantly influenced by the military-industrial complex, especially within the United States. *Battlezone*[123] (1980), a pioneering video game to incorporate notions of 3D space, achieved such success that the U.S. Army subsequently commissioned Atari to create tank simulators modeled after the game.[124] This intersection of military interests and video game development is perhaps nowhere more evident than in titles like *America's Army*[125] (2002) and *Full Spectrum Warrior*[126] (2004). These games, developed under the endorsement of the U.S. Army and other defense entities, were not merely recreational projects, but were strategic endeavors aimed to serve as training aids and recruitment tools.[127] The explicit purpose behind such collaborations was to leverage the immersive qualities of FPS games to prepare soldiers for real-world combat scenarios while simultaneously appealing to a younger demographic potentially interested in military careers.

Even beyond titles with direct military involvement, the FPS genre draws from a variety of militaristic inspirations as seen in *Medal of Honor*[128] (1999) which features scripting by U.S Tier 1 Operators who were deployed overseas.[129] This relationship between

123 Developed by Atari. Published by Atari. Released for Arcade. 1980.

124 Totten, *An Architectural Approach to Level Design,* 33.

125 Developed by Sega Studios, Ubisoft, and United States Army. Published by America's Army, and Ubisoft. Released for PC and Xbox. 2002.

126 Developed by Pandemic Studios, Mass Media, 5th Cell. Published by THQ. Released for PC. 2004.

127 Stephen Graham, "War Play: Practicing Urban Annihilation," in *Space Time Play* (Basel, Berlin: Birkhäuser, 2007), 422.

128 Developed by Steven Spielberg, and DreamWorks Interactive. Published by Electronic Arts. Released for PlayStation. 1999.

129 "Medal of Honor Video Games," Medal of Honor News, February 12, 2011, https://medalofhonornews.com/medal-of-honor-video-games.

military and entertainment has elicited intense scrutiny over the potential real-world implications of virtual violence, mainly stemming from anxieties about the possibility of players recreating game actions in the real world.[130] While many studies have been performed on the correlation between violent video games and real life aggression in players,[131] there has yet to emerge a definitive connection.[132]

Those who reject the negative portrayals of FPS games argue that virtual environments are self-contained worlds governed by rules and conditions distinct from those in reality. Games are still a framed reality independent from external reality,[133] and therefore the behavior of in-game players are unlikely to be adopted by their actual selves, as players would not confuse the game world with the real world.[134] Furthermore, some even argue that "the dissociation of actions from consequences is a compelling feature of [video] games"[135] itself. This delineation is crucial in understanding player interaction within these games, where the architecture and spatial strategies play a significant role in the gameplay and player experience, independent of the narrative's violent content. As "gaming action is occurring within a separate, semiautonomous space," it is "removed from normal life."[136] Though "not essential or fundamental to games but is common,"[137] violence is often featured in video games because "it is the most obvious and natural expression for conflict."[138] Almost all games have conflict situations that support the goal structures within the video game.[139]

> *Conflict implies danger; danger means risk of harm; harm is undesirable. Therefore, a game is an artifice for providing the psychological experiences of conflict and danger while excluding their physical realizations. In short, a game is a safe way to experience reality.*[140]

In FPS games, the heightened presence of conflict demands that game maps be designed to instigate a unique type of architecture—one where players are simultaneously the

130 Diana Pozo, "War Games at Home Home Games at War Geography and Military First Person Shooting Gamers," *Mediascape: UCLA's Journal of Cinema and Media Studies Winter 2011* (2011): 4.

131 Celia Hodent, The Psychology of Video Games, 1st ed. (Routledge, 2020), 59, https://doi.org/10.4324/9781003045670.

132 Anderson et al. in "Violent Video Game Effects on Children and Adolescents: Theory, Research, and Public Policy" conducted a meta-analysis of existing studies to reveal that violent video game exposure was positively associated with aggressive behavior and feelings. However, using the same set of data Hilgard et al. in "Overstated evidence for short-term effects of violent games on affect and behavior: A reanalysis of Anderson et al. 2010." performed a re-analysis that concluded the evidence presented by Anderson and colleagues is less sound than it was originally presented as.

133 Steffen P. Walz, "Approaches to Space in Game Design Research," *DIGAREC Lectures 2008/09*, DIGAREC, no. 2 (2009): 231.

134 Bartholl, "First Person Shooter," 318.

135 Chris Crawford, *The Art of Computer Game Design* (Berkeley, Calif: Osborne/McGraw-Hill, 1984), 17.

136 Galloway, *Gaming,* 6.

137 Crawford, *The Art of Computer Game Design,* 12.

138 Ibid.

139 Staffan Björk and Jussi Holopainen, *Patterns in Game Design, 2005,* 240.

140 Crawford, *The Art of Computer Game Design,* 12.

shooter and the target. Players constantly navigate environments that evoke both safety and danger, balancing between protection and exposure. These digital environments actively shape the dynamics of tension and conflict, engaging players in a dual role that blends aggression and vulnerability with spatial strategy. The key to understanding player interaction within these games lies in their spatial strategies, not in the narrative violence itself.

Another factor of concern surrounding violence in FPS games stems from the increasing realism with which it is depicted. While violence has long been a feature across various video game genres, early titles—particularly within the FPS genre—presented enemies and combat in a highly abstracted form, constrained by the technological limitations of the time. These early representations, often composed of pixelated and rudimentary visuals, distanced players from any semblance of realism. However, with advancements in technology, contemporary games such as *Call of Duty*, *Counterstrike* and *Valorant* have introduced high-definition, lifelike depictions of combat. This progression has increasingly blurred the line between entertainment and simulation, raising ethical concerns about the potential impact of hyper-realistic violence in virtual environments. Despite the increasing realism in FPS games, it remains essential to recognize that these are virtual constructs, and the violence, while visually convincing, is a game mechanic rather than a literal representation of real-world conflict. *Valorant*, like other modern FPS titles, emphasizes spatial mastery through carefully designed maps that require strategic navigation of contested space. The heightened sense of immersion in these games is not solely due to their realism but stems from how players interact with and control space within the game world.

The architectural elements of FPS maps reflect the complexities of real-world tactical environments. However, despite these realistic components, *Valorant* and similar games remain firmly in the realm of virtuality. The violence enacted in these games is mediated through the digital interface, maintaining a separation between the virtual and real worlds. The focus is on spatial strategy, where players navigate and contest environments that are designed to enhance interaction. In *Valorant*, combat becomes a tool for spatial mastery, transforming the game's maps into arenas where interactivity between space and player defines success. It is this dynamic, where space is not merely a backdrop but an active participant in the gameplay, that characterizes the modern FPS genre.

Despite waves of popularity and decline, the FPS genre has been persistently innovated upon by new generations of game designers.[141] Developers continuously challenge the narrative and associated violence within these games, reflecting the genre's resilience and its capacity to captivate players through maps of spatial interest, regardless of

141 Jensen, "Knee Deep in the Dead."

the overarching narrative themes. Even as the themes of conflict and combat remain central, designers increasingly focus on the architectural and spatial elements of game maps, recognizing that these aspects are critical to creating engaging and immersive experiences. The gameplay and narratives within the FPS games reviewed in this thesis, even those centered on conflict, are carefully analyzed to understand how spatial qualities contribute to play experience.

For more detailed analysis on the topic of violence and video gaming, the following references offer great insight:

> *War, Masculinity and Gaming in the Military Entertainment Complex: A Case Study of Call of Duty 4: Modern Warfare* by Kyle Kontour.[142]
>
> *War Games at Home, Home Games at War: Geography and Military First-Person Shooting Games* by Teddy Pozo [writing as Diana M.][143]
>
> *Wordplay and the Discourse of Video Games,* Chapter Two: *Video Games as 'Kid's' Toys* by Christopher A. Paul.[144]
>
> *What Video Games Have to Teach Us About Learning and Literacy,* Chapter Six: *Cultural Models: Do You Want to Be the Blue Sonic of the Dark Sonic?* by James Gee.[145]
>
> *The War Between Effects and Meaning: Rethinking the Video Game Violence Debate* by Henry Jenkins[146]
>
> *The 'First Person Shooter' Perspective: A Different View on First Person Shooters, Gamification, and First Person Terrorist Propaganda* by Sam Andrews.[147]

142 Kyle Kontour, "War, Masculinity, and Gaming in the Military Entertainment Complex: A Case Study of Call of Duty 4: Modern Warfare" (PhD Thesis, 2011).

143 Teddy Pozo writing as Pozo, "War Games at Home Home Games at War Geography and Military First Person Shooting Gamers."

144 Christopher A. Paul, *Wordplay and the Discourse of Video Games: Analyzing Words, Design, and Play,* Routledge Studies in New Media and Cyberculture 10 (New York: Routledge, 2012).

145 Gee, *What Video Games Have to Teach Us About Learning and Literacy*.

146 Henry Jenkins, "The War Between Effects and Meaning: Rethinking the Video Game Violence Debate," in *Digital Generations: Children, Young People, and New Media* (Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers, 2006), 19–31.

147 Sam Andrews, "The 'First Person Shooter' Perspective: A Different View on First Person Shooters, Gamification, and First Person Terrorist Propaganda," *Games and Culture 19*, no. 1 (January 1, 2024): 55–74, https://doi.org/10.1177/15554120231153789.

Aim and Relevance

This thesis aims to provide insights into spatial anatomy competitive multiplayer first-person shooter (FPS) video game environments through the investigation of the tactical FPS game *Valorant*.

Video games refer to games played on personal computers, consoles, and other and other devices with computer processing and video display capabilities. First-person shooters are a specific genre of video games that involve gunfire as a means of elimination from a first-person point-of-view. Competitive multiplayer refers to modes where players engage in player-versus-player (PvP) combat, typically within teams to achieve victory through defeat of the other.

FPS games are selected as the genre of focus due to their complex spatial design. Unlike other video game genres, FPS games demand a high level of spatial awareness and quick decision-making from players. The competitive nature of these games amplifies the importance of map knowledge, strategic movement, and spatial manipulation, making them ideal for studying the impact of virtual architecture on player behaviour and experience. Understanding the elements and patterns of FPS maps is fundamental to comprehending the spatial dynamics of FPS game maps in whole. Elements refer to the basic building blocks of game spaces, such as corridors, rooms, and open areas, each serving a specific function within the gameplay. Patterns, on the other hand, describe how these elements are arranged and interconnected to create a cohesive map layout that facilitates strategic gameplay.

This thesis will evaluate elements based on their capacity to generate specific gameplay types through spatial persuasion, that is, how dimensions, qualities, and functions of space influence different types of player response, movement, and psychological effects. All distinct elements will be catalogued into a taxonomy, presenting an overview of spatial elements that appear in multi-player FPS maps. These elements will then be categorized across multiple lenses that correspond with their functional hierarchy, spatial type, and spatial scale. While taxonomizing elements and collecting patterns are not new to game design research, previous research has been limited to game-objects or space-use, leaving a gap for a focus on spatial conditions, that is, how distinct spatial constructions influence player decisions. By breaking down the spaces of *Valorant's* FPS maps through this structuralist approach—uncovering the fundamental components and relationships that form the basis of the system—a body of baseline data can be built. This data can be used to compare titles within the genre[148] and, from an architectural

148 Pinchbeck, *Doom*, 153.

perspective, understand how spatial elements influence user behaviour in a virtual setting. By analyzing these elements and patterns, recurring spatial configurations that enhance player engagement and tactical decision-making can be identified. FPS games feature a distinct spatial anatomy of contested space that shapes the player's experience and gameplay dynamics. The strategic layout and design of these game spaces is crucial in determining the flow of gameplay, the pacing of combat encounters, and the overall sense of tension and urgency experienced by the player.

In summary, this thesis asserts that:

> Virtual space functions within both theoretical and practical domains of architecture, challenging and expanding traditional architectural boundaries.
>
> First-person shooter (FPS) game spaces exhibit a strong alignment with the architectural principles of mazes, thus serving as contested spaces that engage players through their intricate spatial structures and foster dynamic player interactions.
>
> Video game spaces provide a rich repository of examples that illustrate the extensive possibilities and potential inherent in virtual space design.

In the pursuit of understanding such space, this thesis asks the questions:

> What prototypical spatial types underpin gameplay in FPS games, and how can these be classified as distinct 'elements'?
>
> How do these elements integrate to form more complex, intentional systems within FPS maps, identifiable as 'patterns'?
>
> How does understanding elements and patterns reveal the underlying ludic structures of FPS video games?
>
> How can insights into FPS game maps inform and enhance the design of virtual environments, and in turn, benefit the practice of architecture?

The findings of this thesis work towards broadening the existing understanding of digital space as the use of digital environments becomes increasingly prevalent. Steffen P. Walz[149] testifies that “design can benefit from ludicly-inclined architects who conceptualize programs geared toward mobility, place-making, future learning, or problem simulation, regardless of whether the programs are executed virtually,

149 Professor, writer, lecturer, consultant and conceptual designer for cross-media and interactive entertainment.

physically, or in hybrid situations, using high or low technology."[150] Understanding game space and the way it is constructed can provide significant insights into how experiences can be structured in other digital information-based environments.

150 Walz, *Toward a Ludic Architecture*, 15.

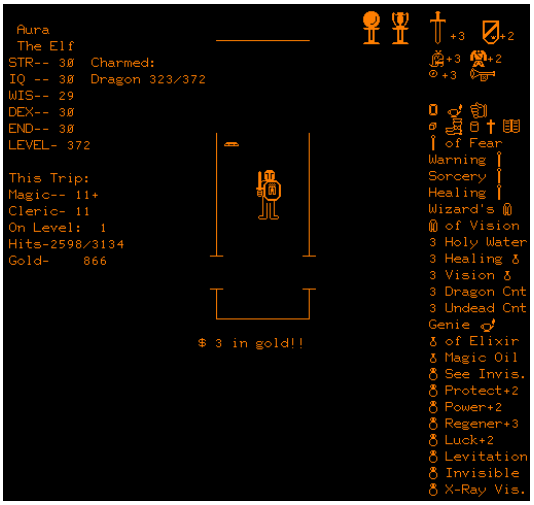
02

CONTEXT

A History of Space Representation in Video Games

Video games span across a wide variety of genres and typologies. The history of spaces designed for video games is expansive and rich with spatial strategies — starting from text-based point-and-click modules to fully stimulative, physics-engine powered, and multi-threaded environments. Representations of game space have always been determined by the technological affordances of the gaming apparatus.[151] As technology advanced, the configurations of these spaces have developed to be more complex, the graphics more realistic and stimulative, and the game more immersive. Ernest Adams,[152] in "The Construction of Ludic Space," situates all games as "lying along a continuum between abstract and representational. The more abstract the game, the more it relies on arbitrary rules to define the game world and the gameplay. The more representational it is, the more it relies on similarities between real-world situations familiar to the player and game-world situations."[153]

Apart from the graphic representation of space, video games include other interface features such as health bars, attack indicators, timers, and more, each serving important functions to the overall game. However, because this thesis focuses on spatial constructions, these interface options will be excluded from the discussion of virtual space and game space. The following material will look at the history of 3D video game spaces as a wider collection of virtual space representations.



Tracing a short spatiotemporal history of the architecture of video games, it begins with the most primitive space: **Text-Based Space.**[154] Games like *Dungeons and Dragons*[155] (1974) and *Empire*[156] (1977) used text to define environments, rooms, narratives, and player actions.

Fig. 3 Screenshot of DnD (video game)
Retrieved from Wikipedia Commons. Public domain.

151 Clara Fernández-Vara, Jose Zagal, and Michael Mateas, "Evolution of Space Configuration in Videogames," 2005.

152 Game designer, lecturer, and writer. Adams is considered to be one of the key figures in video game studies.

153 Adams, "The Construction of Ludic Space."

154 Jacob Boron Dariusz, "A Short History of Digital Gamespace," in *Space Time Play (*Basel: Birkhäuser, 2007), 26.

155 Created by Gary Gygax and Dave Arneson. First Published by Tactical Studies Rules Inc. 1974. Later Published by Wizards of the Coast. 1997.

156 Created by Walter Bright. Published by Interstel. 1987.

Following text-based games, the introduction of computer monitors that can support graphics created **Contained Space**[157]—which was limited to the dimensions of the display monitor. Games like *PONG!*[158] (1972) and *Space Invaders*[159] (1978) were created with simple graphics and all elements of gameplay were fully defined and played within the flat screen of a gaming computer or machine.

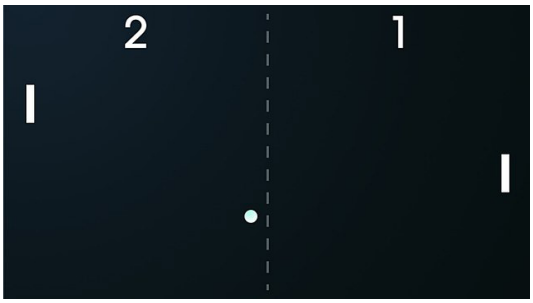


Fig. 4 Screenshot of PONG!
Retrieved from Wikipedia Commons. Public domain.

Soon after, level designers adopted the ability to extend space off-screen such as **Wraparound Space**[160] where space was not necessarily limited to the rectangle of the screen. In *Pac Man*[161] (1980), the space can be imagined as a continuous loop, if the player exited the screen off one edge they re-appeared at the opposite end.

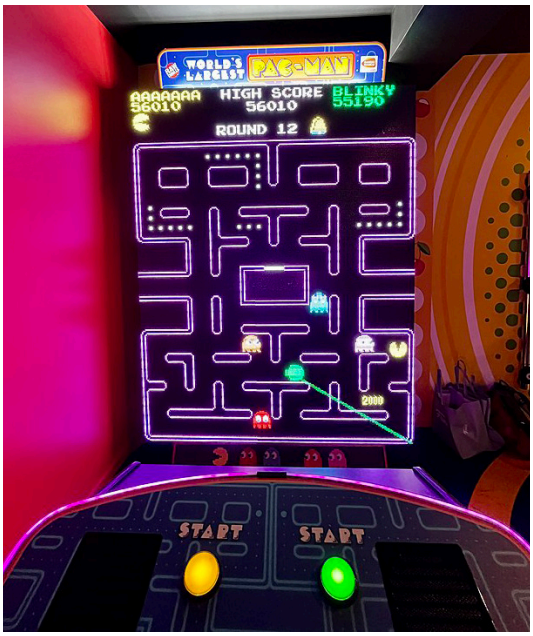


Fig. 5 Image of Pac Man
Retrieved from Wikipedia Commons. Liscensed under CC0.

157 Dariusz, "A Short History of Digital Gamespace," 26.

158 Developed by Atari. Published by Atari. Released for Arcade. 1972.

159 Developed by Taito. Published by Taito. Released for Arcade. 1978.

160 Dariusz, "A Short History of Digital Gamespace," 26.

161 Developed by Namco. Published by Namco. Released for Arcade. 1980

Then came **One Axis Pan**[162] and **Two Axis Pan**[163], further expanded the idea that space can exist off screen and can span vastly. Players could access a wider span of space through the rolling pan of the camera. In *Super Mario Bros*[164] (1985) the player could only move linearly in one direction while in *Sim City*[165] (1989) players could pan in both X and Y directions.



Fig. 6 Screenshot of Super Mario Bros
Retrieved from Wikipedia Commons. IP of Nintendo.

Games like *Berserk*[166] (1980) and *Spy vs Spy*[167] (1984) represented space as a series of rooms existing simultaneously as **Adjacent Spaces**[168] but these spaces were only able to be perceived and navigated one at a time in sequential order. This created the player experience of an interrelated floor plan despite the rooms being represented independent of each other.

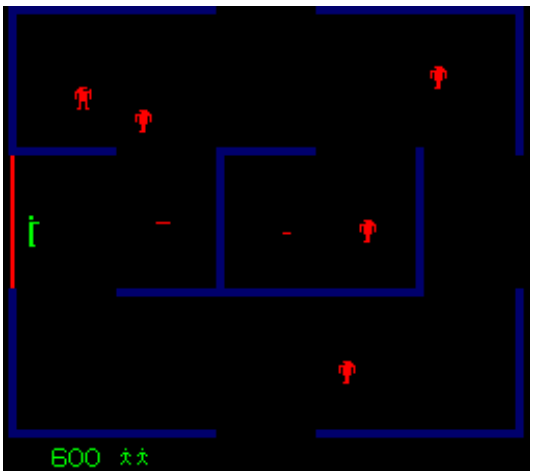


Fig. 7 Screenshot of Berserk
Retrieved from Wikipedia Commons. IP of Stern Electronics.

162 Fernández-Vara, Zagal, and Mateas, "Evolution of Space Configuration in Videogames."
163 Dariusz, "A Short History of Digital Gamespace," 27.
164 Developed by Nintendo. Published by Nintendo. Released for Arcade. 1985
165 Developed by Will Wright. Published by Maxis. Released for PC. 1989.
166 Developed by Alan McNeil, Stern Electronics. Published by Stern Electronics. Released for Arcade. 1980.
167 Developed by Michael Riedel, First Star Software. Published by First Star Software. Released for PC. 1984.
168 Dariusz, "A Short History of Digital Gamespace," 27.

In the pursuit of **3D Illusion**,[169] game designers used perspective lines to create a fabricated sense of depth on screen. Games like *Night Driver*[170] (1976) and *Tempest*[171] (1980) used one-point perspectives created through mathematical algorithms for the illusion of space spanning beyond the surface of the screen.

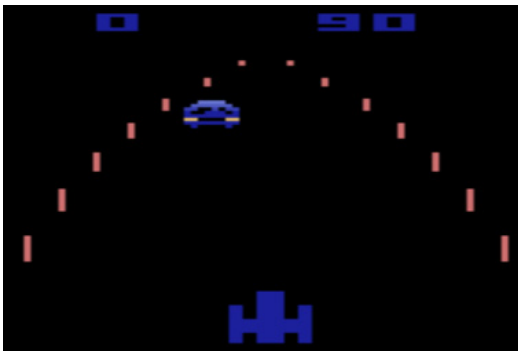


Fig. 8 Screenshot of Night Driver
Retrieved from Wikipedia Commons. IP of Atari Inc.

In similar fashion, **2D Layered Spaces**[172] as illustrated in *Double Dragon*[173] (1987), allowed players to experience a sense of depth through the layering of 2D images that created a foreground, middle ground, and background. The illusion of movement in these games depended on the changing images and the speed of their replacement.



Fig. 9 Screenshot of Double Dragon
Retrieved from Moby Games. IP of Technos Japan.

Isometric[174] was another style of perspective spatial representation. *Zaxxon*[175] (1982) and *Paper Boy*[176] (1984) were both games developed in the early 1980's that used this form of architectural 3D drawing. While purely axonometric images can create a dramatic 3D effect, they also come at the cost of depth perception for the player.[177]

169 Ibid., 28.

170 Developed by Atari. Published by Atari. Released for Arcade. 1976.

171 Developed by Atari. Published by Atari. Released for Arcade. 1981.

172 Dariusz, "A Short History of Digital Gamespace," 27.

173 Developed by Technos Japan. Published by Technos Japan. Released for Arcade. 1987.

174 Dariusz, "A Short History of Digital Gamespace," 28.

175 Developed by Sega. Published by Sega. Released for Arcade. 1982.

176 Developed by Atari. Published by Atari. Released for Arcade. 1984.

177 Totten, *An Architectural Approach to Level Design,* 153.



Fig. 10 Screenshot of Zaxxon
Retrieved from Moby Games. IP of Sega.

In the early 1990's game developers invested into creating realism. In *Mortal Kombat*[178] (1992) the on-screen avatar fighters were created from video capturing live martial artists and actors. The actors were each recorded punching, kicking, dodging, and punching. These movements were then played back at higher speeds during the gameplay to recreate fast-paced, seamless, and realistic action fighting. The implementation of realism aided the immersion of the player into the game's virtual world. Games like *Myst*[179] (1993) used advanced polygon modelling and rendered textured materials in a series of static images. Limited by technology, the game did not allow players to free roam this virtual environment quite yet, but *Myst* established itself as one of the earliest games to provid a feel for an undisrupted navigable 3D environment.



Fig. 11 Screenshot of Myst
Retrieved from Moby Games. IP of Broderbund.

178 Developed by Midway. Published by Midway. Released for Arcade. 1992.

179 Rand and Robyn Miller, Cyan. Published by Broderbund. Released for PC. 1993.

These examples of game spaces paved the way to **Full 3D Immersive Space,**[180] the most recognizable form of digital environment in modern video games. Here, players are stimulated with hyper realistic graphics and can move through space freely in X, Y, and Z directions, utilizing movement mechanics that allude to the physical world. Since their earliest days, video games have presented simulated spaces,[181] where the complexity of a game's functionality and its dependency on a seamless presentation are interconnected. The representation and perception of space has a direct impact on the degree of player immersion and is particularly relevant in the discussion on video gaming and architecture.[182]

Notably, FPS games were not just adopters of full 3D spaces; they were pioneers in the technology that made these immersive environments possible. Early FPS titles introduced players to to the first-person perspective and challenged the boundaries of spatial representation in gaming. The demands of the FPS genre—requiring precision in navigation, shooting mechanics, and spatial complexity—drove the development of advanced 3D engines capable of rendering complex spaces convincingly and in real-time. For example, *Doom* was created with the engine *id Tech 1* that was "responsible for pushing texture and lighting further than any previous PC engine and at a speed that was unheard of outside consoles."[183] *Id Tech 1* introduced binary space partition (BSP)[184] to video gaming,[185] a texturizing tactic that was remarkably powerful in creating more sophisticated 3D environments. Pinchbeck describes the revolutionary integration of BSP in *id Tech 1* below:

> *The atomic unit of id Tech 1 is a vertex, a position in a three-dimensional space. Vertexes join to create lines called linedefs. When you add a height variable to a linedef, this (two-dimensional) vertical space running along the linedef is called a sidedef. These are what textures are mapped onto. Once all vertexes are joined by linedefs, you create a polygon, called a sector, each with its own height variable and lighting. Also, just as every sidedef can be texture mapped, so can the "floor" and "ceiling" areas defined by the sector's shape, called visplanes. finally, you can cut holes in sidedefs to create windows and doors, with the result that light and sound bleed from one sector to another.*[186]

180 Dariusz, "A Short History of Digital Gamespace," 30.

181 Adams, "The Construction of Ludic Space," 1.

182 Boron, "Infinite Regress."

183 Pinchbeck, *Doom*, 34.

184 BSP first arose in context of 3D computer graphic in 1969, where it was particularly useful in rendering. "Binary Space Partitioning," GeeksforGeeks, June 26, 2020, https://www.geeksforgeeks.org/binary-space-partitioning/.

185 Pinchbeck, *Doom*, 34.

186 Ibid.

This technology allowed computer graphics to render at a speed that could keep up with the fast-paced movement and action of FPS games. By pioneering these technologies, FPS games established the standard for 3D interactive environments, significantly influencing how digital spaces are constructed and experienced, both in gaming and beyond. As Adams notes, modern FPS games remain "at the cutting edge of what game hardware can do, so they have the most dramatic graphics."[187] These graphics, combined with the immersive qualities inherent in the first-person perspective, create virtual experiences that extend their impact beyond the screen. John Carmack, creator of *Doom*, reflects on this phenomenon:

> *You know, when somebody got surprised by something in a traditional arcade game, they could be sweating and intense about it, but you'd be like "Dammit, you lost!" but in a first-person game, when you turn around a corner and there's something you didn't expect, we had people literally falling out of their seats.*[188]

187 Ernest Adams, *Fundamentals of Game Design* (New Riders, 2013).

188 Pinchbeck, *Doom*, 19.

Environmental Storytelling Through Visual Aesthetics

As identified in the previous chapter, video game environments encompass many forms of space produced for players to navigate. These spaces can be abstracted, such as the case of early forms, or highly realistic impersonations of reality, such as full 3D virtual spaces. Regardless of their form, these spaces, as they function in alternative ways than required of physical spaces, placing a far greater emphasis on expression and communication.[189] The ability for video game space to express and communicate meaning is attributed to the visual style or texture of architecture and environment, where every object, structure, and spatial design element can contribute to the unfolding of a story.

One approach in analyzing video game spaces is to treat them as a storytelling media. Within game studies, people who study games through their ability to tell stories are referred to as narratologists.[190] Narrative, in the context of games, refers to storytelling, and the relation of events and characters, which can be described as "the representation of an event, or a series of events."[191] Visual style plays a crucial role in this process by shaping the atmosphere and mood of these events, directly impacting how players engage with the virtual world.

In opposition to narratologists, there are those who study games from a different perspective known as ludologists,[192] who views games as systems.[193] Historically, ludologists have argued that too much emphasis has been placed on narrative components of video games over its other significant properties. Greg Costikyan,[194] in "Where Stories End and Games Begin," would even refute that video games are "a storytelling medium" altogether, as "the pleasure that people derive from games is not dependent on their ability to tell stories."[195] However, while he would not describe video games first and foremost through their ability to tell stories, he recognizes that video games can be used to tell stories and that including a narrative plot can enhance (though sometimes hinder) games.[196] This sentiment is shared among ludologists, who reject the

189 Whistance-Smith, "Spatial Communication in Videogame Environments: Exploring, Enacting, Perceiving," 3.

190 Michalis Kokonis, "Intermediality between Games and Fiction: The 'Ludology vs. Narratology' Debate in Computer Game Studies: A Response to Gonzalo Frasca," *Acta Universitatis Sapientiae, Film and Media Studies* 9, no. 1 (December 1, 2014): 173, https://doi.org/10.1515/ausfm-2015-0009.

191 H. Porter Abbott, *The Cambridge Introduction to Narrative*, 2nd ed., Cambridge Introductions to Literature (Cambridge: Cambridge University Press, 2008), 13, https://doi.org/10.1017/CBO9780511816932.

192 Kokonis, "Intermediality between Games and Fiction," 173.

193 Of rules, mechanics, and space.

194 Game designer and writer.

195 Greg Costikyan, "Where Stories End and Games Begin," Personal, *Greg Costikyan* (blog), 2000, http://www.costik.com/gamnstry.html.

196 Ibid.

notion that video games are fundamentally about narrative, and therefore cannot be studied solely in comparison to traditional storytelling arts, such as film.[197]

The dissonance between game theorists—narratologists and ludologists—can be attributed to the juxtaposition between the "demands of the story and the demands of the game," where "divergence from a story's path is likely to make for a less satisfying story; restricting a player's freedom of action is likely to make for a less satisfying game."[198] A story is linear[199] in its structure and is a controlled experience, one that is consciously crafted by someone other than the player. A video game, on the other hand, heavily relies on the action of the player to manifest itself as a medium.

> *Games must provide at least the illusion of free will to the player; players must feel that they have freedom of action within the structure of the game. The structure constrains what they can do, to be sure, but they must feel they have options; if not, they are not actively engaged. Rather, they are mere passive recipients of the experience, and they're not playing any more. They must not be constrained to a linear path of events, unchangeable in order, or they'll feel they're being railroaded through the game, that nothing they do has any impact, that they are not playing in any meaningful sense.*[200]

Therefore, the experience of playing video games cannot be simply reduced to the experience of their narrative. Numerous other factors, many of which are not directly related to storytelling, significantly contribute to the creation of successful games. In this context, the ludologists' emphasis on focusing more on the mechanics and formal structures of gameplay is both relevant and necessary. However, this does not diminish the importance of narrative in video games. While narrative is still a key component, it must be secondary to mechanics and should be seamlessly integrated into the game environment.

> *Buildings in games are not analogous to buildings in the real world, because most of the time their real-world functions are either irrelevant —the real-world activity that the building serves isn't meaningful in the game—or purely metaphorical. Rather, buildings in games are analogous to movie sets: incomplete, false fronts whose function is to support the*

197 Kokonis, "Intermediality between Games and Fiction," 173.

198 Costikyan, "Where Stories End and Games Begin."

199 This is a restrictive definition, as some stories can be told non-linearly. However, Costikyan describes these methods of storytelling as "inferior" because "the author has less control over how the reader encounters his story, he cannot structure the story for maximum effectiveness. Unquestionably it is still possible to tell a story this way--but other than the novelty of story-telling in this alternative mode, there seems little reason to want to do so."
Ibid.

200 Ibid.

> *narrative of the movie. If architecture were only about supporting the gameplay through constraint, concealment and so on, it could all be bare grey concrete. But architecture has a secondary, and still highly valuable role to play: to inform and entertain in its own right.*[201]

Jesper Juul,[202] argues that narrative in the discourse of video games can be "split into a level of discourse (the telling of the story) and the story (the story told)."[203] In video games, the discourse of the narrative — the telling of the story and *how* it is told — is often more impactful than just the story itself. This is due to, again, the core principle of video games themselves, that it is a medium in which can only be realized through the interaction of the player. Precisely because video games are interactive, the player directly participates in the experience and emotions elicited by the story. The experience of play is "at least as much [the player's] product as that of the game designers."[204] Therefore, narratives in video games are most successfully implemented when they are embedded in forms that players can interact with, through objects, environment, and architecture.

> *What can you do with a huge open world filled with thousands of different kinds of objects? You can tell stories with the environment itself.*[205]

The game environment can convey its story, history, and cultural context without the need for explicit exposition. For instance, the juxtaposition of old, decaying structures with modern, technologically advanced elements can suggest a world in transition, filled with conflict and contrast. Environmental storytelling is a key principle in the design of video game spaces and refers to the "art of arranging a careful selection of the objects [and structures] available in a game world so that they suggest a story to the player who sees them."[206] This mode of storytelling in game space is a collaborative endeavor between environment and player, as the interpretation of meaning is ultimately derived by the player. Therefore, architecture in video games serves as metaphors for gameplay narrative and mechanics, as they impart meaning for the player to discern. This suggests that video game architecture can function as signs, entering the domain of semiotics. Michalis Kokonis,[207] in "Intermediality between Games and Fiction," comments that,

■

201 Ernest Adams, "Designer's Notebook: The Role of Architecture in Videogames," *Game Developer* (blog), 2002, https://www.gamedeveloper.com/design/designer-s-notebook-the-role-of-architecture-in-videogames.

202 Video game theorist and game developer.

203 Jesper Juul, "Games Telling Stories?," Journal Archive, Game Studies, July 2001, https://www.gamestudies.org/0101/juul-gts/.

204 Costikyan, "Where Stories End and Games Begin."

205 Bart Stewart, "Environmental Storytelling," Game Developer, 2015, https://www.gamedeveloper.com/design/environmental-storytelling.

206 Ibid.

207 Professor, writer, and researcher with interests in issues of narratology in cinema, the novel, and on cultural studies.

from a purely pragmatic view: "What the gamer faces on the screen [before them are] just some shapes, colours, designs, [and] objects. Playing the game means assigning some meaning to each one of them, configuring them out, which means treating them as signs that need interpretation."[208] The visual aesthetics of video game environments, one that is filled with signs, metaphors, and allusions, contribute to the story of the game which, in turn, contribute to meaningful gameplay.

A prime example of these principles in action can be found in the architecture of *Valorant,* where visual aesthetics are integral to the overall experience, playing a significant role in narrative of the game world. In *Valorant*, each map alludes to a location in the real world, with a distinct visual style that conveys a specific cultural or historical context.[209] In doing so, these maps become "the chief mechanism through which *Valorant* doles out morsels of the story."[210] Lydia Zanotti, 3D environment artist on *Valorant*, emphasizes that each environment is designed with careful consideration on how it supports the established narrative within the game, even down to the "graffiti, props, and small details to the map,"[211] that all come together to "tell a story to the players."[212] These details are more than decorations, as they carry symbolic meanings that resonate with the game's broader themes of resistance, espionage, and conflict. For instance, the juxtaposition of ancient and modern elements in the *Valorant* map *Ascent*—where traditional Venetian architecture is disrupted by advanced technology—suggests a world caught in transition. The fragmented city is filled with remnants of daily life, like open pizza boxes and abandoned market stalls, which subtly convey a sense of disruption and abandonment. Joseph Killeen, narrative writer for *Valorant*, testifies that developing a "visual language and baking it into the DNA [of maps]"[213] is crucial to the process of map design. Even without a fully articulated official story or lore[214] from Riot Games, players can grasp the world's condition through its environments, made possible by the powerful environmental storytelling embedded in the game's visual aesthetics. In addition to intricate spatial conditions, this layering of narrative in maps not only enriches the player's visual experience but also deepens their engagement with the game world as they navigate through it.

208 Kokonis, "Intermediality between Games and Fiction."

209 Joson, "Map Design and Built Environments in Video Games."

210 Mikhail Klimentov, "Here's How Breeze, 'Valorant's' Newest Map, Was Built," *Washington Post* (blog), April 26, 2021, https://www.washingtonpost.com/video-games/2021/04/26/heres-how-breeze-valorants-newest-map-was-built/.

211 Lydia Zanotti, "The Art of VALORANT Map Environments," Riot Games, November 16, 2020, https://playvalorant.com/en-us/news/dev/the-art-of-valorant-map-environments/.

212 Ibid.

213 *How We Shaped Pearl // Dev Diaries - VALORANT*, Youtube Video, Dev Diaries - VALORANT, 2022, https://www.youtube.com/watch?v=nrJDA0ZcwrQ.

214 Riot Games periodically releases cinematic animations to tell fragments of the story, but leaves the interpretations ultimately up to its players as there does not exist an official body of text that explains the lore of the world in its entirety.

Architecture serves many roles in video games, whether that be embedding narratives, serving as formal manifestations of game rules and structures, or other purposes. Through this amalgamation, digital architecture—meaning both landscape and structures—is "what turns the bare grid of the chessboard into the living world of the computer game."[215] This thesis recognizes the multifaceted functions of architecture in video games. While architecture within video games cannot be deprived of its visual aesthetics and role of world building, the focus of this thesis is specifically on its impact on movement, perspective, and player engagement through its formal properties.



Fig. 12 In game capture of the disrupted architecture in 'Ascent'
Screenshot of Valorant, IP of Riot Games.



Fig. 13 In game capture of abandoned pizza in 'Ascent'
Screenshot of Valorant, IP of Riot Games.

215 Adams, "The Role of Architecture in Videogames."

Movement, Rhythm, and Flow

> *[M]ovement is indeed a central feature of play as a human practice in space[,] that makes it possible to think of play and digital environments[,] such as computer games[,] as being constitutes through relational movements.*[216]

The modality of movement is central to the experience of architecture, comprising of many ideologies within theory and practice, in so they can be considered to lie at the core of design and serve as a pre-condition for spatiality.[217] Understanding the role of movement in video games is essential for comprehending how architectural design influences in-game dynamics. Movement, rhythm, and flow are central features of gameplay, akin to how circulation paths in architecture guide experiences.

Lev Manovich,[218] in *The Language of New Media*, argues that video games confront players with a space meant "to be traversed, to be mapped out by moving through it."[219] Furthermore, this intentional navigation of space is an "essential, if not the key component, of the gameplay."[220] The linking of points via movement in virtual space is a foundational principle of cyberspace itself.[221] Movement in virtual space links points, guiding the player's view, enforcing sightlines, triggering velocity, and presenting or concealing parts of the whole.[222] This active engagement demands participation, affecting, shocking, and surprising the player, much like the designed spaces in architecture. Video games are inherently linked to movement, rhythm, and flow.

Architecturally, play is a rhythmic activity enabled by space, that occurs within a space of play and produces space.[223] Space, whether that be virtual or physical, both demands to be moved through, as one cannot have a "spatial experience without the kinesthetic experience, without the sense of motion and body speed and body moving through space."[224]

■

216 Walz, *Toward a Ludic Architecture, 51.*

217 Ibid., 29.

218 Artist, author, and theorist of digital culture.

219 Lev Manovich, *The Language of New Media*, 4th ed., Leonardo (Cambridge, Mass.: MIT Press, 2002), 245.

220 Ibid.

221 Nitsche, *Video Game Spaces, 173.*

222 Walz, *Toward a Ludic Architecture, 30.*

223 Ibid., 29.

224 William J. Mitchell, "Action in the Hands of the User," in *Space Time Play* (Basel: Birkhäuser, n.d.), 407.

Henri Lefebvre's[225] theory of *rhythmanalysis*, presented in *The Production of Space*[226] and *Rhythmanalysis: Space, Time, and Everyday Life*,[227] provides a framework for understanding these rhythmic qualities in architecture.

> *It is possible to envision a sort of 'rhythm analysis' which would address itself to the concrete reality of rhythms, and perhaps even to their use (or appropriation). Such an approach would seek to discover those rhythms whose existence is signaled only through mediations, through indirect effects or manifestations. Rhythm analysis might eventually even displace psychoanalysis, as being more concrete, more effective, and closer to a pedagogy of appropriation (the appropriation of the body, as of spatial practice).*[228]

Lefebvre suggests that rhythm is created through repetition and even asserts that rhythm cannot exist "without repetition in time and space."[229] At its core, *rhythmanalysis* seeks to understand the relationships between body and space-time through interactions between the space-user and space, studying the appropriation of the body as a spatial practice. In an application of such theory, Iain Borden,[230] in *Skateboarding, Space, and the City: Architecture and the Body*, investigates movements produced through traversing architecture on-top of a skateboard. He cites Lefebvre and reconciles: "Skateboarding creates 'repetitions and redundancies of rhythms' and 'symmetries and asymmetries' irreducible to analytic thought."[231] Borden affirms that the interaction enacted by space-users (skateboarders) and their terrain allows for architecture to be thought as "not a thing but a flow."[232]

Flow[233] is a concept many game theorists consider lying at the center of gameplay and immersion. Paolo Perdercini, game developer and educator, points out that "the gamer's relationship with architecture is closer to that of a skateboarder or a parkour athlete."[234] Psychologically, flow is the mental state in which a person engaged within an activity is fully immersed in their act. It induces intense concentration, involvement,

225 French philosopher and sociologist best known for his pioneering work on space, urbanism, and everyday life.

226 Henri Lefebvre, *The Production of Space, trans. Donald Nicholson-Smith,* Reprinted (Oxford: Blackwell, 1997).

227 Henri Lefebvre, *Rhythmanalysis: Space, Time and Everyday Life,* trans. Stuart Elden and Gerald Moore, Athlone Contemporary European Thinkers (New York: Continuum, 2004).

228 Lefebvre, *The Production of Space*, 206.

229 Lefebvre, *Rhythmanalysis,* 6.

230 Professor of Architecture and Urban Culture.

231 Iain Borden, *Skateboarding, Space and the City: Architecture and the Body* (Oxford: Berg, 2001), 113.

232 Ibid., 9.

233 Coined by psychologist Mihály Csíkszentmihályi in 1970 in his book *Flow: The Psychology of Optimal Experience.*

234 Götz and Gerber, *Architectonics of Game Spaces: The Spatial Logic of the Virtual and Its Meaning for the Real*, 47.

and enjoyment in the activity.[235] Architecturally, flow can be used to describe a type of architecture that provokes rhythmic movement by space-user through space. In video games, flow occurs when players "become lost in the game's gameplay"[236] and fully immerses themselves into the virtual world.

Movement, repetition, rhythm, and flow are interconnected concepts that shape the spatial and experiential qualities of physical and digital space. Movement initiates interaction within space, influencing how inhabitants interact with and navigate their environment. Repetition involves the recurrence of actions, creating patterns that contribute to rhythm,[237] which is the structured sequence of movements in time. Together, these elements contribute to flow, which is the harmonious and seamless progression through space as space-users become fully immersed within the environment.

Walz, in *Toward a Ludic Architecture: The Space of Play and Games*, asserts that that play has four dimensions in relation to movement:[238]

> Whether physical or virtual, play is grounded in and executed through movement: The nature of play is kinetic.
>
> **Kinesis bridges a player with one or more players, play-objects, and/or play environments (or combination thereof) that feature some kind of valence and, in their own ways, play back.**
>
> This dialectical to-and-fro creates and/or adjusts to a play rhythm, which relates to alternations between tension and termination: From both, a play dynamic emerges.
>
> Play takes place on a play-ground and simultaneously defines that play-ground (i.e. by defining its boundaries in space and time).

Focusing on the second dimension, "kinesis bridges a player with play-objects and play environments,"[239] this highlights the importance of movement in connecting players to their virtual surroundings. Understanding movement in video games allows us to better comprehend the spatial dynamics of FPS games. Movement is not merely functional; it is a critical component that defines the spatial experience. The way players navigate through game spaces, including their speed and direction, shapes their interaction with virtual architecture.

■

235 Walz, *Toward a Ludic Architecture*, 39.

236 Sin, "Architecture at Play," 50.

237 See more on different types of rhythm that can be present within game spaces in *Towards a Ludic Architecture: The Space of Play and Games* pages 51-58.

238 Walz, *Toward a Ludic Architecture*, 59.

239 Ibid., 59.

Despite the boundaries that contain players within an FPS map, these spaces do not confine but rather facilitate dynamic movement, creating repetition and circularity in both space and time.[240] As players move through FPS game levels, they encounter various spatial patterns and structures. These spaces afford movement at the scale of the player, maintaining a constant flow that encourages exploration and interaction.[241] Movement influences the perception of scale, orientation, and immersion within the game's environment. For example, rapid movement through large open spaces can amplify the perceived size of the environment, while slow navigation through cramped areas can enhance the sense of confinement. Movement is a vital dimension in video games, deeply intertwined with the spatial and experiential qualities of virtual environments. The very concept of play is attributed to "free movement within a rigid structure."[242]

240 E. A. Grosz, *Architecture from the Outside: Essays on Virtual and Real Space, Writing Architecture Series (*Cambridge, Mass: MIT Press, 2001).

241 Sin, "Architecture at Play," 240.

242 Salen and Zimmerman, *Rules of Play*, 304.

Linear and Nonlinear Gameplay: Singleplayer vs. Multiplayer

This distinction between linear and nonlinear games is necessary to observe due to the differences in spatial design that accommodate gameplay. Similar to circulation paths in architecture, where the movement through spaces is deliberately crafted to create a specific experience or narrative, game design employs spatial configurations to guide player interactions.

Henry Jenkins[243] and Kurt Squire,[244] in "The Art of Contested Spaces," observe that the spaces of linear and nonlinear games are classified as limited by either "soft rails" or "hard rails," where the former allows for multi-directional play and the latter tightly programs player's ability to move.[245] Walz speculates on this and suggests that the "game environment can be divided into proposed promenades and imposed promenades."[246]

Singleplayer games often feature linear progression that follows a predefined storyline, and space is specifically created to complement a static narrative.[247] Spatial organization is structured around the journey within the game, having a designated path that takes the player from start to end where architecture can resemble corridors or paths aimed to guide, pace, and challenge the player whilst supporting the narrative plot.[248] This confines the player's movements to a pre-arranged path, where each step and every encounter is deliberately designed to unfold in a predetermined manner.[249] The player traverses from one room to the next, conquering each obstacle in the same order as any other player.[250] Linear design allows for more of a cinematic experience, but it takes away from exploration and feeling connected to the crafted world. While a linear journey may be experienced differently each time, the structure of its presentation remains the same.

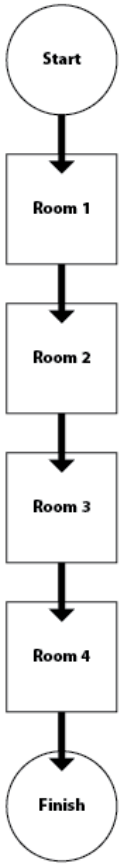


Fig. 14 Linear progression
Diagram by author.

243 Media scholar and professor of Communication, Journalism, and Cinematic Arts.

244 Professor and scholar with research interests in theories and approaches to game-based learning, and the design of games for impact.

245 Kurt Squire and Henry Jenkins, "The Art of Contested Spaces," in *Game On: The History and Culture of Video Games* (NY, USA: Universe Publishing, 2002), 69, https://web.mit.edu/~21fms/People/henry3/contestedspaces.html.

246 Walz, *Toward a Ludic Architecture,* 99.

247 Sin, "Architecture at Play," 34.

248 James Murff, "How FPS Architecture Makes Us Think," *Fanbyte* (blog), 2023, https://www.fanbyte.com/legacy/how-fps-architecture-makes-us-think.

249 Sin, "Architecture at Play," 34.

250 John Feil and Marc Scattergood, *Beginning Game Level Design* (Boston, MA: Thomson Course Technology, 2005), 73.

> *Single-player games feature linear levels that are not meant to be explored, but rather "cleared" of hostile creatures while multi-player levels feature multiple overlapping paths with dangerous intersections.*[251]

Conversely, multiplayer games are non-scripted and often nonlinear.[252] Unlike single-player and co-op games, other characters within the game, whether ally or enemy, can be real people. In games that are meant for constant replay, like multiplayer FPS games, a linear play style does not suit the genre. Instead, having spaces that allow for circular movement makes for more interesting and entertaining gameplay.[253] In this context, the term "gameplay" refers to the game's capacity to provide the player with meaningful choices and options, the accessibility of these choices, and their relevance to the player's in-game circumstances. The same game can be played multiple times with each time producing a different gaming experience and game outcome. Due to the interaction of multiple players, the game cannot follow the same rigid structure of single player games. If players never encounter each other, nothing occurs within the game. Therefore, spaces in multiplayer games are designed to foster as much interaction, even deadly

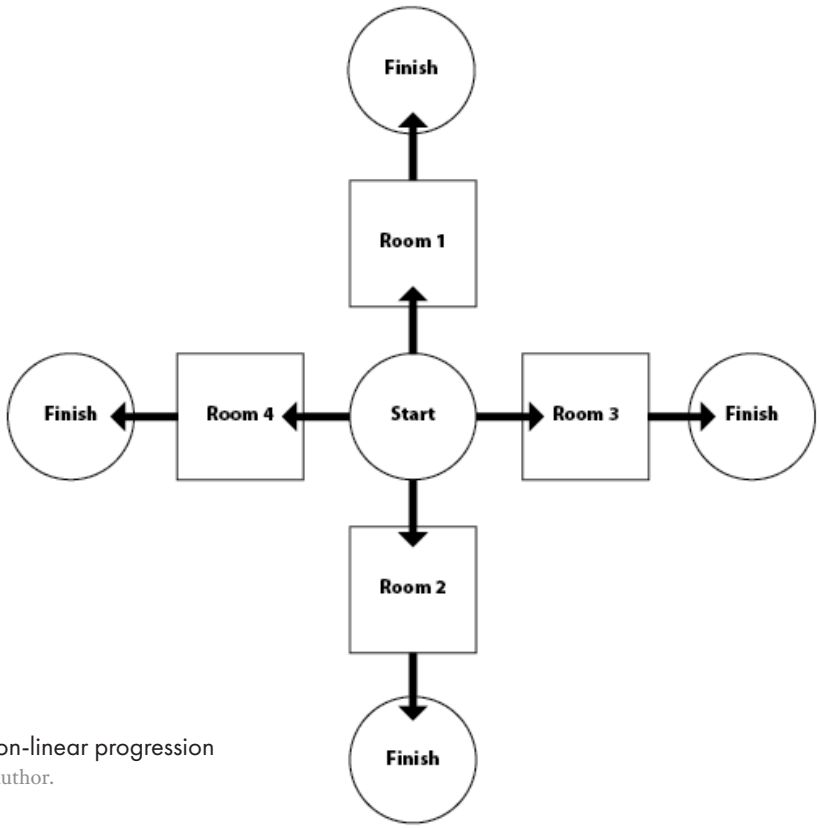


Fig. 15 Non-linear progression
Diagram by author.

251 Squire and Jenkins, "The Art of Contested Spaces."

252 Sin, "Architecture at Play," 38.

253 Feil and Scattergood, *Beginning Game Level Design*, 74.

ones, as possible. In nonlinear games, space is akin to a network of paths with various destinations, and, in especially competitive multiplayer games, these spaces are carefully placed and balanced to negate overt advantages of one team over the other.

In architecture, nonlinear spaces are akin to modern urban designs where multiple pathways and open areas encourage exploration and spontaneous encounters. Examples include large public squares or parks, which allow for various routes to be taken and activities to be engaged in, providing a dynamic environment that adapts to the needs and movements of its users. These spaces are designed to be flexible, accommodating a range of activities and interactions that can change over time. In a comparable way, multiplayer maps are designed to anticipate chance encounters between opposing players. Environments may contain elements that funnel players into places of contest, such as choke points (bottle necks) or open arenas,[254] while offering different routes to avoid or confront such places. With the addition of varying sightlines created by staggered obstacles, these contested spaces allow for surprising meetings.

Environments for FPS games are typically designed specifically for either singleplayer or multiplayer experiences, but not both.[255] Singleplayer maps often follow a linear sequence of challenges that players must overcome to reach the final goal. In contrast, multiplayer maps are crafted to create dynamic areas where player-vs.-player combat can occur. In either case, the spaces within video games serve as the platform upon which the game unfolds. However, multiplayer game modes in FPS games are more psychologically complex than singleplayer.[256] Pinchbeck speaks on *Doom*'s multiplayer "deathmatch"[257] mode as being more complex for a few reasons:

> *Sharing with other people your emotional response to your actions or another person's actions is inherently more complex. In deathmatch, every kill counts, in terms of reward. On top of this, when playing competitively, there's not just the penalty of having to reload or respawn; there's public humiliation, which raises the stakes or significance of getting wasted [...] on a busy server. Equally, the focus of a multiplayer game changes from mainly skill-based prowess to psychological prowess, the ability to predict*

254 Murff, "How FPS Architecture Makes Us Think."

255 Kenneth Hullett, "The Science of Level Design: Design Patterns and Analysis of Player Behavior in First-Person Shooter Levels" (PhD Thesis, Santa Cruz, USA, University of California, 2012), 5.

256 Pinchbeck, *Doom*, 136.

257 Deathmatch is a competitive multiplayer game mode in which players face off against one another in the game, their computers connected to each other via LAN. It is one of the principal modes of playing the game in a multiplayer online setting. While Doom was not the first game to feature player-versus-player combat in a first-person shooter, it is undoubtedly the game to have broadly popularized the concept, leading to most Doom competitors released in its wake to also feature deathmatch or variants thereof.
"Deathmatch", DoomWiki, last modified March 3, 2024, https://doomwiki.org/wiki/Deathmatch.

> *and react to a highly emergent flow of events and, if you are really good, to start controlling and manipulating them.*[258]

As Pinchbeck points out, the heightened psychological intensity attributed to public competition within multiplayer nodes significantly amplifies the ambition and tactical behavior of players. Unlike single-player games, where victory often revolves around qualitative objectives such as the number of monsters killed or flags captured, multiplayer strategies vary widely as each team prioritizes different approaches to win the game. Due to real-time player decisions, maps must provide players with a variety of choices. Consequently, FPS multiplayer maps prioritize networked paths, offering a wide range of spaces and junctions where players can make informed decisions about which direction to take. This design creates an almost infinite number of play variations, making each session unpredictable and highly engaging. Therefore, multiplayer FPS games exhibit greater complexity than their single-player counterparts because of the sophisticated use of spatial design to facilitate gameplay, resulting in heightened psychological engagement.

■

258 Pinchbeck, *Doom*, 137–38.

Types of Maps and Emerging Play

FPS multiplayer maps are spaces of contest as defined by Mcgregor where "the environment is a setting for contests between entities," and the environment directly "affects gameplay."[259] Multiplayer maps are more pertinent to this study as they offer complex architectural arrangements to accommodate dynamic and diverse interactions among opposing groups of players.

FPS maps can be broadly categorized into symmetric or asymmetric maps.[260] Symmetric maps tend to have either mirror or rotational symmetry about their center with two opposing teams spawning at opposite ends, presented with the same landscape before them.[261] Asymmetric maps allow for greater diversity in topography, encouraging teams to position themselves and play accordingly.[262] While symmetric maps ensure that teams playing against each other are fairly positioned within the map, affording neither side and advantage due to superior elevation or cover, it can become quickly repetitive. Thus, players can potentially become dissatisfied with the predictability of such maps. In this way, asymmetric maps are more appealing to players and game designers as the variance in its architecture offers positioning opportunities that may number from one to many, remain static or change location, or any permutation thereof.[263]

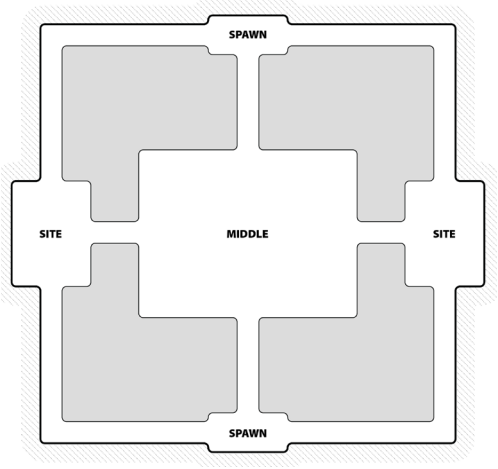


Fig. 16 Symmetric Map Layout
Diagram by author.

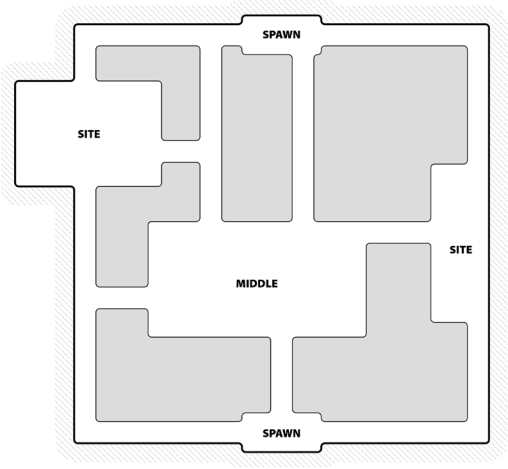


Fig. 17 Asymmetric Map Layout
Diagram by author.

259 Mcgregor, "Situations of Play: Patterns of Spatial Use in Videogames," 539.

260 James Holloway, "Deathmatch Map Design: The Architecture of Flow," *Game Developer* (blog), 2013, https://www.gamedeveloper.com/design/deathmatch-map-design-the-architecture-of-flow.

261 Ibid.

262 Ibid.

263 Ibid.

The maps featured in *Valorant* provide excellent examples of asymmetric maps[264] that enhance the gameplay experience. Each map in *Valorant* is meticulously designed with unique features and varied terrain, ensuring that no two areas are alike. These maps also feature elements that can be found repeated across different maps, such as chokepoints, open areas, and elevated positions. Despite these elements appearing repetitively in maps, the variety in spatial conditions creates distinction between maps through unique configurations and how the overall circulation is structured. For example, some maps might utilize a three-lane path system, creating multiple routes for engagement and flanking, while others might employ a two-lane path, focusing action more directly and intensely.

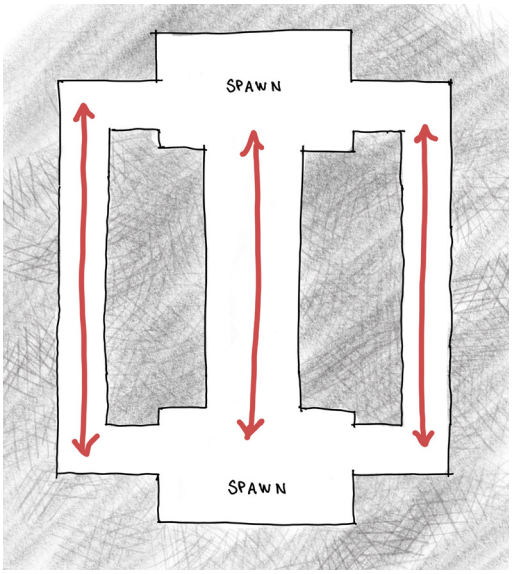


Fig. 18 Three lane layout
Diagram by author.

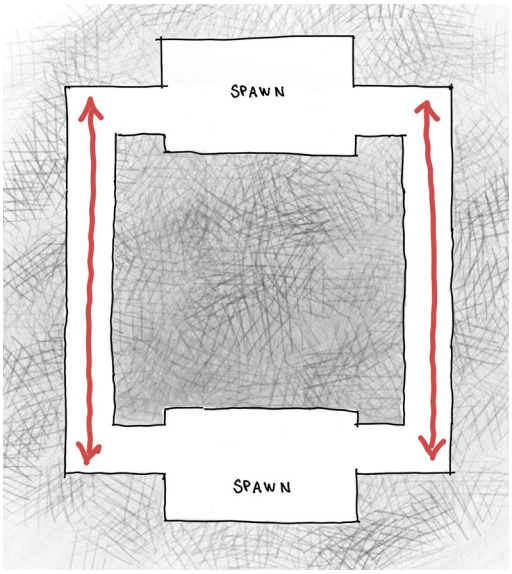


Fig. 19 Two lane layout
Diagram by author.

The strategic use of elements and patterns in *Valorant* maps results in intricate spatial relationships within each environment. Players must continuously adapt their playstyle in accordance with distinct spatial conditions as they move through the map, making strategic decisions based on the unique characteristics of each separate space. The asymmetric designs in *Valorant* maps, coupled with their deployment of repeated elements in varied spatial contexts, contribute to a more engaging and unpredictable gaming experience. This unpredictability, often referred to as *emergent gameplay*, prioritizes the design of systems over static content.[265] Emergence, derived from mathematics,[266] describes the phenomenon where complex patterns and behaviours

264 Except for in the "Team Deathmatch" mode, where novel symmetric maps were introduced specifically for this game mode.

265 Salen and Zimmerman, *Rules of Play*, 158.

266 See works of John Casti and John Holland.

arise from a limited set of simple rules.[267]

> *The idea that games are spaces where players can address problems through creative solutions is useful for defining how we must think of game worlds as emergent spaces.*[268]

In *Valorant*, maps are static in that they are hard-coded environments; the layout of each map remains consistent every time it is loaded. However, these maps exhibit dynamic qualities due to their capacity to support *emergent gameplay*. The fixed spatial configurations serve as a stable framework, and while the elements are static, their diversity provides a rich tapestry of strategic possibilities, fostering emergent interactions and strategies that players develop within these spaces. This results in gameplay that remains fresh and compelling, as players must continually refine their tactics and adapt to the evolving strategies of their opponents who may appropriate spaces in different ways.

267 Salen and Zimmerman, *Rules of Play*, 170.

268 Totten, *An Architectural Approach to Level Design*, 309.

The Minds Behind the Maps

At the heart of *Valorant* lies its intricately designed maps, each a battlefield where players' tactical skills are put to the test. Behind these maps are a team of designers whose creative backgrounds and expertise have been instrumental in crafting the spaces where the game's action unfolds.

One such designer is Chris Carney, a licensed architect who transitioned into the video game industry. Carney played a crucial role as lead level designer for *Split*, one of *Valorant's* most iconic maps.[269] Carney's extensive background in architecture and FPS map design is evident in *Split's* intricate layout, which emphasizes verticality and tight spaces to create intense firefights. According to the blog post "The Creation of Split,"[270] the design team aimed to create a map that encouraged players to think vertically, introducing new dynamics in player movement and strategy. Carney and his team focused on crafting a map that balanced high ground and low ground, forcing players to consider multiple angles and levels of engagement. The blog details how the team experimented with different configurations to ensure that both attackers and defenders had viable strategies, resulting in a map that rewards both tactical planning and quick reflexes. The design process was iterative, involving extensive playtesting to refine sightlines, cover options, and the flow of movement.

Salvatore Garozzo, another key designer for *Valorant*, had unique expertise in the creation of game maps. As former *Counter-Strike* world champion, he used his professional gaming experience to develop community maps[271] such as "de_nuke_ve" and "de_cache" that was later officially acquired and implemented by Valve[272] into *CS:GO*, demarking its excellent design.[273] Since working at Riot Games, Garozzo has worked on many of the published maps, and contributed significantly to the spatial layout of *Breeze*, one of *Valorant's* largest and most open maps. As detailed in an interview with The Washington Post titled "Here's how Breeze, 'Valorant's' newest map, was built,"[274] Garozzo's goal with *Breeze* was to create a map that contrasted with the tighter, more confined spaces of earlier maps like *Split*. *Breeze* features wide-open areas, long sightlines, and expansive beaches, which demand a different style of play. The spacious design encourages long-range engagements and requires players to be more

269 Chris Carney, "The Creation of Split," Riot Games, June 17, 2020, https://playvalorant.com/en-us/news/dev/the-creation-of-split/.

270 Ibid.

271 Community maps in CS:GO refer to custom maps designed, modelled, and uploaded informally by players or members of the CS:GO community.

272 Development company behind Counter-Strike.

273 "Sal Garozzo," accessed September 3, 2024, http://www.garozzo.net/.

274 Klimentov, "Here's How Breeze, 'Valorant's' Newest Map, Was Built."

aware of their surroundings, as cover is sparser, and positioning becomes crucial.

Riot Games' design philosophy extends beyond the initial creation of maps; it also involves ongoing iteration and response to player feedback. The *Valorant* development team has been proactive in addressing player concerns regarding map balance and design. This feedback loop ensures that maps remain competitive and enjoyable over time. For instance, after the release of *Breeze*, some players expressed concerns about the map's large open spaces, which were perceived as favoring certain playstyles. In response, the design team made adjustments to improve the balance, adding more cover and refining sightlines to ensure that all player roles could thrive on the map. This iterative approach to map design highlights the importance of player input in shaping the evolution of *Valorant's* competitive spaces.

Together, Carney and Garozzo represent just two of the many designers who contribute to the creation of *Valorant's* virtual environments, but their diverse backgrounds already illustrate the interdisciplinary nature of game design. The process of crafting these intricate virtual spaces pulls inspiration and techniques from a wide array of industries and disciplines, with perhaps the field of architecture being the strongest influence. For example, Joshua Haun, environment artist for *Valorant* who holds a bachelor's degree in Architecture, specifically mentions looking at parametric architecture firms such as Zaha Hadid and Norman Foster in the development of buildings for *Valorant* maps.[275]

Moreover, many of the design strategies for map layout shares strong alignments with urban design concepts on flow and connectivity. The maps account for the way players move, gather, and interact, much like pedestrians in a city. These virtual spaces are not just static backdrops but living spaces activated through player movement and engagement.

Just as *Valorant* itself builds on the legacy of earlier FPS games, the designers responsible for its maps draw from a rich lineage of design knowledge that has developed over decades. Level designers often move across multiple projects within the industry, bringing with them a wealth of experience and a shared understanding of the principles that make FPS maps successful. For example, many of *Valorant's* designers came from *Counter-Strike*. This shared knowledge is evident in the maps created by its designers, comprised of diverse backgrounds including architecture, as highlighted through engaging and consistent environments. However, despite the clear influence of this shared design knowledge, there is a noticeable lack of formal documentation or classification of the architectural elements that are common across most multiplayer FPS maps. This scarcity might stem from the fact that these strategies are so ingrained

275 *How We Shaped Pearl // Dev Diaries - VALORANT.*

and widely understood within the profession that they are often passed on informally, rather than being codified into a unified body of work. This thesis suggests that by applying *space syntax* and *pattern theory*, which are successful in documenting and organizing recurring knowledge in other fields, a framework that names and classifies these elements can be developed, contributing to a deeper understanding of the design strategies that underpin successful FPS maps.

Applying Space Syntax and Pattern Theory to FPS Maps

Bill Hillier and Julienne Hanson's theory of *space syntax*[276] strives to understand the relationships between spaces—how they are linked and how they function in a layout. Originating in the field of architecture and urban planning, *space syntax* analyzes spatial configurations and their influence on natural co-presence—the way spatial layouts can informally and automatically bring people together or keep them apart, [277] or in other words, how space influences the behaviors of space users.

Thus, the theory of *space syntax* states the fundamental properties of space:

> *Space is not a background to human activity but is central to it. Space is first and foremost configurational. In other words, what happens in an isolated area – a room, corridor, street, or public space – is fundamentally affected by the links between that space and the arrangement of spaces to which it is connected*.[278]

The second statement is particularly pertinent to this thesis: every element of a place is interconnected, and the way one part is designed influences all other parts and their overall functionality and cohesion.[279]

Immediately, this sentiment is familiar to those who work with *pattern theory*, especially when it is regarded as a systems theory.[280] Here, the term 'system' denotes "a containment of elements which relate to each other by their spatial and functional relationships."[281] In the development of the *space syntax*, Hillier and Hanson remarked on this similarity but offer key differences in the way they approach spatial organization:

> *For example, the "pattern language" of Christopher Alexander and his colleagues at Berkeley (1977), while appearing at first to be close to our notion of fundamental syntactic generators, is in fact quite remote, in intention as well as in its intrinsic nature. For our purposes, Alexander's*

276 Bill Hillier, *Space Is the Machine: A Configurational Theory of Architecture* (NY, USA: Cambridge University Press, 1996); Bill Hillier and Julienne Hanson, The Social Logic of Space (Cambridge (GB) New York: Cambridge University Press, 1984).

277 David Seamon, "Revealing Environmental and Place Wholes: Lessons from Christopher Alexander's Theory of Wholeness & Bill Hillier's Space Syntax," *Environmental Philosophy 1,* no. 1 (2004): 24.

278 Payushi Goel, "Space Syntax," *RTF | Rethinking The Future* (blog), March 25, 2021, https://www.re-thinkingthefuture.com/architectural-community/a3701-space-syntax/.

279 Seamon, "Revealing Environmental and Place Wholes," 30.

280 Such as Leitner who view the term pattern as "used for an object-like center that is created in a transformation to solve a problem, usually a functional need in the context of the surrounding whole."
Helmut Leitner, *Pattern Theory: Introduction and Perspectives on the Tracks of Christopher Alexander (*Graz: HLS Software, 2015), 105.

281 Ibid., 104.

> *notion of pattern is too bound to the contingent properties of configurations to be useful for us; while at a more abstract level, his preoccupation with hierarchical forms of spatial arrangement (surprising in view of his earlier attack on hierarchical thinking in " A city is not a tree" (1966) would hinder the formations of non-hierarchical, abstract notions of spatial relations which, in our view, are essential to given proper account of spatial organization.*[282]

Alexander, architect and theorist, introduced the concept of design patterns as reusable solutions to recurring problems in architecture in his seminal work, *A Pattern Language*.[283] These patterns were intended to provide practical guidelines for architectural design, ensuring functionality, aesthetic appeal, and harmony within built environments. The focus was on developing a method to codify design knowledge into distinct yet interconnected components, emphasizing the practical application of this concept, as illustrated by the following description:

> *Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of a solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice.*[284]

The key differences between the two theories lies with the lens in which they view and analyze space configurations. *Space syntax* focuses on the structural and quantitative relationships within spaces, using analytical methods to understand how spatial configurations impact behavior and movement; while *pattern theory* centers on qualitative design solutions to identify and solve recurring design problems. Nascimento and Faria, in *"The Pattern in The Social Logic of Space (1984) and in A Pattern Language (1977),"* summarize this as:

> *Hillier and Hanson conducted their research, theory and methodology using the structuralist approach, in contrast to Alexander and partners that used phenomenological dialectical approaches.*[285]

Although the first deals with syntax and the second with language, both are "undoubtedly spatial readings of certain levels and dimensions of what guides and structures space."[286] Furthermore, they are "complementary parts in a dialectical possibility."[287]

■

282 Hillier and Hanson, *The Social Logic of Space, xi*.

283 Christopher Alexander et al., *A Pattern Language: Towns, Buildings, Construction* (NY, USA: Oxford University Press, 1977).

284 Ibid., 77.

285 Adriana Nascimento and Ana Cristina Faria, "The Pattern in The Social Logic of Space (1984) and in A Pattern Language (1977)," in *Urban Form and the Sustainable and Prosperous Cities* (XXVIII International Seminar on Urban Form, Glasgow: University of Strathclyde Publishing, 2022), 320, https://strathprints.strath.ac.uk/80459/.

286 Ibid., 315.

287 Ibid., 321.

This thesis proposes that, through the theoretical combination of *space syntax* and *pattern theory*, the spaces of FPS games can be understood as a configurational system of spatial elements that, through assemblage, creates collections of spatial patterns. The creation of a *space syntax* provides description of the distinct spatial elements that are present within the game maps, while *pattern theory* documents the heightened functionality of these elements once they are arranged together into a string. Together, this analysis identifies part-to-whole relationship present within the system of FPS game space.

03

STATE OF THE ART

Drawing Video Game Spaces

Luke Caspar Pearson[288] and Sandra Youkhana,[289] in *Video Game Atlas: Mapping Interactive Worlds*,[290] explores the intersection between architectural thinking and video game design. Pearson and Youkhana investigated how virtual environments in video games can be analyzed, understood, and represented through the lens of architectural methodology. By applying architectural drawing and mapping techniques to digital landscapes, they have created a collection of drawings that examine player movement across maps or levels, the alignment between real-world and in-game buildings and locations, and understanding the scale of in-game environments along with player interactions. Employing traditional methods of architectural representation, which are plans, sections, elevations, and axonometric projections, *Video Game Atlas* offers a detailed breakdown of video game environments, treating them with the same rigor as real-world buildings or urban spaces. This approach to using architectural drawing as a means of analyzing video game spaces is highly relevant to the study of game architecture, particularly in relation to how spatial design influences player behavior and experience.

By adopting similar architectural drawing techniques, this research builds on Pearson and Youkhana's approach to spatial analysis, applying it to the examination of FPS environments, where architectural drawing is ultilized to dissect complex, interactive spaces, revealing how level design influences gameplay.

288 Luke Pearson and Sandra Youkhana, V*ideogame Atlas Mapping Interactive Worlds* (London: Thames & Hudson Ltd, 2022).

289 Associate Professor at the Bartlett School of Architecture, co-founder of You+Pea, and writer with interests in the relationships between architecture and games.

290 Associate Professor at the Bartlett School of Architecture, co-founder of You+Pea, and registered architect with interests in how the real world is extracted, altered, and applied to the design of virtual environments.

Taxonomy of Game Elements

Dan Pinchbeck investigates the affordances[291] of FPS game spaces in his work *An Affordance Based Model for Gameplay*,[292] where he taxonomizes "objects according to the types of affordances they exhibit."[293] In the context of game design, affordance refers to the possible actions that an object or environment enables for the player. Pinchbeck's approach highlights the importance of understanding these affordances to create meaningful interactions within the game world. By categorizing objects based on their functionality, Pinchbeck's taxonomy reflects a set of elements that derive meaning from their use, offering insights into how players engage with and perceive these objects.

In another investigation, *Counting Barrels in Quake 4*,[294] Pinchbeck meticulously counts the numbers of barrels are present within the game. Through this analysis, he establishes a baseline of data that allows *Quake 4* (2005)[295] to be compared with other games in the genre. This comparative analysis underscores the significance of quantifying game objects to understand their distribution and impact within different game environments. Objects, in the game design context, refer to "any entity that appears in a game scene and can change state."[296] This includes movable boxes, interactive switches, and destructible elements, among others. By focusing on game objects, Pinchbeck's research provides a framework for understanding how individual elements contribute to the overall gameplay experience.

However, Pinchbeck's focus on game objects leaves out the consideration of spatial structures and their ability to influence player behavior. This omission highlights a gap in taxonomizing spatial conditions within FPS games. While objects within the game are crucial for interaction, the spaces they inhabit also play a pivotal role in shaping gameplay dynamics. The interaction between both space and space-objects creates a richer, more immersive experience, necessitating a broader approach to taxonomizing spatial elements.

291 Pinchbeck describes affordances as the functionality of an object, he uses the example of a chair: "[T]hink about a chair. [A]lthough we can use chairs for many things, we use them primarily for sitting on, and this dominant affordance is what we perceive first and foremost when we see a chair. This flips back around in the other direction too: we could argue that we determine an object is a chair because we identify its dominant affordance as enabling us to sit on it. This two-way process is really very useful when we start to think about games and gameplay mechanics." Pinchbeck, *Doom*, 152.

292 Dan Pinchbeck, "An Affordance Based Model for Gameplay," in *Breaking New Ground: Innovation in Games, Play, Practice and Theory* (DiGRA 2009, DiGRA, 2009), https://dl.digra.org/index.php/dl/article/view/365.

293 Pinchbeck, *Doom*, 153.

294 Dan Pinchbeck, "Counting Barrels in Quake 4: Affordances and Homodiegetic Structures in FPS Worlds," in *Proceedings of DiGRA 2007 Conference: Situated Play,* 2007, https://dl.digra.org/index.php/dl/article/view/344.

295 Developed by Raven Software. Published by Activision. Released for PC and Xbox 360. 2005.

296 Ahmed Khalifa, "Level Design Patterns in 2D Games," *Game Developer* (blog), 2019, https://www.gamedeveloper.com/design/level-design-patterns-in-2d-games.

The work of Yiou Wang and Yujie Wang in *Moving Architecture, Animated Maze: The Intertextuality Between Player and Environment Agents*,[297] taxonomizes the formal spatial conditions found within a simple maze, presenting an analysis of space but omitting space-objects. In their study, they identify the maze as a configurational complex assembled through distinct elements: *passage*, *corner*, *junction*, or *dead end*. These elements "construct the maze using logical organizing principles just as vocabulary constructs language."[298] This practice of breaking down the maze into a set of nodes echoes the work of Jay Kappraff[299] et al., who identifies maze-making methods as node permutations of meander links and knots.[300] By deconstructing the maze into fundamental components, Wang and Wang offer a comprehensive understanding of spatial conditions and their influence on player navigation and interaction.

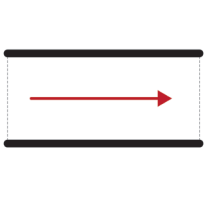


Fig. 20 Passage

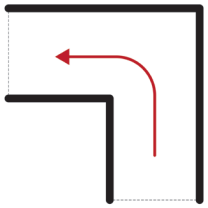


Fig. 21 Corner

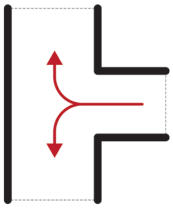


Fig. 22 Junction

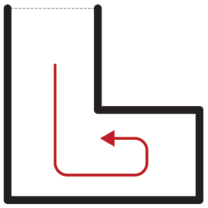


Fig. 23 Dead End

Diagrams by author with reference to the work of Yiou Wang and Yujie Wang.

This thesis synthesizes both object-based and space-based elements to develop a taxonomy for FPS game maps. Objects, as seen in Pinchbeck's work, possess the ability to influence player actions and enable interactions that can alter the game environment; therefore, can be considered as a spatial element within the context of FPS maps. Examples of this can include a door that can be closed or opened by players, subsequently revealing or disabling a path within a networked map. Space in FPS maps, which can be understood as complex mazes, can be deconstructed in a similar manner to Wang's work. By examining both game objects and spatial configurations, a more holistic understanding of FPS game environments can be achieved through highlighting the interplay between static elements and dynamic interactions.

297 Wang and Wang, "Moving Architecture, Animated Maze."

298 Ibid.

299 Professor and researcher in mathematics.

300 Jay Kappraff, Ljiljana Radović, and Slavik Jablan, "Meanders, Knots, Labyrinths and Mazes," *Journal of Knot Theory and Its Ramifications 25,* no. 09 (August 2016): 1641009, https://doi.org/10.1142/S0218216516410091.

Pattern Templates in Video Game Design

In the early 1990s, as object-oriented programming emerged as a dominant paradigm, several computer scientists began to take an interest in the work of Christopher Alexander. Their interest was driven by the recognition that effective object-oriented programming requires a thorough analysis of the problem at hand and the development of a conceptual object-oriented solution.[301]

> *While pattern theory originates in architecture, it is a general theory of development (of change, of transformation, of unfolding, of the creative process) and, as such, is relevant to almost every field of application[.] Pattern theory produces a new view of all phenomena and offers a method of dealing with the world in a creative and productive way.*[302]

Thus, Alexander's work was adapted by software engineers in the 1990s, notably through the work of the "Gang of Four"[303] in their seminal book *Design Patterns: Elements of Reusable Object-Oriented Software*, which formalized patterns in software design. Then, Jan O. Borchers applied pattern theory to interaction design.[304]

From software engineering and interaction design, the concept migrated to game design. In the article "The Case for Game Design Patterns,"[305] Bernd Kreimeier[306] argued for the necessity of patterns in game design, proposing that a shared vocabulary and conceptual framework could enhance the field. Game designers began to identify and document recurring design decisions within games, creating collections of patterns that describe successful solutions to common gameplay problems.

Subsequently, in *Patterns in Game Design,* Staffan Bjork[307] and Jussi Holopainen[308] establish a collection of over 200 patterns to allow a shared language in order to "talk about the essence of games and gameplay in as much detail and with as much clarity as we wish."[309] However, in contrast to the problem-solution pair templates that had previously been used in developing pattern collections, Bjork and Holopainen chose to

301 Christopher Barney, *Pattern Language for Game Design,* 1st edition (Boca Raton: CRC Press, 2021), 29.

302 Leitner, *Pattern Theory*, 11.

303 Erich Gamma, Richard Helm, Ralph Johnson, and John Vlissides.

304 Jan O. Borchers, "A Pattern Approach to Interaction Design," in *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, DIS '00 (New York, NY, USA: Association for Computing Machinery, 2000), 370, https://doi.org/10.1145/347642.347795.

305 Bernd Kreimeier, "The Case for Game Design Patterns," *Game Developer* (blog), 2002, https://www.gamedeveloper.com/design/the-case-for-game-design-patterns.

306 Programmer, writer, and developer of game mods for FPS games.

307 Professor, researcher, and writer with interests in game design and game systems.

308 Writer, researcher, and lecturer with interests in conceptual frameworks of game design.

309 Björk and Holopainen, *Patterns in Game Design*, 5.

define game design patterns as "semiformal interdependent descriptions of commonly reoccurring parts of the design of a game that concern gameplay."[310] They justify this decision with three observations:

> *First, defining patterns from problems creates a risk of viewing patterns as a method for only removing unwanted effects of a design rather than tools to support creative design work. Second, many of the patterns we identified described characteristics that more or less automatically guaranteed other characteristics in the game, in other words, the problem described in a pattern might easily be solved by applying a related and more specific pattern. Third, the effect of introducing, removing, or modifying a game design pattern in a game affected many different aspects of the gameplay, making game design patterns imprecise tools for solving problems mechanically. However, we believed that game design patterns offer a good model for how to structure knowledge about gameplay that could be used both for design and analysis of games.*[311]

As a result, Bjork and Holopainen develops the following pattern template to document reoccurring patterns within video games, that can be applied to game environments, game information, game interaction, game goals, game actions, and more:[312]

> **Name**
> "The name of a game design pattern can be a single world or a short phrase describing the concept. We have deliberately not included aliases to minimize the number of names that need to be remembered; we instead provide dictionary-style references to similar concepts in other models and fields of study."
>
> **Core Definition**
> "A brief sentence in italics follows immediately after the name. This sentence describes the core idea of the pattern. The purpose of this core description is to support browsing through a pattern collection, providing an initial overview for first-time readers and reminding returning readers of the contents of the pattern."
>
> **General Description**
> "The pattern then continues with a short general description of the properties found in games that are the basis for the pattern, followed by

310 Ibid., 34.

311 Ibid.

312 Ibid., 38.

the motivation for the pattern's name. General properties of the pattern are described using game examples and concepts from the component framework. Other patterns are not used in this part of the description to make it usable without reading other patterns. The first part of the pattern description ends with some explicit examples of games of various types that contain the pattern."

Using the Pattern

"As patterns are general descriptions, the application of a pattern to any given situation requires a number of choices specific to the design context. This section is used to mention the common choices a designer is faced with when trying to apply a pattern, often exemplified by specific game components. The game design patterns mentioned in this section are primarily related to the described pattern through the instantiated by and modulated by patterns."

Consequences

"This section deals with the consequences of gameplay that can appear when the pattern occurs in the game. As such, the section is directed toward analyzing gameplay to help solve design problems in an already existing design or to suggest other design patterns to instantiate in the design of the game. The description makes use of other game design patterns, primarily with the instantiates and modulates relations but also with the potentially conflicting relations. However, patterns with other relations can also be present, especially when the consequences depend on the interaction between several patterns."

Relations

"This section lists the relations that exist between the described pattern and other patterns. The related patterns are sorted into the five identified categories of relations: instantiates, modulates, instantiated by, modulated by, and potentially conflicting with."

References

"This section lists the related previous works that have either been a direct inspiration for the pattern or contain descriptions of the main aspects of the pattern."

The following is an example of the pattern "Combat" retrieved from their list of patterns, classified under game "Action" patterns:[313]

Name
"*Combat*"

Core Definition
"Actions where the intent is to kill or otherwise overcome opponents."

General Description
"Symbolizing the actions between game elements in games as *Combat* is one of the oldest and most common ways to give games themes. By doing so, the theme of the game contains a link with the real-world competition between players as well as alludes to the tension, uncertainty, and importance of the real-world equivalent. Combat in games gives players clear goals and opponents and gives clear indication of what players have succeeded and what players have failed."

Using the Pattern
"In *Real-Time Games*[314], the main difference between design choices for *Combat* lies in whether players control *Avatars*[315] or *Units*.[316] *Imperfect Information*[317] is often the cause of bad *Game State Overview*[318] or the problem of perceiving enemy actions as they occur while *Randomness*[319] occurs due to opponents' guesses to the Imperfect Information they have. Control of *Avatars* in *Combat* requires *Timing*[320] and *Dexterity*-

313 Ibid., 145.

314 In which "the progression of game time during play is tied to the real time."
Ibid., 339.

315 "Avatar is a game element, which is tightly connected to the player's success and failure in the game. In many cases, the Avatar is the only means through which a player can affect the game world."
Ibid., 77.

316 "Units are groups of game elements under the player's control that let the player perform actions to influence the Game World." For example, chess pieces are units.
Ibid., 79.

317 "One aspect of information about the total game situation is not fully known to a player, either the information known is totally wrong or the accuracy of the information is limited."
Ibid., 124.

318 "Players are provided with information that extends beyond the observational abilities provided by game elements." For example, the map interface in a racing game that shows the location of other players on track.
Ibid., 142.

319 "Effects or events in the game cannot be exactly predicted." Usually achieved through a random number generator. For example, dice rolls in a gambling game.
Ibid., 373.

320 "The effect on gameplay that actions have to be performed at certain points in game time to be performed at all or that the direct effect of actions varies greatly depending on when they are performed."
Ibid., 362.

Based Actions[321], typically *Aim & Shoot*[322] or *Combos*[323] of close combat maneuvers. *Damage*[324] in this case is often abstracted to forced retreats, stuns simulated by forced *No-Ops*,[325] and health values shown by *Progress Indicators*.[326] Fighting games also often combine loss of *Combat* with *Player Elimination*.[327] *Real-Time Games* with *Avatars* and *Team of Play*[328] often have special *Penalties*[329] for team killing or make those events impossible through *Privileged Abilities*.[330] Often knowledge of *Strategic Locations*[331] is important as well as efficient *Resource Management*."[332]

Consequences

"*Combat* is the means to achieving *Capture*,[333] *Overcome*,[334] or

321 "Actions whose success or failure depends on some form of dexterity, in most cases, eye-hand coordination."
Ibid., 364.

322 "The act of taking aim at something and then shooting at it."
Ibid., 150.

323 "Sets of actions that trigger additional effects than those that occur due to the individual actions." Most evident in fighting games, where a series of individually timed consecutive punches, kicks, and more can trigger a more powerful attack.
Ibid., 386.

324 "Effects from actions or events that can lead to negative consequences." Common types of damage are the reduction of player health, hit points, or shields.
Ibid., 184.

325 "The action of doing nothing." In limited time games, such as the timer for planting the spike in Valorant, performing no-op (no operation, derived from programming) can be a tactical choice to wait until the timer runs out in which the defender players automatically win the round.
Ibid., 154.

326 "The player is given information about his current progress towards a closure in addition to the configuration of game elements involved."
Ibid., 142.

327 "In games with Player Elimination, the players' game sessions can be finished without the players' consent, often as a penalty for failing to achieve something." For example, in FPS games a player will be eliminated and barred from playing the rest of the round if they are seen, hit by an enemy, then depletes all health.
Ibid., 350.

328 "Players in a group or a team coordinate their actions, abilities, and roles in order to reach a common goal."
Ibid., 247.

329 "Players are inflicted with something perceived as negative or stripped of an advantage, due to failure to meet a requirement in the game."
Ibid., 188.

330 "Privileged Abilities are those that let players perform actions that are not readily available to all other players."
Ibid., 155.

331 "Strategic Locations are areas in the Game World that give an advantage to the players controlling them."
Ibid., 100.

332 "The players have to plan, manage, and control resource flows within the game in order to reach the goals of the game."
Ibid., 115.

333 "In conflict, two or more parties, often players or players against the game system, have goals, that cannot be satisfied together."
Ibid., 239.

334 "This is the goal of the player to defeat an opposing force in a test, or a series of tests, involving attributes or performance of low-level actions."
Ibid., 280.

Eliminate[335] goals against *Enemies*[336] and gives rise to *Conflict*[337] against other players. When these goals deal with *Area Control*,[338] the presence of *Combat* is especially common since the opposing goals typically are also achieved by *Combat*. The actual actions required to successfully win *Combat* depend heavily on the definitions of how to successfully complete the goals. Participating in *Combat* is a *Risk/Reward*[339] choice as are the *Tradeoffs*[340] that have to be considered between different possible actions within the Combat.

Relations

Instantiates: *Tension, Conflict, Randomness, Imperfect Information, Timing, Player Elimination, Perceivable Margins, Higher-Level Closures as Gameplay Progresses, Collaborative Actions, Attention Swapping, Resource Management, Aim & Shoot, Dexterity-Based Actions, Budgeted Action Points, Risk/Reward, Tradeoffs*
Modulates: None
Instantiated by: *Overcome, Eliminate, Capture, Area Control, Enemies*
Modulated by: *Real-Time Games, Turn-Based Games, Damage, Dice, Avatars, Units, Lives, Tournaments, Privileged Abilities, Combos, Strategic Locations, Achilles' Heels, Dedicated Game Facilitators*
Potentially Conflicting with: None

Such game design patterns provide a semi-formal tool for capturing and sharing knowledge, facilitating communication among designers and fostering innovation within the industry. Thus, the lineage of pattern theory in the video game field represents a progressive adaptation and expansion of Alexander's original ideas, tailored to address the specific needs and complexities of creating and analyzing interactive digital environments. The relevance of pattern theory to FPS games lies in its ability to describe the spatial arrangements and gameplay dynamics that create engaging and challenging game environments.

335 "Eliminate is the goal to remove a game element from its location in the game space."
Ibid., 284.

336 "Enemies are Avatars and Units that hinder the players trying to complete the goals."
Ibid., 70.

337 "In conflict, two or more parties, often players or players against the game system, have goals, that cannot be satisfied together."
Ibid., 239.

338 "Being in control over who can move within an area in the game world, or having access to actions linked to locations in the game world."
Ibid., 184.

339 "That the chance for receiving a Reward in the game is linked to some risk of receiving a Penalty if the player fails to acquire the Reward."
Ibid., 375.

340 "That players must choose between several different options and compare values against each other."
Ibid., 371.

04

METHOD OVERVIEW

The primary goal of this thesis is to thoroughly analyze the spatial conditions of FPS game environments, with special reference to *Valorant* (2020), by identifying and categorizing elements and patterns. FPS game maps are best understood through their spatial anatomy, which includes the distinct types of spaces created by geometric shapes and the interconnected patterns of use that are combined to form the overall map.

Valorant has been identified as particularly pertinent to the study's focus due to its popularity, lineage, and wide array of maps. *Valorant* periodically releases new maps approximately every few months, expanding the existing pool of maps available to players. Each new map builds upon the foundational elements of previous designs while incorporating innovative features and varied spatial conditions. Currently, *Valorant* has nine competitive playable maps. For the purposes of this research, five maps have been selected to be reviewed. These are: *Ascent*, *Split*, *Sunset*, *Breeze,* and *Bind*.

These five maps were chosen above others for several reasons. First, as maps are periodically released, some maps were not available at the time of this analysis. Nevertheless, the spatial elements and design principles identified in the research are anticipated to be applicable to new maps and future map releases as well. Second, certain maps, such as *Haven* and *Lotus*, deviate from the conventional two-site structure by incorporating a third *site*, which would considerably broaden the scope of this study. Third, other maps introduce unique dynamics, such as a central spawn point in *Fracture*, which would similarly increase the scope and complexity of the analysis. Joe Lansford, level designer for *Valorant*, illuminates that the game aims to have “separate groups of



Fig. 24 ‘Haven’ map, sites indicated in red
Images retrieved from https://valoplant.gg/
Annotated by author.



Fig. 25 ‘Fracture’ map, spawns indicated in red

core and unique maps,"[341] where the core maps provide a standardized, competitive environment. Due to the consistent nature of core maps, they are more appropriate for studying reoccurring patterns. By focusing on *Ascent*, *Split*, *Sunset*, *Breeze,* and *Bind*, this thesis can provide a detailed and focused analysis of key elements and patterns that define *Valorant's* map design, while still maintaining relevance to other maps and those that are still in development.

A fundamental aspect of this thesis involves the illustration of *Valorant*'s environment maps. This is integral for subsequent sections that assess elements and patterns within these maps, thus enabling a comprehensive analysis of architectural and gameplay dynamics. The previously identified five maps from *Valorant* will be scrutinized to discern recurring elements and the patterns they contribute to the overall design. These maps are crucial visual tools for evaluating spatial elements and patterns in later stages of the analysis. They facilitate a detailed exploration of how architectural principles are implemented in FPS games and how these principles systematically affect player behavior and game outcomes.

In addition to direct analysis of the games themselves through firsthand experience, this research is also deeply informed by the vast array of paratextual media generated by player communities. These communities often create fragmented but essential knowledge about the games, shared across various unofficial platforms. This body of information adds val-uable insight that would otherwise be difficult to access through formal channels. This process is similar to Pearson and Youkhana's:

> *"Beyond our own primary research, a book [about video games] could not be produced without the vast bodies of information created around each game by its player communi-ties. Much of this information is fragmented, hiding in Discord channels, Reddit boards, game wikis, forums and YouTube clips. [M]uch of the prevailing knowledge unofficial and developed through research made by players."*[342]

By integrating these player-driven sources, the research benefits from a richer, community-informed understanding of the spatial dynamics and design choices present in each game, which might not be evident through official materials alone.

The following are various methods and tools employed to analyze these virtual environments comprehensively:

341 Wanzi Koh, "How Valorant Map Designers Create a New Map," ONE Esports, March 11, 2022, https://www.oneesports.gg/valorant/valorant-map-design-explained-riot-devs/.

342 Luke Pearson and Sandra Youkhana, *Videogame Atlas Mapping Interactive Worlds* (London: Thames & Hudson Ltd, 2022), 8.

1. INITIAL MAP ANALYSIS

1.1 Visual Inspection and Initial Observations

Visual inspection involves a thorough examination of the game maps by navigating through them in the game environment. This process includes:

Playing through the maps to gain a firsthand experience of the spatial layout and player interactions.

Capturing images and videos of significant areas, paths, and elements within the map.

1.2 Graphical Translation and Representation

Modelling the maps to build and accurate recreation of the digital environment.

Illustrate FPS maps using orthographic projections of these 3D terrains, adhering to architectural standards.

1.3 Topological Mapping

Topological mapping involves creating simplified representations of the game maps to understand their structural properties:

Representing key areas and connections between them to visualize the map's layout through node and link diagrams.

Examining the routes players can take to reach different objectives and identifying critical paths and alternative routes.

2. SPATIAL EVALUATION OF FPS MAPS

The basic concepts underlying the spatial characteristic of FPS maps will be expounded and systematically classified by type. In the process, an attempt will be made to draw a clear distinction between spatial practice, and its influence on spatial comprehension and experience. The purpose of this is to establish an understanding of different structural elements at work within these maps that allow them to be playable at a highly competitive level. The following two-step evaluation employs methodologies from two theories: *space syntax* and *pattern theory.*

2.1 Identifying Elements

Space syntax strives to understand the relationships between spaces—how they are linked and how they function in a layout. In order to analyze relationships across spatial conditions, it first advocates for the creation of a syntax. Hillier and Hanson asserts that a syntax model must aim to:[343]

> Find irreducible objects and relations, or 'elementary structures' within the system of study.
>
> Represent these elementary structures in some kind of graphical notation or ideography.
>
> Show how elementary structures are related to each other to make a coherent system.
>
> Show how they may be combined together to form more complex structures.

Adhering to these rules, this thesis utilizes the methods for creating a space syntax to:

> Find elementary structures, identified as 'spatial elements', that serve to create distinct spaces within the environments of FPS maps through their spatial affordance.
>
> Represent these structures in a graphically annotated taxonomy of elements.
>
> Show how spatial elements share properties and differences.
>
> Show how they come together to form patterns, which in turn come together to form a FPS map.

The creation of a space syntax provides a description of parts, or elements, present within the system of FPS game space. After elements have been identified, they will be organized through the lenses of functional hierarchy, spatial attribute, and scale of space.

2.2 Collecting Patterns

This analysis attempts to reconcile the part to the whole, where individual elements assemble into a collective unity. In this process, possible relations between elements that can render a system are reviewed under the specific classifications of a pattern. This methodology is designed to classify patterns created through various assemblages of spatial elements identified in the previous section.

■

343 Bill Hillier and Julienne Hanson, *The Social Logic of Space* (Cambridge (GB) New York: Cambridge University Press, 1984), 52.

In a similar fashion to Bjork and Holopainen, this thesis proposes a collection of patterns that serve to document commonly reoccurring spatial types and arrangements in FPS video game maps. The patterns utilize the following pattern template, adapted from the field of game design for the domain of FPS map design:[344]

Name

The name of the pattern should provide an immediate general understanding of its function.

Description

A high level description of the pattern and the major design considerations.

Objective/Purpose

The objective and purpose for the pattern identifies the goal that the space serves to accomplish.

Solution (collection of elements)

The description of a general arrangement of spatial entities/elements that can be employed to achieve the objective and purposed outlined above. This solution can range from concrete implementations, or abstract structures that can encompass a family of interchangeable elements.

Variables

Aspects of the pattern that can be varied.

Consequences

A description of the gameplay that the pattern creates.

Diagram of pattern

Diagram of the elements that serve in the arrangement of the pattern.

Relationships

How the pattern interacts with other patterns

Examples

Examples from *Valorant* Maps in which the pattern exists.

■

344 Developed by author adapted from Bjork and Holopainen, Barney, Hullet, and Kreimeier .
Kenneth Hullett, "The Science of Level Design: Design Patterns and Analysis of Player Behavior in First-Person Shooter Levels" (PhD Thesis, Santa Cruz, USA, University of California, 2012), 25; Staffan Björk and Jussi Holopainen, *Patterns in Game Design,* 2005, 39; Bernd Kreimeier, "The Case For Game Design Patterns," *Game Developer* (blog), 2002, https://www.gamedeveloper.com/design/the-case-for-game-design-patterns.

05

ILLUSTRATIVE OVERVIEW OF VALORANT MAPS

The plan is the generator— Le Corbusier, *Towards a New Architecture*[345]

Plans are typically one of the first drawings an architect creates in the process of designing. Since they offer a top-down view of spaces, plans show the arrangement and flow of spaces that make them suitable for diagramming.[346] In video games, the plans of the game space are often viewed as maps. These maps can provide graphical insight into types of spaces in video game environments, and the pacing of movement and challenges navigated by players. Furthermore, they illustrate flow and relationships between different spatial conditions. Since maps in FPS games manifest possibilities for the player, understanding them in plan allows a further understanding of maps as playgrounds for *emergence* through their use of spatial complexities.

The following section is dedicated to the illustrated plans of the game spaces present in the following maps: *Ascent*, *Split*, *Sunset*, *Breeze,* and *Bind*.

345 Le Corbusier, *Towards a New Architecture*, trans. Frederick Etchells (New York: Dover Publications, 1986), 46.

346 Christopher W. Totten, *An Architectural Approach to Level Design* (Florida: A K Peters/CRC Press, 2014), 55, https://doi.org/10.1201/b21989.

Ascent

An open playground for small wars of position and attrition divide two sites on Ascent. Each site can be fortified by irreversible bomb doors; once they're down, you'll have to destroy them or find another way. Yield as little territory as possible.[347] — Official Description by Riot Games.



Fig. 26 Bird-eye Perspective of 'Ascent'

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

347 "VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020, https://playvalorant.com/en-us/maps.



Fig. 27 Illustration of Map 'Ascent'
Illustration by author.

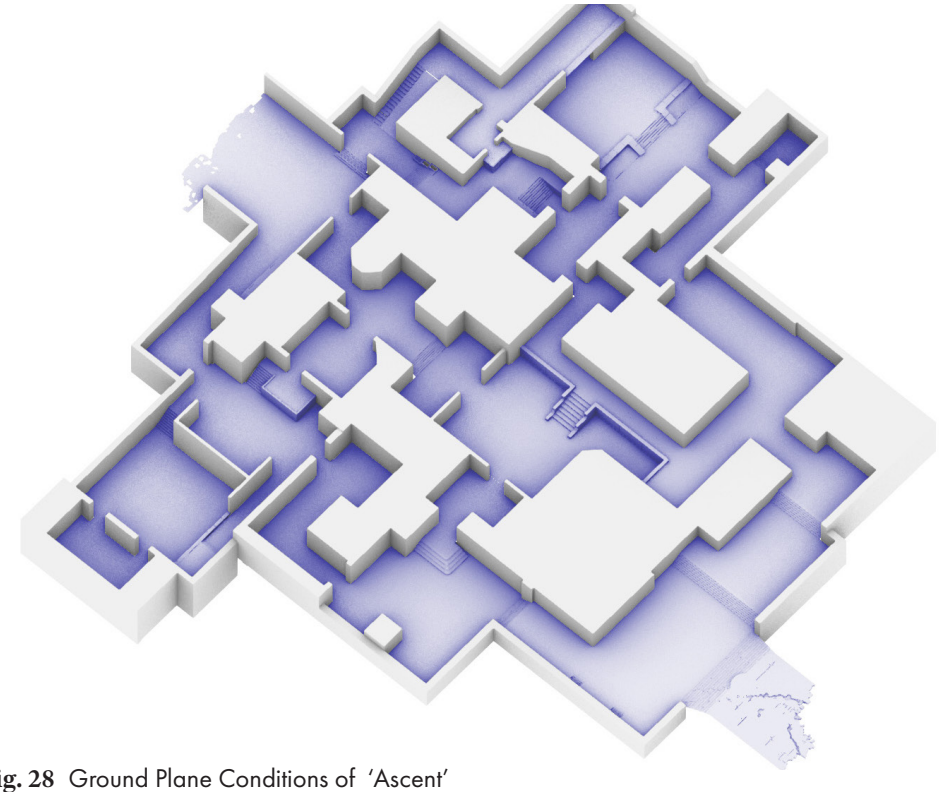


Fig. 28 Ground Plane Conditions of 'Ascent'
Image by author, 3D model by author.

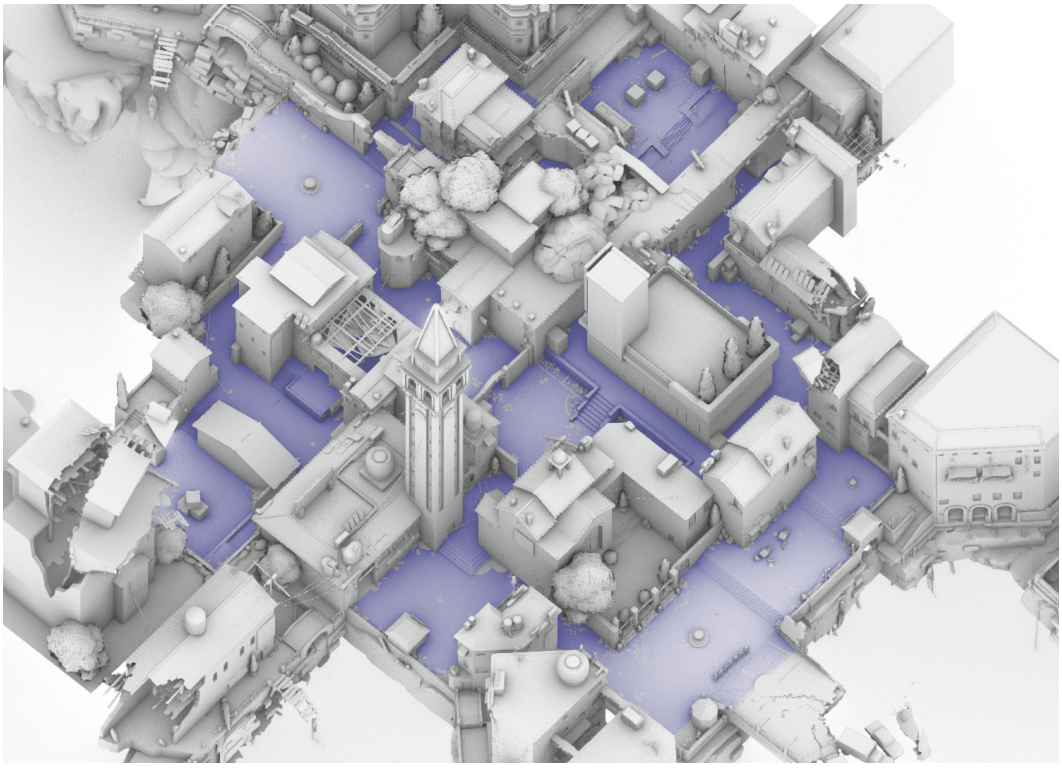


Fig. 29 Illustration of In-Game Map 'Ascent'
Image by author, 3D model retrived from Valorant (IP property of Riot Games).

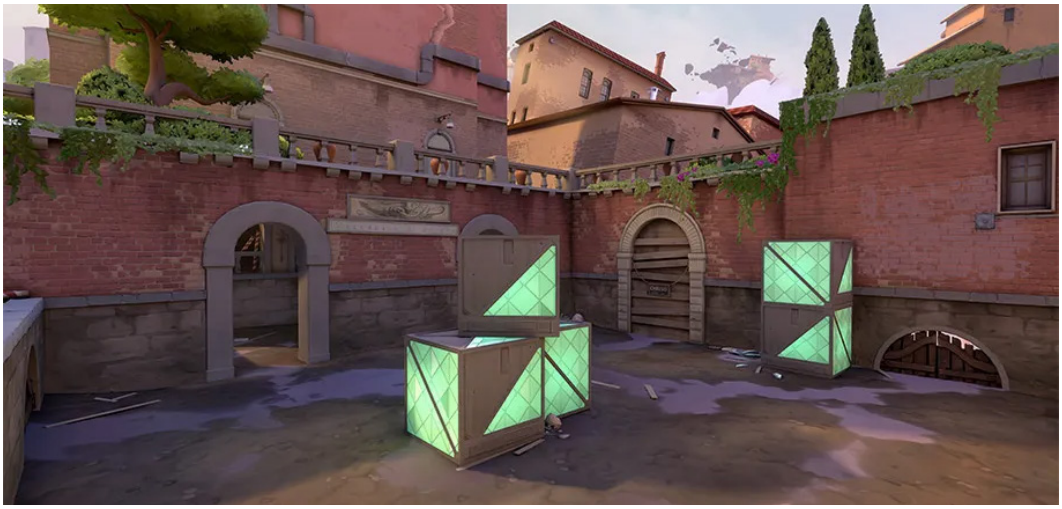


Fig. 30 In-game capture of 'Ascent' Site B
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 31 In-game capture of 'Ascent' outside of Attacker Spawn
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 32 In-game capture of 'Ascent' near Middle
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Split

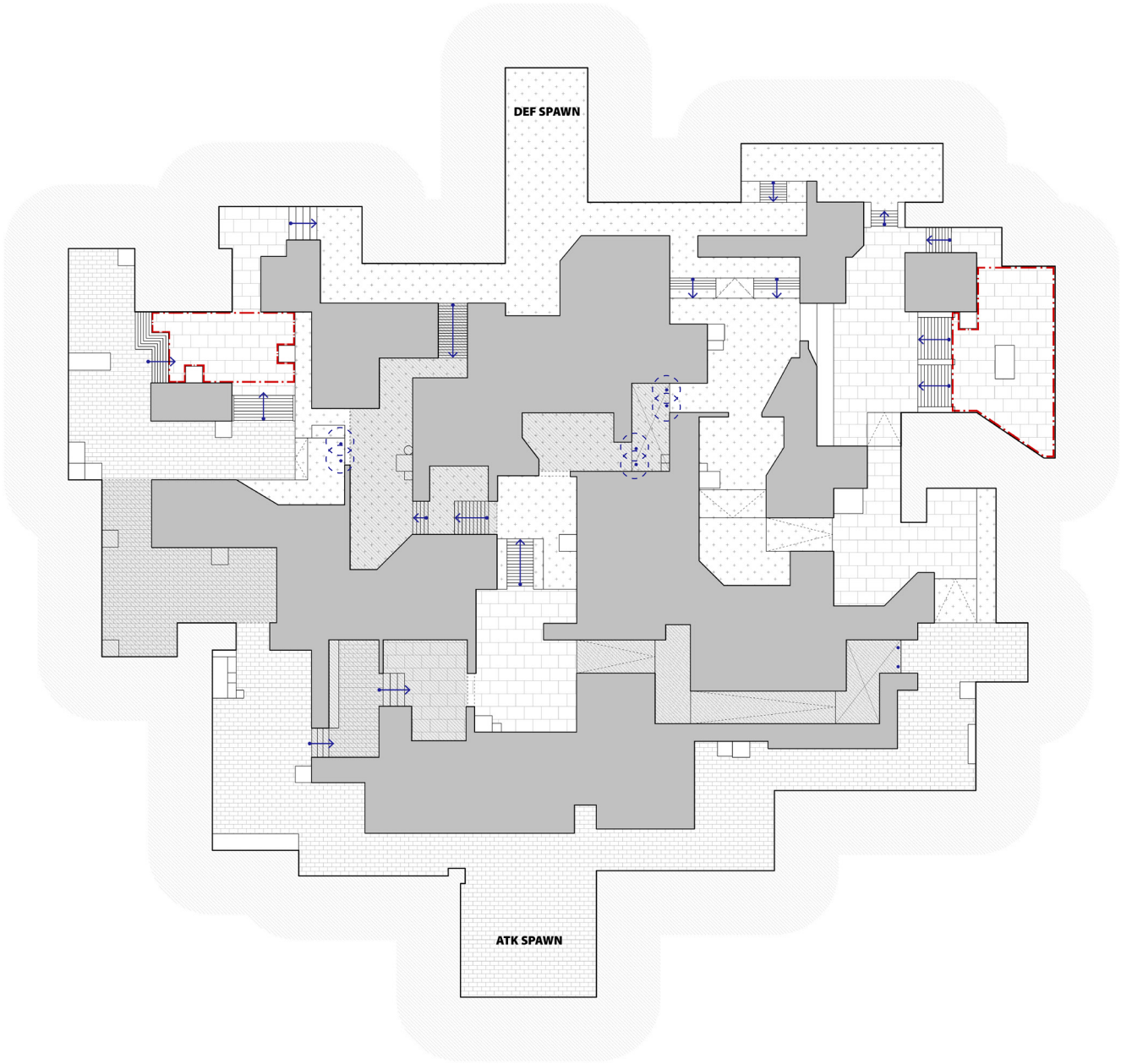
If you want to go far, you'll have to go up. A pair of sites split by an elevated center allows for rapid movement using two rope ascenders. Each site is built with a looming tower vital for control. Remember to watch above before it all blows sky-high.[348]— Official Description by Riot Games.



Fig. 33 Bird-eye Perspective of 'Split'

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

348 "VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020, https://playvalorant.com/en-us/maps.



0m ——— *10m*

35°41’23” N, 139°41’32” E

Sites

DN → UP *Direction of Stairs*

Ropes

Fig. 34 Illustration of Map ‘Split’
Illustration by author.

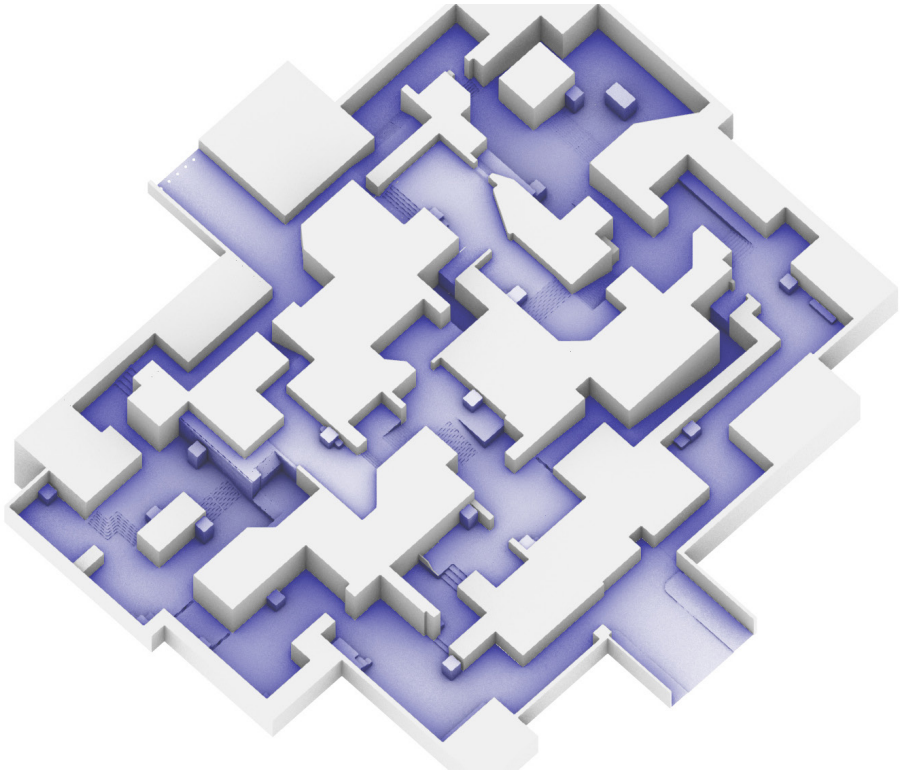


Fig. 35 Ground Plane Conditions of 'Split'
Image by author, 3D model by author.

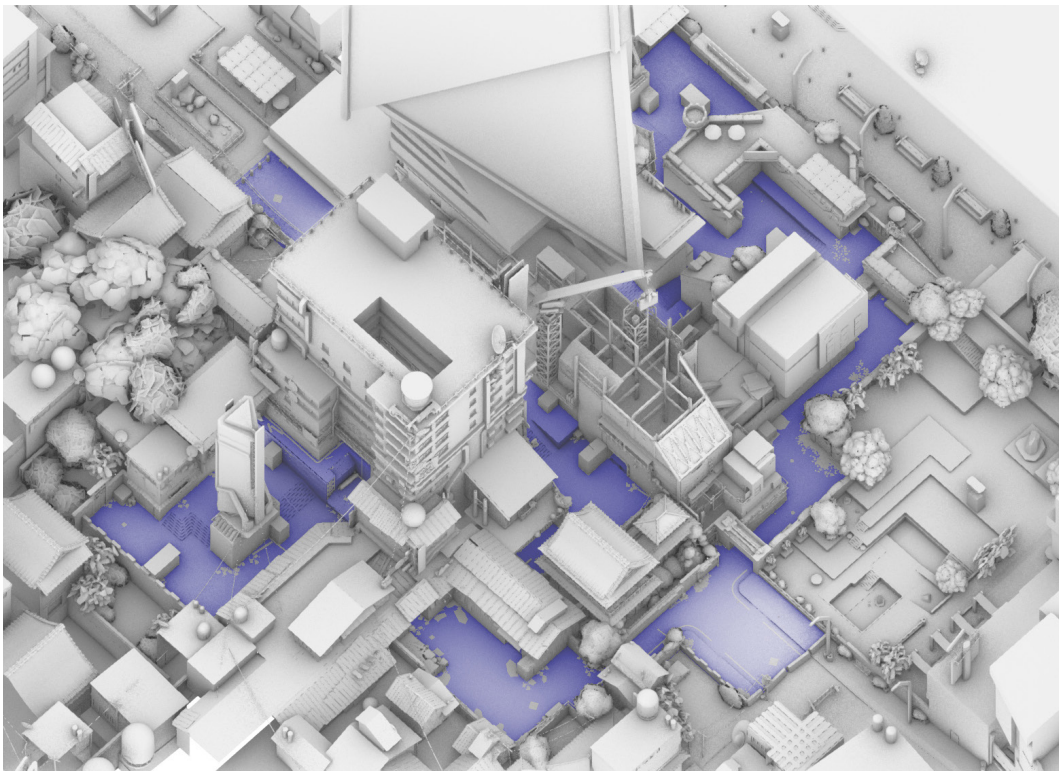


Fig. 36 Illustration of In-Game Map 'Split'
Image by author, 3D model retrived from Valorant (IP property of Riot Games).



Fig. 37 In-game capture of 'Split' near attacker spawn
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 38 In-game capture of 'Split' outside of B Main
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 39 In-game capture of 'Split' near defender spawn
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Sunset

A disaster at a local kingdom facility threatens to engulf the whole neighborhood. Stop at your favorite food truck then fight across the city in this traditional three lane map.[349] — Official Description by Riot Games.



Fig. 40 Bird-eye Perspective of 'Sunset'

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

349 "VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020, https://playvalorant.com/en-us/maps.



Fig. 41 Illustration of Map 'Sunset'
Illustration by author.

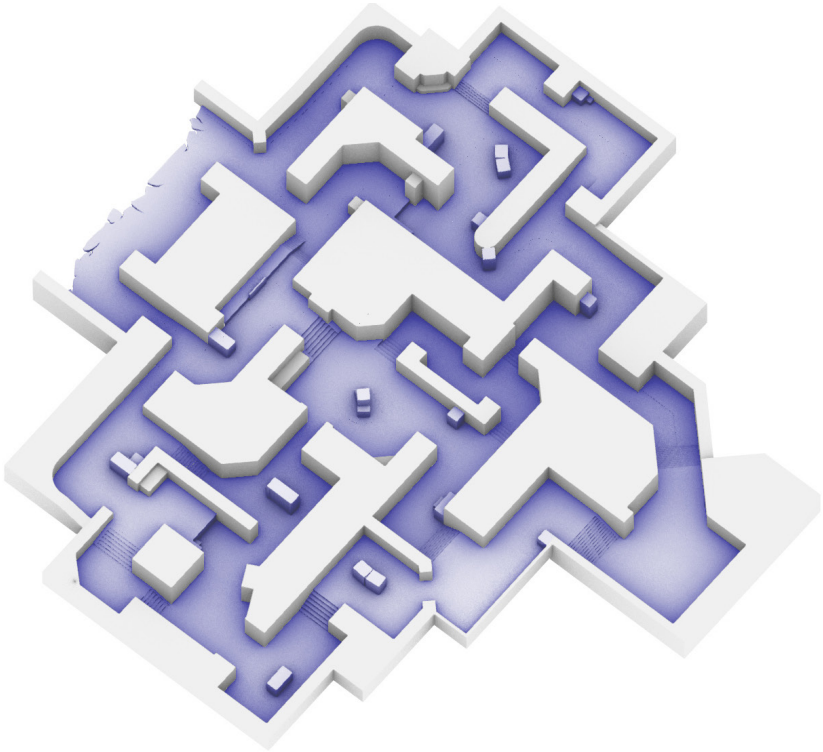


Fig. 42 Ground Plane Conditions of 'Sunset'
Image by author, 3D model by author.



Fig. 43 Illustration of In-Game Map 'Sunset'
Image by author, 3D model retrived from Valorant (IP property of Riot Games).



Fig. 44 In-game capture of 'Sunset' Site A
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 45 In-game capture of 'Sunset' outside of A Main
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 46 In-game capture of 'Sunset' near Middle
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Breeze

Take in the sights of historic ruins or seaside caves on this tropical paradise. But bring some cover. You'll need them for the wide open spaces and long range engagements. Watch your flanks and this will be a Breeze.[350] — Official Description by Riot Games.



Fig. 47 Bird-eye Perspective of 'Breeze'

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

350 "VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020, https://playvalorant.com/en-us/maps.

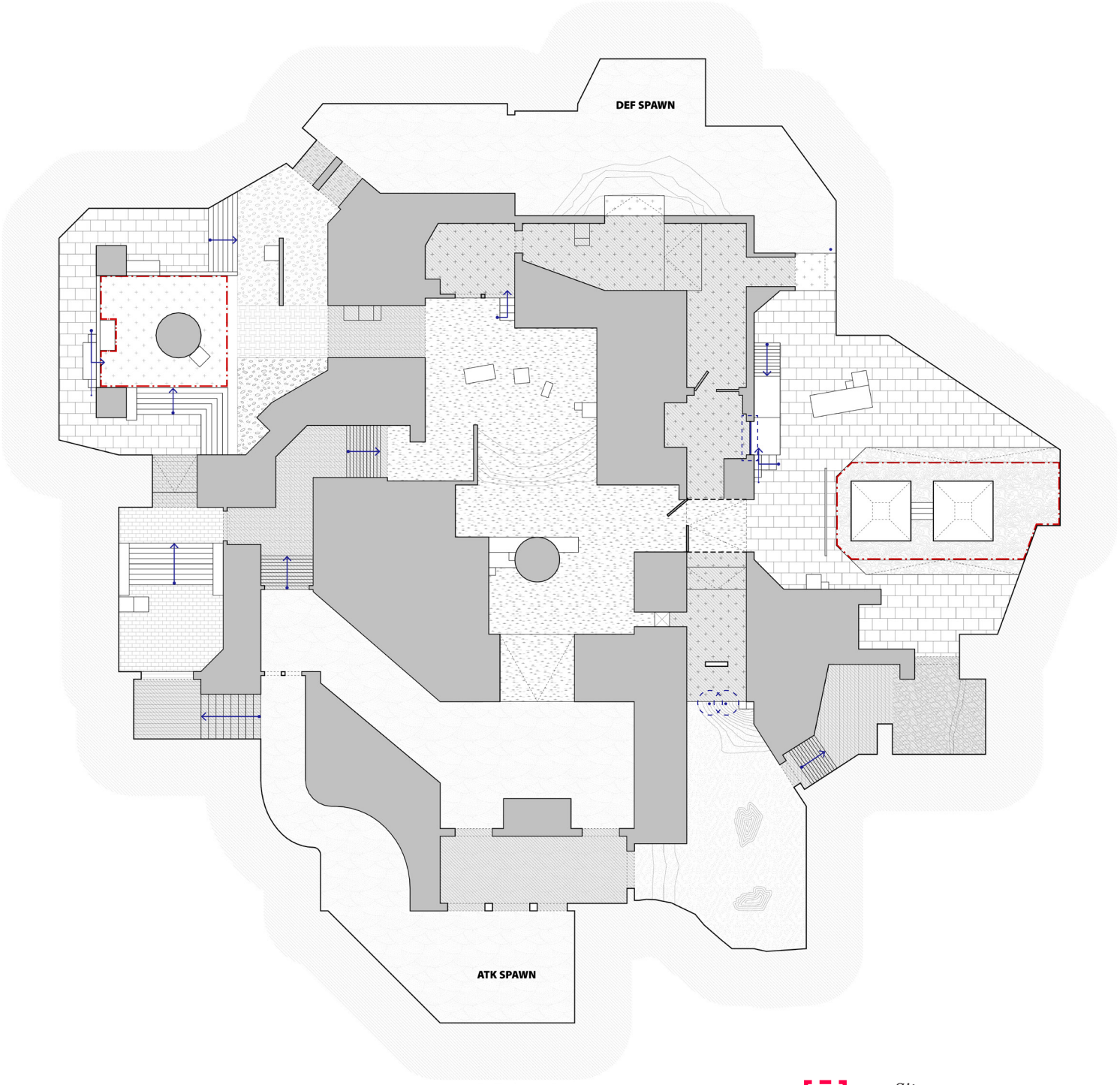


Fig. 48 Illustration of Map 'Breeze'
Illustration by author.

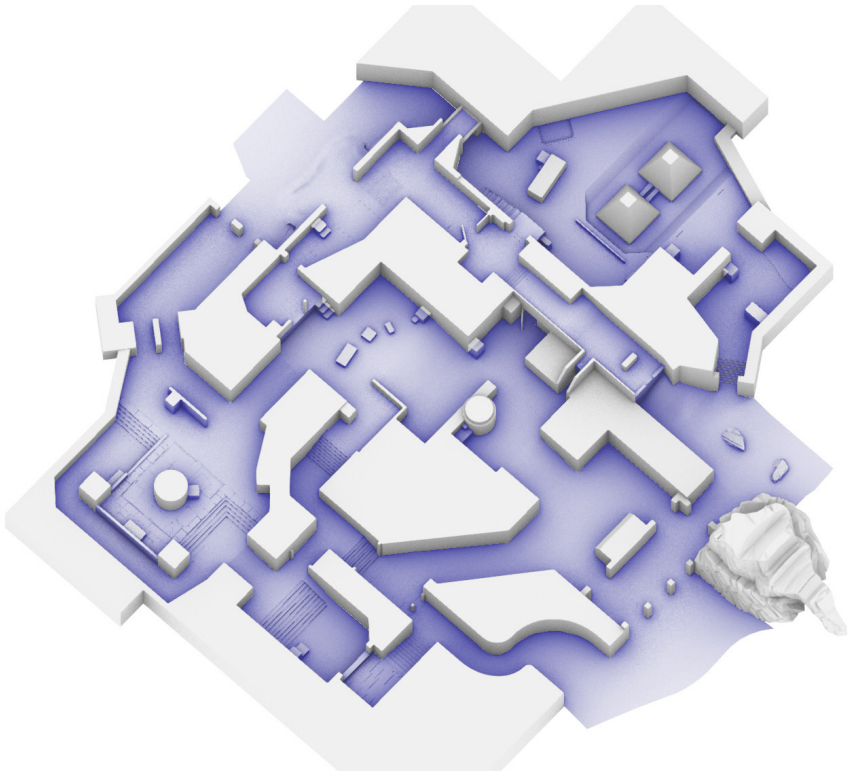


Fig. 49 Ground Plane Conditions of 'Breeze'
Image by author, 3D model by author.

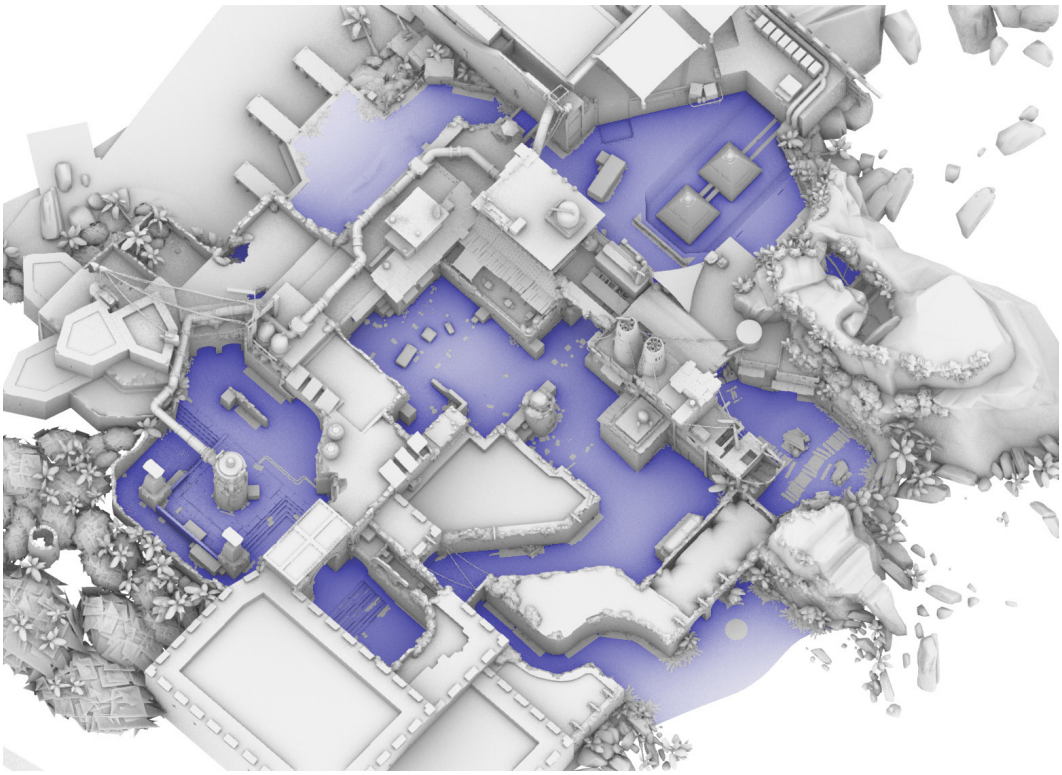


Fig. 50 Illustration of In-Game Map 'Breeze'
Image by author, 3D model retrived from Valorant (IP property of Riot Games).



Fig. 51 In-game capture of 'Breeze' Site A

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 52 In-game capture of 'Breeze' in Hallway above Middle and A Site

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 53 In-game capture of 'Breeze' near Middle

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

Bind

> *Two sites. No middle. Gotta pick left or right. What's it going to be then? Both offer direct paths for attackers and a pair of one-way teleporters make it easier to flank.*[351] — Official Description by Riot Games.

Bind is unique among *Valorant* maps in that it deviates from the typical three-lane interconnected layout seen in *Ascent*, *Breeze*, *Split*, and *Sunset*. Unlike these maps, *Bind* lacks a central *Middle* area, which traditionally facilitates flanking and quick rotations. To compensate for this, *Bind* features two *main* paths leading to each *Site*, effectively creating a four-lane layout instead of the usual three.

To further address the absence of a central *Middle*, *Bind* introduces a unique mechanic: *Portals*. These *Portals* enable rapid travel between the two sides of the map, allowing for quick rotations and strategic repositioning. This design choice ensures that despite the lack of a *Middle*, *Bind* remains dynamic and balanced, offering alternative strategies for movement and engagement through its four-lane structure and the innovative use of *Portals*.



Fig. 54 Bird-eye Perspective of 'Bind'

Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

351 "VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020, https://playvalorant.com/en-us/maps.

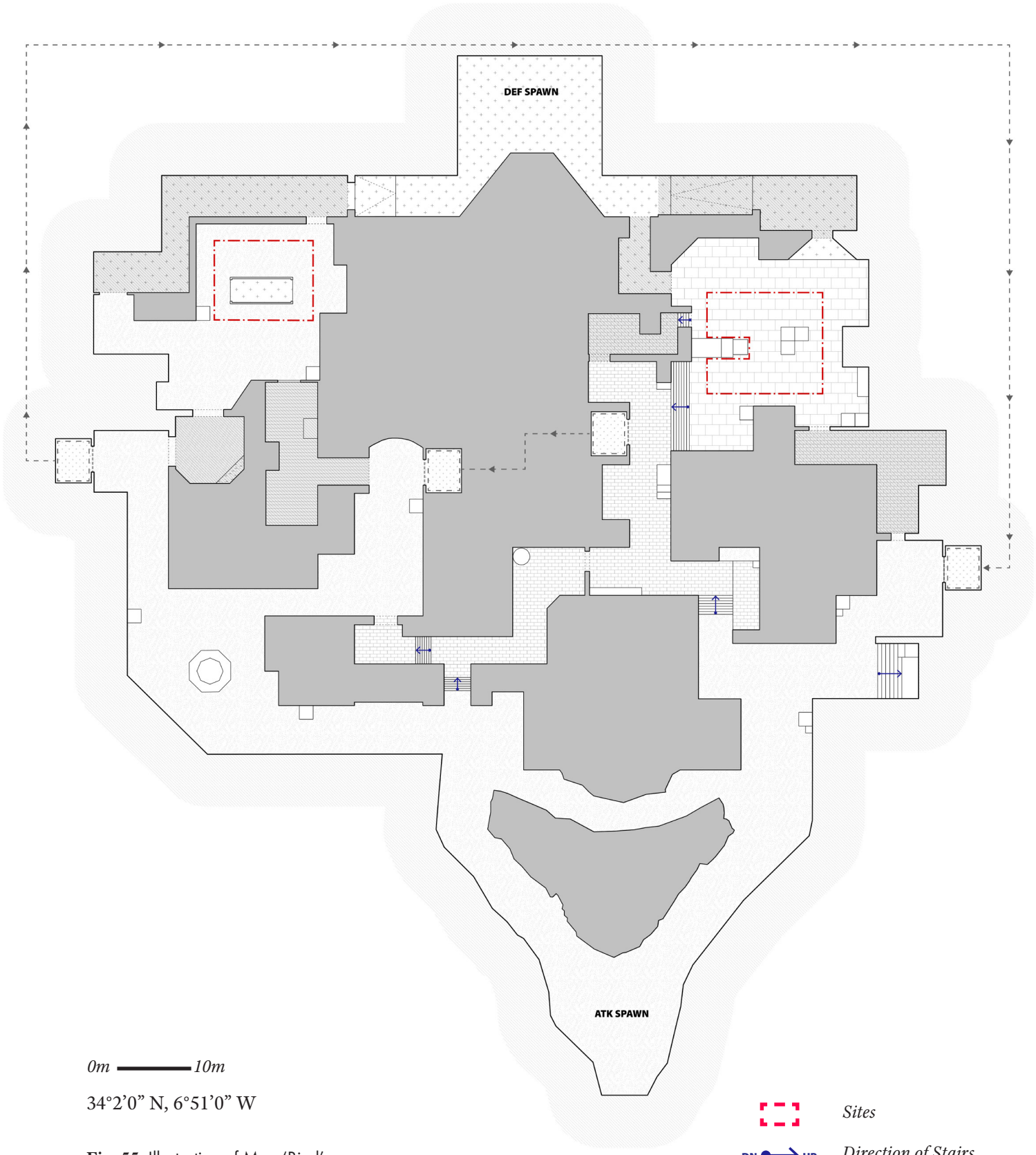


Fig. 55 Illustration of Map 'Bind'
Illustration by author.

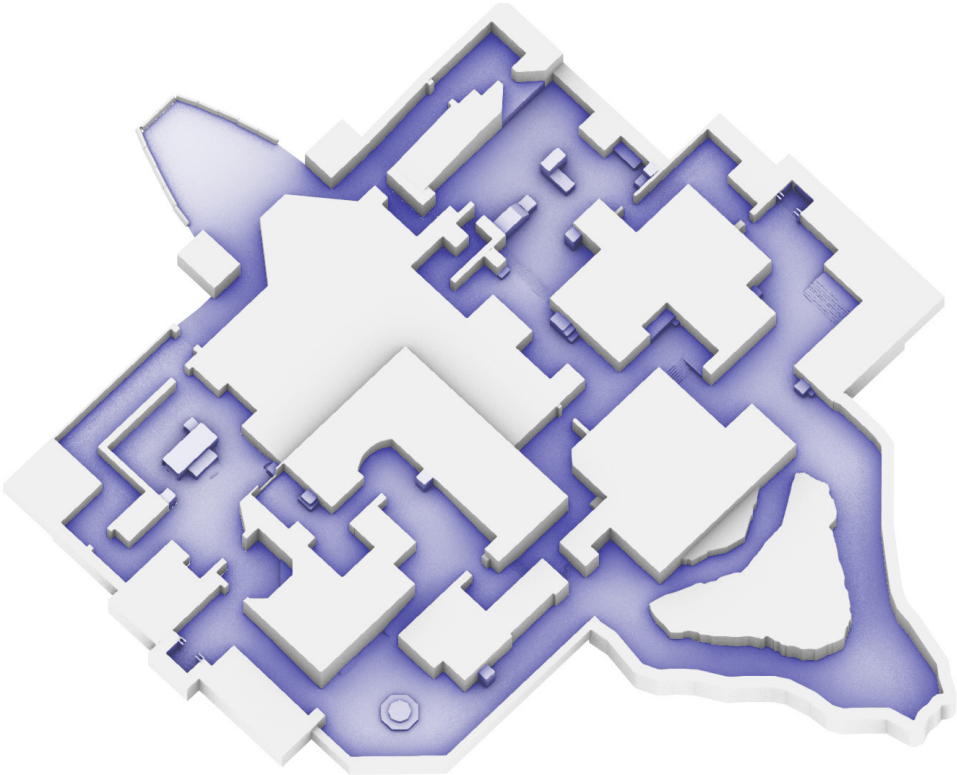


Fig. 56 Ground Plane Conditions of 'Bind'
Image by author, 3D model by author.

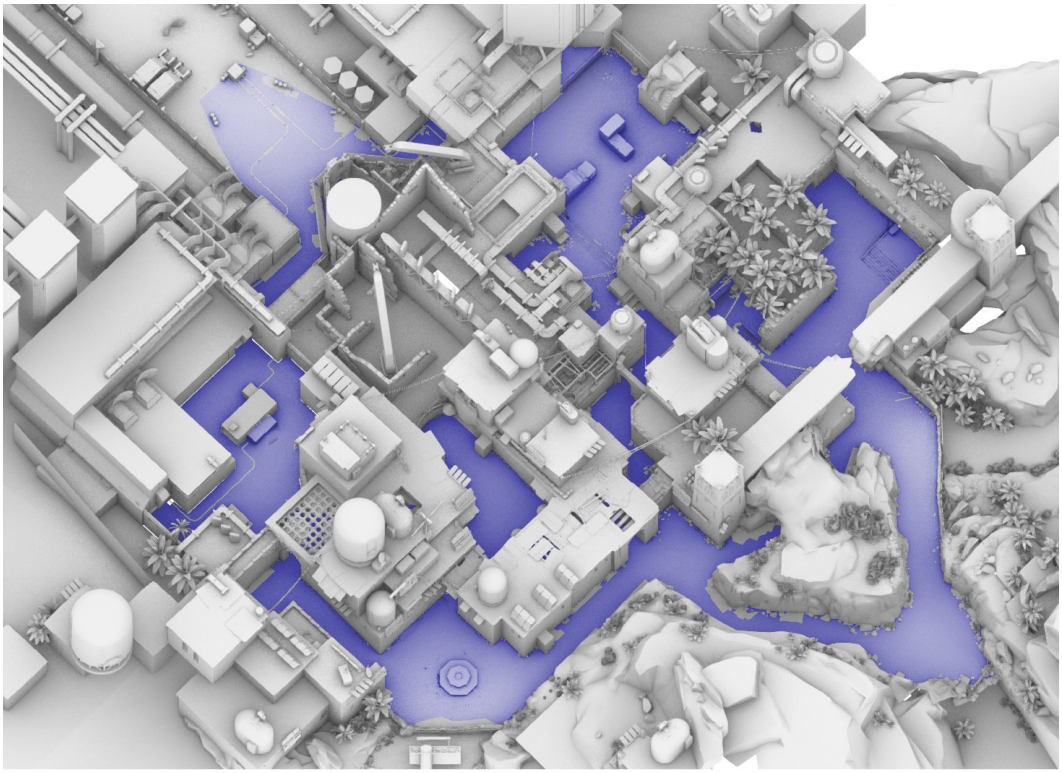


Fig. 57 Illustration of In-Game Map 'Bind'
Image by author, 3D model retrived from Valorant (IP property of Riot Games).



Fig. 58 In-game capture of 'Bind' near attacker spawn
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/



Fig. 59 In-game capture of 'Bind' at the entry of site A through A short
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

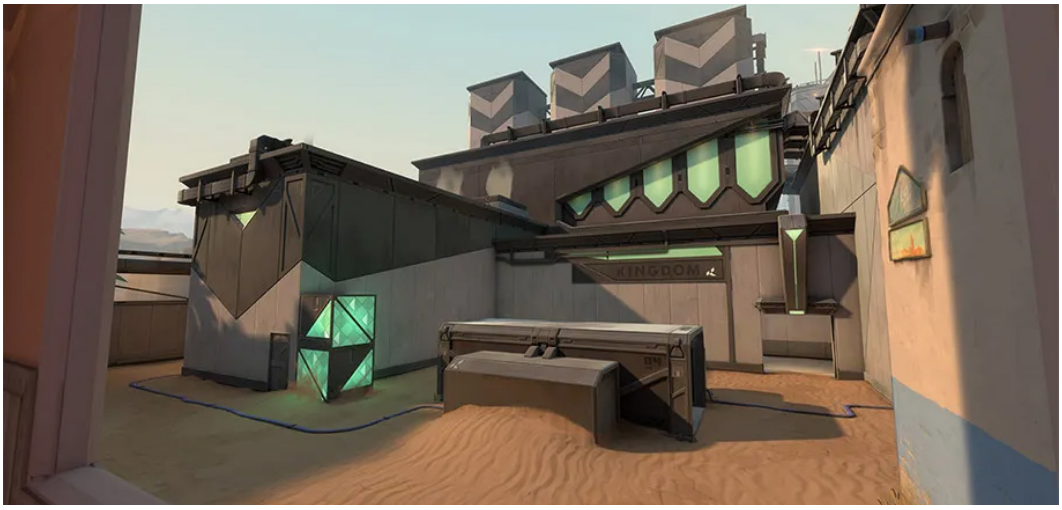


Fig. 60 In-game capture of 'Bind' at the entry of site B through B short
Image retrieved from Riot Games https://playvalorant.com/en-us/maps/

06

SPATIAL ANATOMY OF FPS GAME MAPS

First-person shooter (FPS) games represent a confluence of complex spatial design and immersive player experiences. Central to these games is the meticulous construction of game maps that significantly influence gameplay, player strategies, and overall enjoyment. This section delves into various aspects of FPS map design with a specific focus on elements and patterns.

> *While players have the ability to control many parts of their gameplay, much of how each round can be played out comes down to the maps. Maps in Valorant can vary greatly in design; however, many fundamental strategies and mechanics remain very similar on all maps. Each map has different standard protocols and nuances that occur within each game and are exacerbated within the upper echelon of gameplay.*[341]

In competitive multiplayer games like Valorant, map design is an intricate blend of various architectural elements that collectively define the gameplay environment. These elements, which range from simple pathways to complex interactive zones, are meticulously where different spaces, distances of engagement, and variety in sightlines generate different tactical decisions.[342]

FPS maps can be analyzed across three different scales: macro-scale, meso-scale, and micro-scale. The macro-scale, akin to the essence of an architectural parti, encapsulates the core ideas surrounding gameplay. This means the overarching layout and strategic flow of the map, including the placement of major objectives, key routes, and *spawn* points. This scale focuses on providing a general structure for main objectives.

On the meso-scale, spaces that support and enhance the main gameplay objectives are introduced. These spaces facilitate player movement between macro-scale features and add complexity to possible circulation paths.

Lastly, on the micro-scale, elements of space are examined as they relate to individual gameplay instances, and often can be seen as divorced from the entire level. This scale includes specific details that directly impact close-quarters combat and player interactions.

These scales correspond to *rudimentary*, *intermediate*, and *sophisticated* categories of spatial elements. By analyzing FPS maps through these three scales, designers can create well-balanced and immersive environments that cater to different styles of play and enhance the overall gaming experience. The integration of macro-scale strategy, meso-scale connectivity, and micro-scale detail ensures a cohesive and compelling virtual

341 Jonathan Ung, "How Valorant's Game Design Enhances Competition and Player Experience," *Medium* (blog), August 1, 2024, https://medium.com/@jua10/how-valorants-game-design-enhances-competition-and-player-experience-9451c488222e.

342 Christian Güttler and Troels Johansson, "Spatial Principles of Level-Design in Multi-Player First-Person Shooters," NetGames '03 (ACM, 2003), 4.

battlefield that challenges and engages players at every level. The taxonomy of these elements, categorized and ordered into rudimentary, intermediate, and sophisticated collections of elements reveals the nuanced layers of architectural design in FPS games and facilitates an understanding of these elements and their interrelationships.

The naming of these elements has been approached from multiple sources to ensure comprehensiveness and accuracy. Names designated by the game developers have been utilized where available, providing an official terminology that aligns with the game's design language. Additionally, names derived from other video games have been incorporated to draw parallels and highlight common design practices across different titles. Furthermore, names adopted by the gaming community have been included to reflect the emerging vernacular and practical usage by players.

Gameplay

> *Shooter games are about the projection of force, usually by an individual vulnerable to others doing the same thing. The gameplay consists of making accurate shots and avoiding being hit. Shooter games depend very heavily on level design for their experience. The concepts of cover [...] are critical to any shooter.*[343]

In multiplayer FPS games, the stakes are higher, as players face real individuals with comparable skills and intentions rather than computer-controlled opponents.[344] This interaction necessitates a unique gameplay dynamic where success hinges not only on individual skill but also on understanding the map's spatial intricacies and effectively coordinating with team members through in-game voice communication or text chat.

In multiplayer FPS games, the term *gameplay* encompasses both individual possibilities and team-based strategies, where each player is both an individual competitor and also a member of a team, bearing responsibilities and opportunities for mutual benefit. Thus, players are compelled not just to strive for personal victory but also to contribute to their team's success. This requirement does not relegate the player to a passive role; rather, it acknowledges that diverse strategies and courses of action correspond to different roles within the team's hierarchy. Individual players have their own opportunities, though these are shaped and sometimes constrained by their interactions with teammates and the strategic options available to the group. Consequently, it is crucial for multiplayer FPS maps to enable such team oriented strategic planning through its spatial composition. Otherwise, gameplay devolves into a series of isolated decisions that undermine the fundamentally collaborative structure of the game.

Since FPS games are contested space, then combat is a fundamental aspect of the gameplay. To participate in combat, aiming is a key skill, even more so if the game provides limited ammunition, as is the case in *Valorant*. Aiming requires players to align their target with the center of their screen (indicated by a crosshair), a mechanic that is as much about precision as it is about reflexes, as players need to achieve this by moving their mouse both accurately and swiftly.

Valorant builds upon a core set of gameplay rules that emphasize strategy, team coordination, and individual mechanical precision. The game follows a familiar structure

343 Ernest Adams, *Fundamentals of Shooter Game Design* (California: New Riders, 2014).

344 Dan Pinchbeck, *Doom: Scarydarkfast*, Lanmark Video Games 3 (USA: University of Michigan Press, 2013), 137–38.

akin to *CS:GO* and *Rainbow Siege Six*[345] (2015),[346] where the primary objective revolves around capturing or defending key *sites* on the map. These *sites* are the focal points of each round, and the outcome of the game hinges on how well teams can execute their strategies within a strict time limit. At the start of each round, players are divided into two teams: attackers and defenders. The attackers' main objective is to plant a spike (an explosive-like device) at one of the designated *sites* (A or B) and ensure its detonation, while the defenders must prevent this by either eliminating the attackers or defusing the spike if it has been planted. The roles switch at halftime, allowing all players to experience the the role of an attacker or defender in the same match.

One of the critical aspects that heighten the intensity of *Valorant's* gameplay is the time constraint imposed on each round. Attackers have a limited window to successfully plant the spike, typically around 100 seconds per round. This time limit creates a constant pressure that forces teams to make rapid decisions and execute their plans with precision. The tension often escalates as the clock ticks down, sometimes culminating in moments where victory or defeat is determined by mere milliseconds—whether it's a last-second spike plant, a perfectly timed defusal, or an eleventh-hour elimination. This time pressure also means that every move, every hesitation, and every engagement can significantly impact the round's outcome. Players must balance the need to act quickly with the necessity of making sound tactical decisions, creating a dynamic where both speed and strategy are equally crucial.

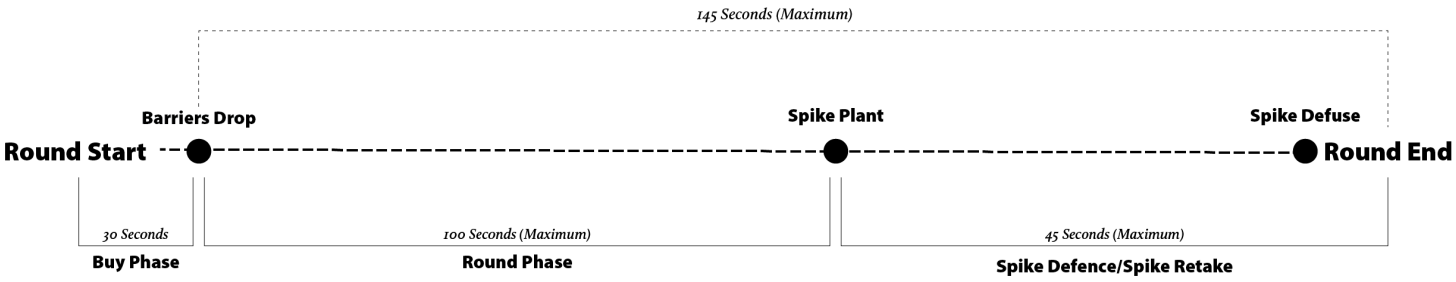


Fig. 61 Timeline of gameplay in Valorant
Image by author.

345 Developed by Ubisoft. Published by Ubisoft. Released for PC. 2015.

346 Michael Espinosa, "The Best Part About 'Valorant'? Its Potential.," *The Stanford Daily* (blog), September 1, 2020, https://stanforddaily.com/2020/09/01/the-best-part-about-valorant-its-potential/.

Valorant offers multiple avenues to secure a win, reflecting its emphasis on strategic diversity. The most straightforward victory conditions are:

> Planting and Defending the Spike: As attackers, successfully planting the spike at a site and defending it until it detonates will secure the round. This objective is the primary focus of the attackers' strategy.
>
> Eliminating the Opponents: Both attackers and defenders can win a round by eliminating all members of the opposing team. This victory condition often occurs when teams engage in firefights before the spike is planted.
>
> Defusing the Spike: If the defenders allow the attackers to plant the spike, they must then shift their focus to defusing it before it detonates. Successfully defusing the spike results in a round win for the defenders.
>
> Running Down the Clock: If the attackers fail to plant the spike before the round timer expires, the defenders automatically win, highlighting the importance of timing and pressure in every round.

While these pathways offer varied approaches to victory, this thesis posits that the optimal strategy for attackers often involves targeting a site with the least number of defenders. This approach maximizes the attackers' chances of overwhelming the defense, securing the site, and planting the spike with minimal resistance. Therefore, the spatial patterns identified in this thesis were specifically chosen in their ability to facilitate these scenarios.

In typical FPS play, the player must simultaneously concentrate on two areas: potential threats to their avatar and the target(s) they need to engage.[347] Maps in FPS games are designed around movement and shooting mechanics; lines of sight and cover are critically important features. Therefore, gameplay elements need to facilitate and encourage combat and deadly encounters between opposing players,[348] while also providing opportunities to break from combat and seek refuge.

In *Valorant*, the player's screen includes a plan view of the map, displaying the positions of teammates relative to each other. Since synchronized movements are critical for effective team play, knowing where each teammate is located becomes a key aspect of gameplay. As a result, players must simultaneously engage with space from both a first-person perspective and an overhead plan view. This dual spatial awareness requires players to navigate and coordinate two modes of space, positioning their virtual bodies

347 Adams, *Fundamentals of Shooter Game Design*.

348 Christopher Barney, *Pattern Language for Game Design,* 1st edition (Boca Raton: CRC Press, 2021), 400.

in relation to their teammates, adding to the cognitive complexity in navigating space of FPS games. As Clara Fernandez-Vara[349] notes, "When dealing with mazes and labyrinths, one must also bear in mind the fact that having a complete view of the circuit is very different from being inside the circuit."[350]

These maps provide both areas of danger and areas of safety, as it is essential to ensure that players or teams are never entirely confined to a space from which escape is impossible. Effectively, at any given moment in an FPS game, there should be multiple paths, choices, and combat scenarios each player can take. Adams explains, "if you have a game designed for two teams of three players each, there should be at least four ways for one team to approach the other. This prevents one team from simply covering all the approaches and then doing nothing."[351]

349 Media scholar, game designer, and writer.

350 Clara Fernández-Vara, "Labyrinth and Maze: Video Game Navigation Challenges," in *Space Time Play* (Basel, Berlin: Birkhäuser, 2007), 75.

351 Adams, *Fundamentals of Shooter Game Design*.

Circulation and Layout

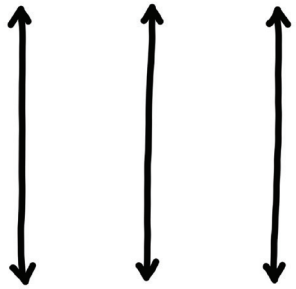


Fig. 62 Three primary lanes
Image by author.

A common layout structure in FPS maps is the "three-lane layout,"[352] a type of layout that is insistently reoccurring in FPS maps,[353] and is the basis of many *Valorant* maps[354] — which underscores its effectiveness. In this layout, there are three primary pathways (or lanes) that attacking players can use to navigate from their spawn point to the objective. The three primary lanes—left, middle, and right—each offer distinct tactical advantages and challenges. Typically, the middle lane is wider than the peripheral lanes as controlling the middle lane allows players to move freely to either side objective, offering strategic flexibility and control over the map. David Vonderhaar, director of the studio[355] that produced *Call of Duty* (2003)[356], comments on why the three-lane layout is successful:

> *It's a very generic term to represent the idea that when you start a match, and you look out, you need to understand right away that the way to navigate the map is this way, this way, and this way. So there's never more than three decisions in your brain about how you move or where you check down, to where people can be. And that's really key.*[357]

However, the true essence of FPS map design lies in its connectivity, and this is where the layout begins to evolve. The middle lane is often the central point of engagement and is rarely isolated. It is usually connected to the peripheral lanes through the use of *links*, which are secondary paths that bridge the main lanes. While the three-lane structure provides the foundational paths, it is the *links*—secondary connections between the main lanes and *middle*—that create a more complex and adaptable environment. These *links* enable more fluid movement between lanes, offering opportunities for flanking, rotations, and strategic repositioning. As these connections multiply, the map begins to resemble a more square-like structure, often referred to as the "four-square layout."[358]

352 Also known as "three lane loop."

353 For example, most maps in Counter-Strike and Valorant.

354 "The Birth of Ascent," July 20, 2020, https://playvalorant.com/en-us/news/dev/the-birth-of-ascent/.

355 Treyarch participated in the development of the Call of Duty series from 2005 onwards.

356 Developed by Infinity Ward. Published by Activision. Released for PC. 2003.

357 Henry Godfrey-Evans, "Why Have 'Three Lane Maps' Endured in Call of Duty?," *Medium* (blog), December 17, 2021, https://medium.com/super-jump/why-have-three-lane-maps-endured-in-call-of-duty-9d3d2837efc9.

358 Alexander Mistakidis, "Level Design on Element Arena," Alexander "Zone" Mistakidis, June 10, 2021, https://amist.co/level-design-on-element-arena/; "How to Develop a Map That Works - Valve Developer Community," accessed August 13, 2024, https://developer.valvesoftware.com/wiki/How_to_Develop_a_Map_That_Works.

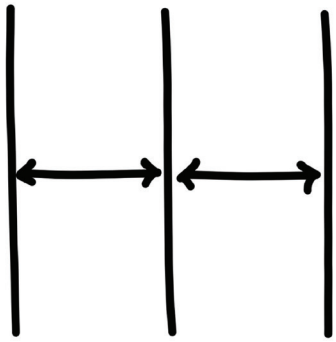


Fig. 63 Links established for connectivity
Image by author.

This evolution from a linear three-lane design to a more interconnected grid emphasizes the importance of flexibility and adaptability in gameplay. The *links* create a network of pathways that not only enhance connectivity but also introduce additional collision points, making the map more dynamic and unpredictable. This blending of the three-lane structure with the four-square layout results in a hybrid map design that balances the clarity of primary lanes with the complexity of a more distributed engagement field, ultimately enriching the tactical depth and strategic options available to players. Combined, these multiple lanes and interconnections prevent any single strategy from dominating, promoting a balanced and skill-based competition where no single position or route guarantees victory.

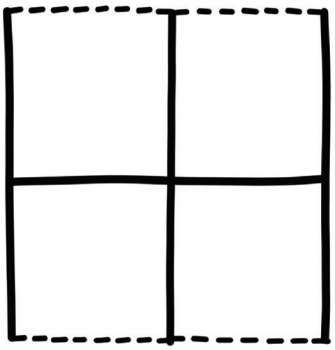


Fig. 64 Further connections resulting in a four square layout
Image by author.

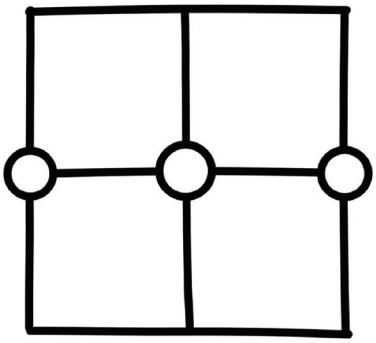


Fig. 65 Intersections in the four-square layout become nodes.
Image by author.

It is crucial that FPS game maps provide both direct or indirect routes between important locations, and the moments where these paths intersect serve as both nodes and collision points. Direct pathways encourage faster-paced action, while indirect routes promote flanking and map control strategies.[359]

359 Rachel, "Analyzing Map Design in FPS Environments," The Dogood Press, December 13, 2023, https://thedogoodpress.com/technology/5303/analyzing-map-design-in-fps-environments/.

Nodes and Collision Points

The design of maps goes beyond mere circulation and layout; it involves the strategic placement of *nodes* or *collision points*—areas where paths intersect and where combat scenarios are most likely to occur.

In architecture, moments where paths intersect to form junctions are referred to as *nodes*. Nodes can also refer to distinct points or areas within a field that can be identified and differentiated from their surroundings,[360] and are focal points of activity and interaction.[361] Kevin Lynch,[362] in *The Image of the City*, describe nodes as:

> *Nodes are points, the strategic spots in a city into which an observer can enter, and which are the intensive foci to and from which he is traveling. They may be primarily junctions, places of a break in transportation, a crossing or convergence of paths, moments of shift from one structure to another. Or the nodes may be simply concentrations, which gain their importance from being the condensation of some use or physical character, as a street-corner hangout or an enclosed square. The concept of node is related to the concept of path, since junctions are typically the convergence of paths, events on the journey.*[363]

In the realm of multiplayer first-person shooter games, the concept of nodes translates into what is known as *collision points*. These collision points are often the most exciting parts of FPS gameplay, as they are where critical confrontations typically occur. Gameplay is significantly shaped by these collision points, which arise when the mission-based routes of opposing teams intersect one or more times within the level. This intersection is crucial for giving the defending team a fair chance to prevent the attacking team from fulfilling their mission. While it is theoretically possible for the two teams to complete their objectives without meeting, such scenarios would reduce the game to a mere race against time, undermining the core dynamics of combat and strategy that define the gameplay.[364] These points necessitate a range of tactical decisions, such as choosing to rush through them and overwhelm the enemy, or slowly clearing every angle ensuring no enemy is actively holding a sightline. In any case, the anticipation of collision points enable both teams and individual players to strategically

360 Terry Hon-Tai Sin, "Architecture at Play: The Magic Circle and Flow in Video Game Spaces" (MA Thesis, Cambridge, ON, University of Waterloo, 2012), 69, http://hdl.handle.net/10012/6660.

361 Kevin Lynch, *The Image of the City* (Cambridge, Massachusetts ; London, England: The MIT Press, Massachusetts Institute of Technology, 1996), 41.

362 Urban planner, theorist, and writer.

363 Lynch, *The Image of the City*, 41.

364 Güttler and Johansson, "Spatial Principles of Level-Design in Multi-Player First-Person Shooters," 6.

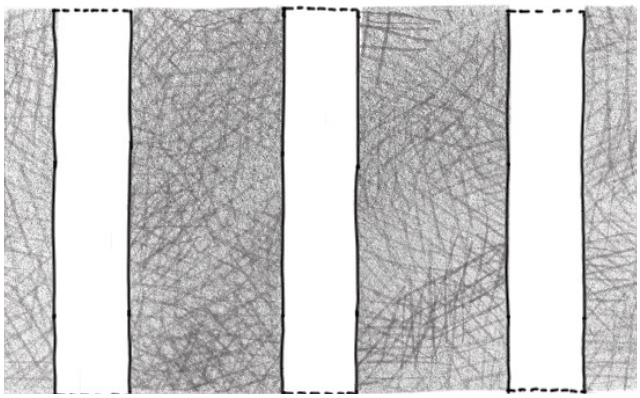


Fig. 66 Traditional three lane layout
Image by author.

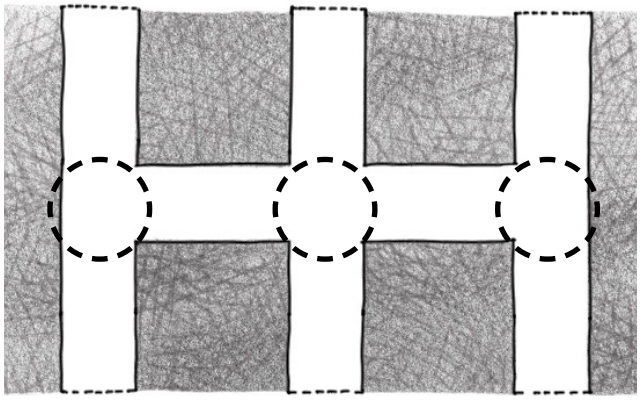


Fig. 67 Intersecting paths connecting three lanes to create nodes
Image by author.

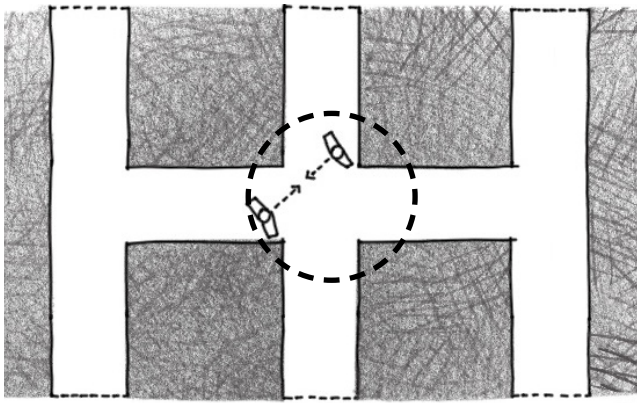


Fig. 68 Nodes then become collision points
Image by author.

prepare for these key encounters.[365] In the maps of *Valorant*, nodes are strategically designed to act as focal points for gameplay, serving as either major objectives (*Sites*) or key areas of control (*Middle*). These nodes are not arbitrarily placed but are the result of careful consideration of how players will navigate the map, where their routes are likely to intersect in relation to where they spawn, and the time it takes for them to reach a collision point.

The *sites*, designated as A and B, are classic examples of a major collision point. These areas are the ultimate objectives for attackers, who must plant the spike, and for defenders, who must prevent this from happening. The design of these *sites* inherently encourages player convergence, as multiple paths lead to these critical areas from different directions—be it through *choke points*, *links*, or flanking routes. The fact that these *Sites* are the culmination of various paths ensures that players from both teams are drawn into conflict as they attempt to either secure or contest the objective. Similarly, the *Middle* (often referred to simply as "mid") in *Valorant* maps functions as a crucial node due to its strategic significance in controlling the flow of the game. Controlling mid typically offers a team greater flexibility in rotating between *Sites*, enabling them to respond quickly to threats or capitalize on opportunities. This control is often hard-fought, as mid tends to be a highly contested area where multiple paths intersect, creating a natural collision point.

Understanding these nodes is key to mastering gameplay in *Valorant* and other FPS games. Players who can predict the flow of their opponents and position themselves advantageously at these critical points are more likely to succeed. The ability to read the map, anticipate where collisions will occur, and strategically prepare for these key encounters is a skill that separates novice players from experts. In essence, identifying and mastering these nodes—whether they be *sites* or the *middle* of the map—allows players to understand not just where the action will happen, but also why it happens there.

To summarize, FPS maps feature a common three lane layout with intersecting paths across lanes to provide direct and indirect routes between important locations. These intersections are considered nodes in urban design and collision points in FPS games; both serve analogous purposes in structuring and guiding interactions within their respective environments. Both are defined by the convergence of paths and the concentration of activity, making them critical for engagement.

In the research conducted for this thesis, it is evident that while all nodes can be classified as elements, not all elements function as nodes. Elements within a map are

365 Ibid., 5.

identified based on their ability to generate specific types of gameplay interactions. Nodes, in particular, are crucial elements because they are the designed locations where collision points—the moments of player confrontation—are most likely to occur. By their very nature, nodes are focal points of activity, where the convergence of paths and objectives makes encounters almost inevitable. As such, collision points always occur at nodes, as these are the spaces specifically designed to facilitate player interaction.

However, it is important to recognize that collision points are not exclusively confined to nodes. While nodes are the primary locations where these interactions are expected, collision points can emerge spontaneously throughout the map, driven by the unpredictable dynamics of player movement and strategy. For example, a confrontation might unexpectedly take place at a team's spawn point—an area not typically designed as a node. If attackers are delayed in reaching their objective, defenders may advance beyond their designated areas, past *site* and past *middle*, to engage the opposing team at their spawn. This type of encounter, while uncommon, occurs outside of designated nodes, yet can still become collision points, underscoring the emergent nature of these game maps.

Thus, while nodes are the designed epicentres of gameplay where collision points are expected, the possibility of such encounters extends beyond these fixed points. The entire map, with its various elements, becomes a dynamic environment where any location can potentially become contested.

Given that elements in this thesis are defined by their ability to generate distinct gameplay, spaces of intensified combat at nodes are certainly considered elements. However, elements in a multiplayer FPS map extend beyond just nodes and collision points. Some elements, though not designed as nodes, play a significant role in shaping the gameplay experience by influencing player behaviour in various ways. For instance, certain elements are intended to evoke feelings of tension or anxiety, often through their scale or spatial configuration. In response to these psychological effects, players may move through these spaces at slower or faster speeds. Due to the ability of these spaces to influence the behaviour of players as a direct response to their spatial attributes, these spaces are pertinent in the identification of elements.

To understand how game elements create unique gameplay experiences, it is crucial to examine them through multiple lenses: their hierarchical complexity (rudimentary to sophisticated), their spatial attributes (open, closed, space-objects, and non-attributes), and their scale (small to large). Analyzing these dimensions reveals how basic mechanics evolve into complex systems, how spatial configurations influence player behaviour, and how scale impacts the intensity and strategy of gameplay.

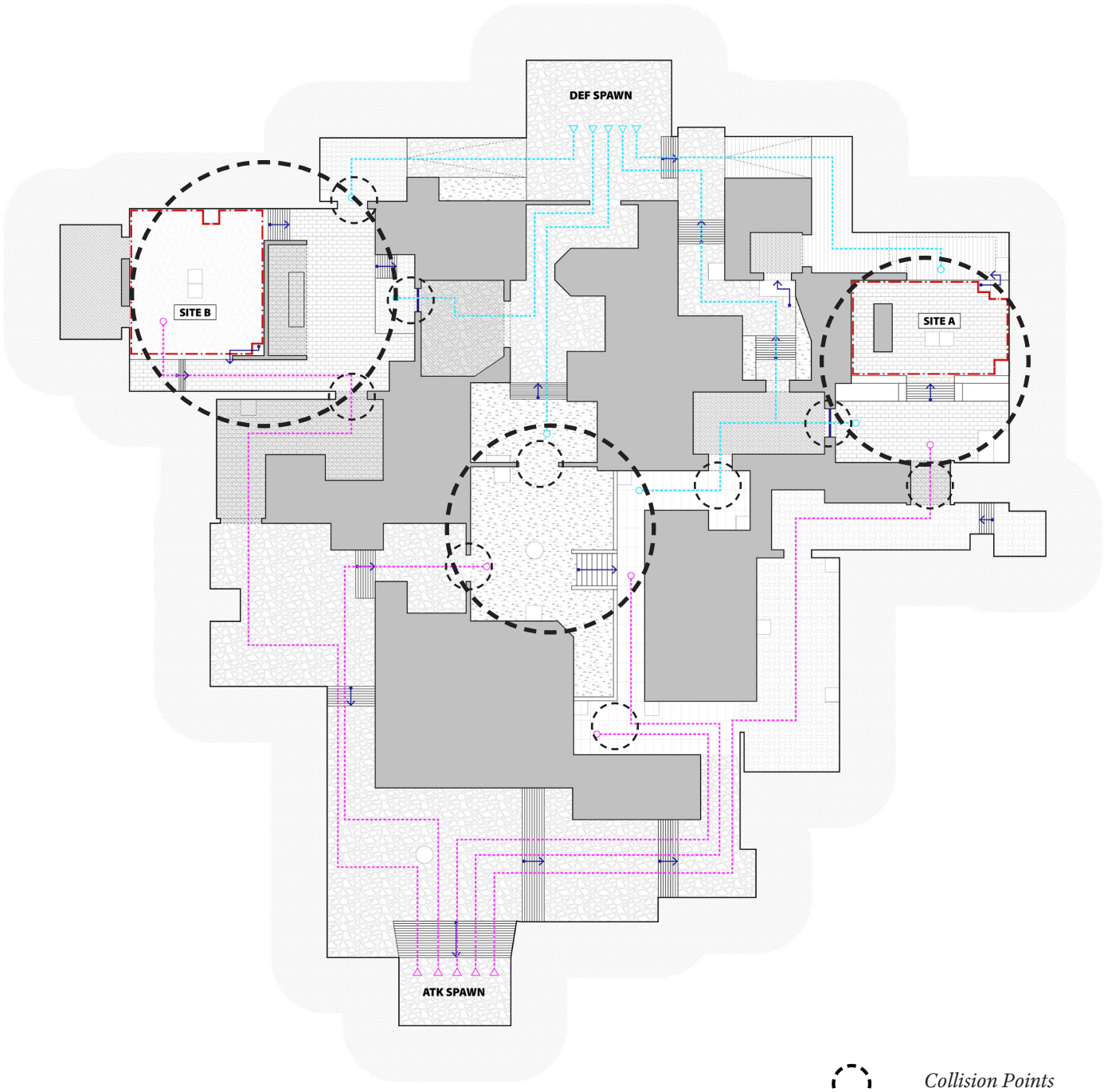


Fig. 69 Paths of convergence in 'Ascent'

Resulting nodes that house collision points

Image by author.

Illustrated Taxonomy of Spatial Elements

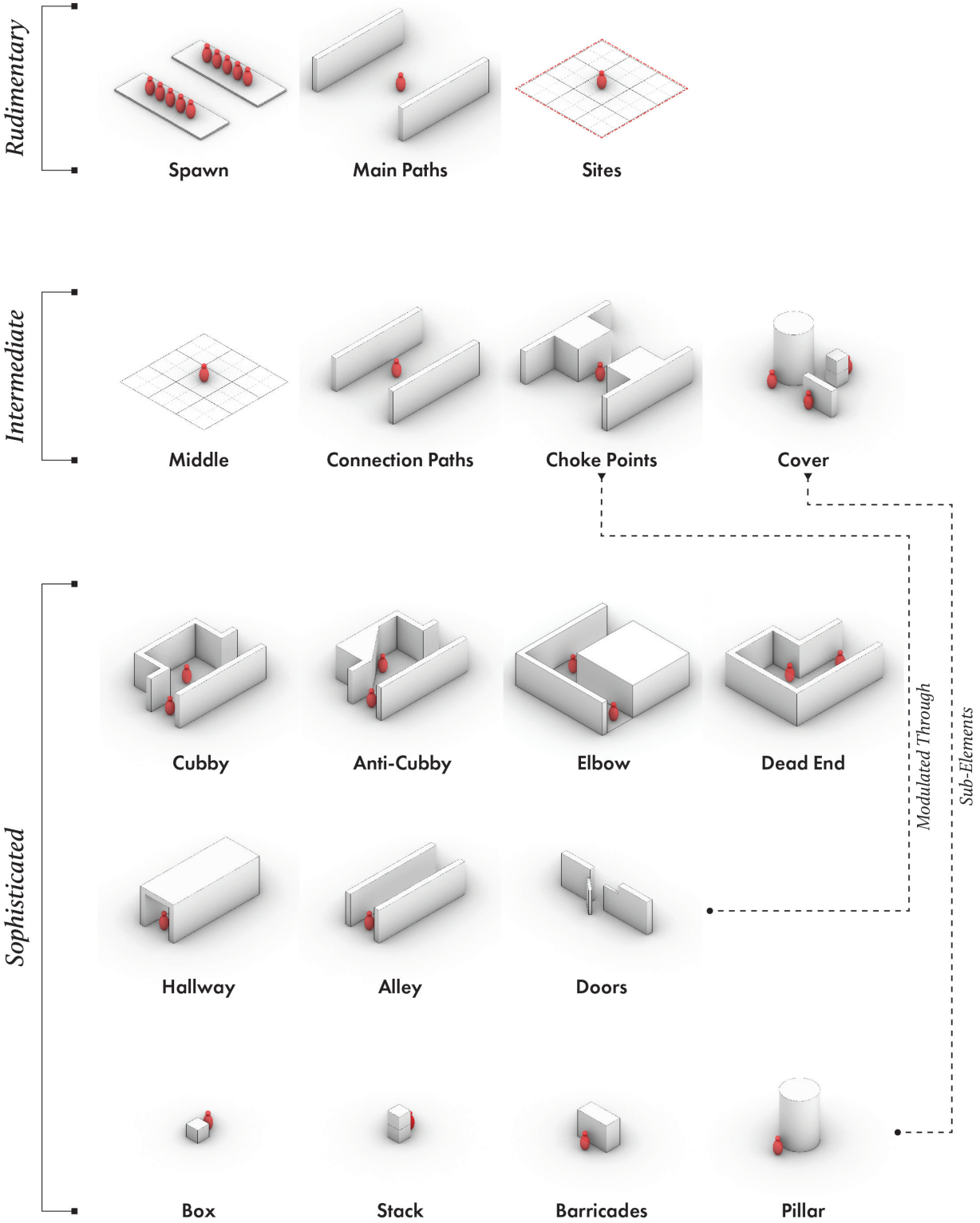
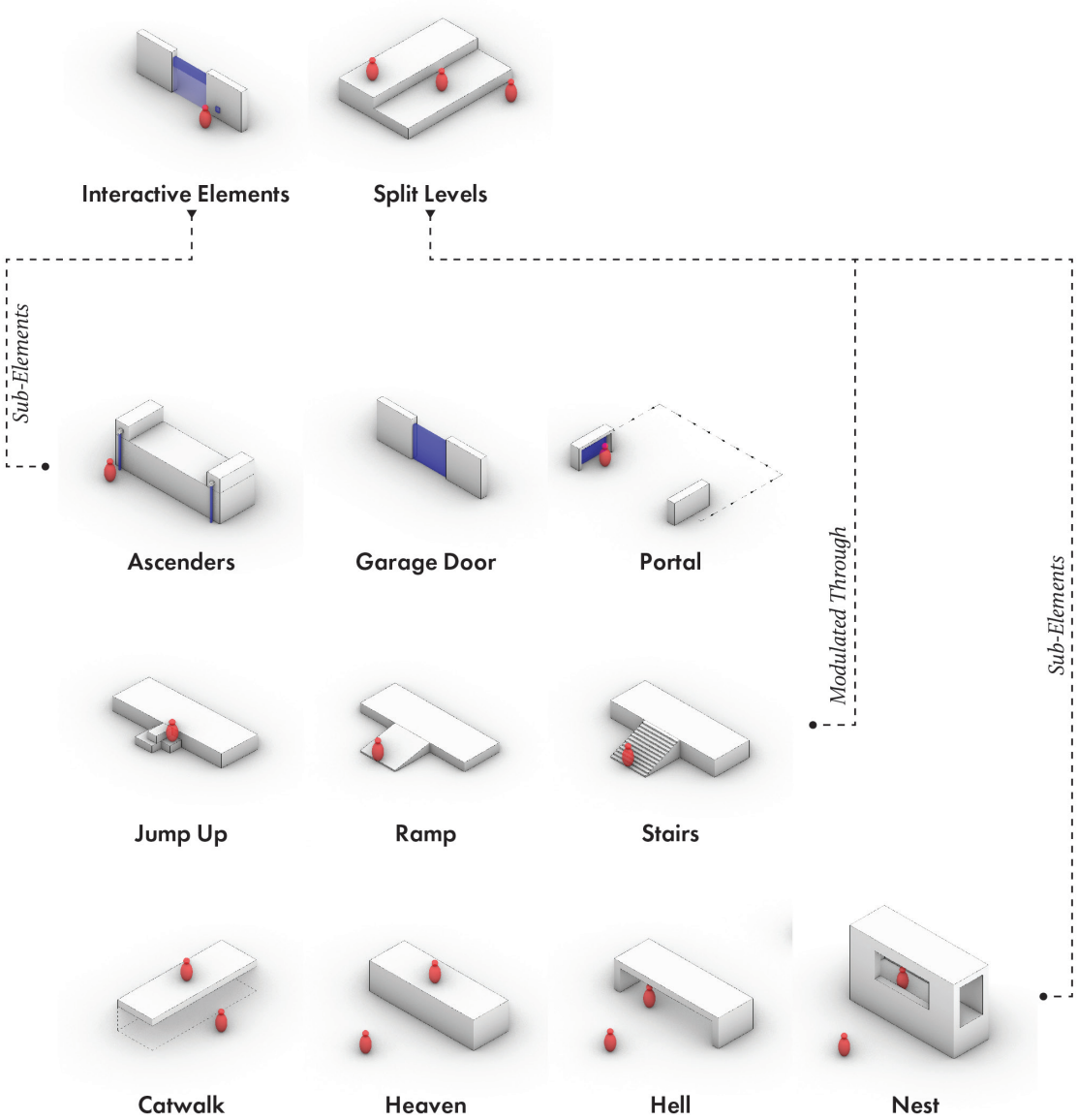


Fig. 70 Taxonomy of FPS game elements found in Valorant

Organized into rudimentary, intermediate, and sophisticated categories.
Image by author.



Hierarchy of Elements in FPS Maps

Rudimentary Elements

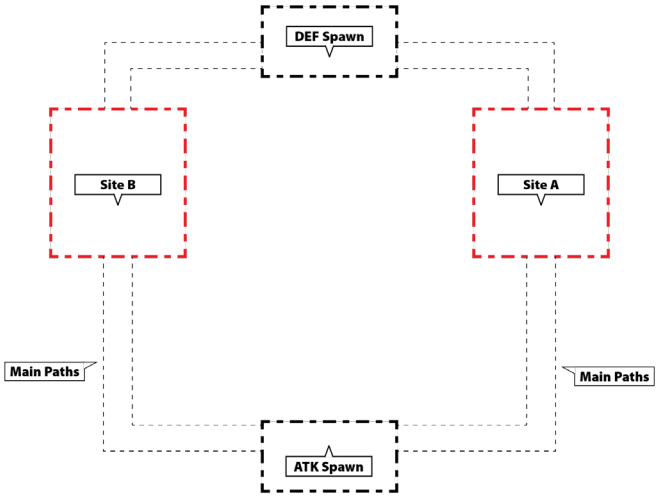


Fig. 71 Diagram of how rudimentary elements form the map
Image by author.

Rudimentary elements form the foundational aspects of FPS maps. They are the simplest building blocks that establish the basic structure of the game and environment. These elements provide the essential framework within which all other components operate, ensuring that the map functions at a fundamental level. In *Valorant*, these include:

> *Spawn*: The initial location where players begin their game at the start of every round, marking their point of departure. It is a secure area free from immediate threat, allowing players to strategize before entering combat zones.
>
> *Main* (Paths): These are primary routes that connect different areas of the map. These paths are crucial for navigation and are often the most direct routes between key points like attacker *spawn* to *site*. *Main* paths dictate the primary flow of movement and are designed to facilitate quick and direct traversal of the map to the game objectives.
>
> *Site*: Critical areas where specific objectives must be completed, such as planting or defusing a spike.[366] These sites are focal points for gameplay and often become the center of intense combat.

■

366 A spike is a device that needs to be activated through pressing a designated key by players once inside the boundaries of a site. In other games, similar devices are referred to as 'bombs'.

Intermediate Elements

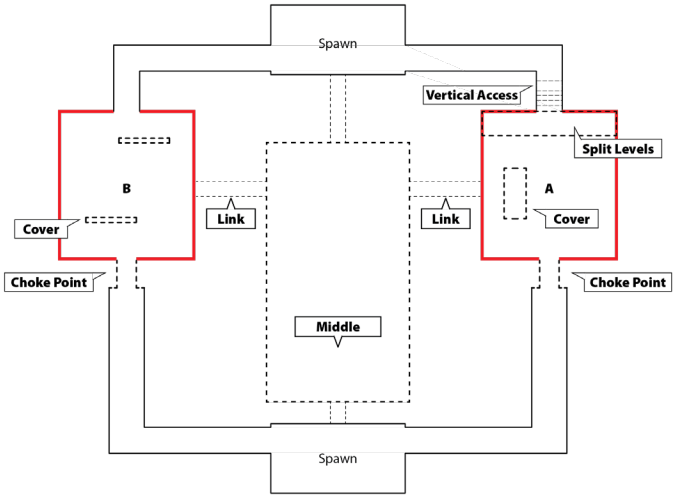


Fig. 72 Diagram of intermediate elements adding connection and complexity

Image by author.

Intermediate elements add complexity to the map by introducing varied tactical opportunities and movement options. Through the combination of rudimentary and intermediate elements, the three-lane interconnected layout of the map is established. Key intermediate elements include:

Middle: A central area that often serves as a strategic control point. Dominating the middle can provide significant advantages in terms of map control and sightlines. The middle area is typically designed to be highly contestable, offering significant rewards to the team that controls it.

Links (Connection Paths): Secondary routes that connect primary paths and other important areas. These paths offer alternative strategies and can be used for flanking maneuvers, allowing for diverse tactical approaches and unpredictability in player movement.

Chokepoints: Narrow areas where players are funnelled, creating opportunities for ambushes and defensive stands. Controlling chokepoints is crucial for map dominance as they often become the sites of critical engagements.

Cover: Objects and structures that provide protection from enemy fire. Effective use of cover is essential for survival and tactical positioning. Cover can vary in size and height, each offering different levels of protection and tactical advantages.

Interactive Elements: Features that can be manipulated by players, such as doors that can be opened and closed or allow players to climb into elevations not possible otherwise through interacting with a designated key.

Split Levels: Areas with vertical differentiation, such as platforms or elevated positions. These levels can be used to gain superior sightlines and control. The addition of split levels creates the need for heightened awareness, as one must manually adjust the crosshair of their avatar to higher or lower elevations than otherwise.

Sophisticated Elements

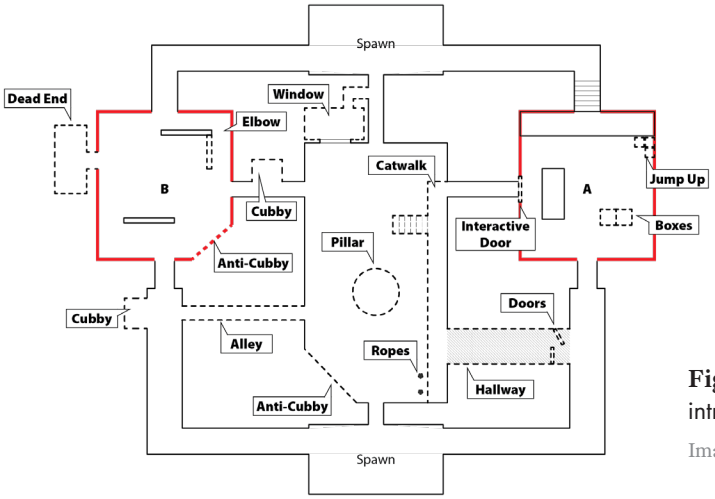


Fig. 73 Diagram of sophisticated elements introducing varaibility

Image by author.

Sophisticated elements introduce further rhythms in pacing through movement constraints and scales of space. It is important to note that elements of the sophisticated category can often be absorbed into the elements of the rudimentary and intermediate categories. For example, *heaven* and *hell* can combine to create *split levels*; and *pillars*, *boxes*, and *stacks*, are all considered as *cover*. Sophisticated elements introduce further variability and nuance of rudimentary and intermediate elements. They include:

Cubby: Small recessed areas that provide hidden vantage points for ambushes or defense. Cubbies allow players to surprise opponents or hold strategic positions discreetly.

Anti-Cubby: Anti-cubby are spaces that feature a slanted wall to prevent enemies from hiding within its corner. This slanted wall is the factor that prevents this space from acting as a *cubby*.

Elbow: Elbows are 90 degree turns in a hallway that change the direction of movement, often used to break sightlines and create tactical engagements through affording places of hiding.

Dead End: In a multi-player game, most maps are designed with the least possible dead-ends and the most paths to allow for continuous circulation and constant action.[367] However, dead ends can serve as deadly areas where players can hide to ambush as they are unexpected areas outside the normal circulation.

Hallway: Long, narrow paths that channel player movement and create opportunities for long-range engagements. Hallways often serve as connectors between major areas and can be strategically vital for control.

Alley: Like hallways but often shorter, wider, and without a ceiling, providing quick routes between larger areas. Alleys can facilitate rapid movement and quick escapes or flanks. Hallways and Alleys commonly act as the *main* approach to *sites*.

Catwalk/Rafter: Narrow elevated paths, often without *cover*.

Heaven: High vantage points that provide superior lines of sight. *Heaven* positions offer dominant control over key areas and are often crucial for defense.

Hell: Low-lying areas directly below high vantage points, often used for defensive positions. *Hell* positions can be used to catch opponents off guard or hold critical areas, especially when occupied by teammates in conjunction with heaven.

Nest: Elevated, enclosed areas that provide a secure vantage point for sniping or observation. Nests offer strong defensive positions and control over significant portions of the map through its commanding view.

Doors: These are double swing doors where one side is in the fully closed position, and the other is slightly ajar, leaving a small gap where players can enter through.

■

367 Sin, "Architecture at Play," 77.

Box: Simple rectangular objects that provide cover and can be used for tactical positioning. In relation to player metrics, the height of the box is just barely tall enough to cover the height of the player.

Stack: Vertical arrangements of boxes that create multi-level cover. Through stacking, these boxes are tall enough to cover the full height of the player.

Standalone objects: The are objects that are larger than *box* or *stack*, but smaller than a *pillar*.

Pillar: Vertical structures that can block sightlines and provide cover, often found in larger rooms or open areas.

Ascenders: Mechanisms or objects that allow players to move vertically, such as ladders or ropes.

Garage Door: Large movable barriers that can open or close, altering the layout and flow of the map.

Portal: Devices that instantly transport players to different locations, offering unique circulation and rotation opportunities.

Jump-up: A collection of objects that players can jump onto, providing minor height advantages or access higher elevations. This can sometimes require a higher mechanical skill than other forms of vertical connection, as some jump-ups need perfect timing of speed and control to land, otherwise falling off.

Ramp: Inclined surfaces that connect different levels, facilitating smooth vertical movement. Offers smoother travel than stairs.

Stairs: Steps that provide access to higher or lower levels.

Spatial and Non-Spatial Classification of Elements

While nodes and collision points are crucial for understanding the strategic placement of combat scenarios within FPS maps, the architecture of these maps encompasses more than just these intersections. The arrangement of various spaces shapes the overall structure of an FPS map—each with its own scale and spatial characteristics, defined primarily by their openness or confinement. The dichotomy between *open* and *confined* spaces distinctly modifies the way the game is played.[368] Open spaces afford long sightlines with few obstacles, requiring constant vigilance to avoid surprise encounters. Conversely, confined spaces create anxiety and necessitate quick reflexes in claustrophobic settings.[369] The properties of being open or confined align directly with the scales of small to large spaces. As Christopher Totten[370] notes in "Designing Better Levels Through Human Survival Instincts," that "in games, the size of spaces can serve to create or alleviate tension or set the stage for dramatic encounters."[371] Therefore, elements can also be evaluated based on their ability to create and dissipate tension through their open and confined spatial properties.

However, it is important to recognize that not all elements identified in this thesis neatly fall into the categories of open or confined spaces. Some elements are better described as space-objects, while others lack any direct spatial attributes altogether. Space-objects—such as *boxes*, *pillars*, and other forms of *cover*—serve as modular components within the map, providing cover, breaking lines of sight, and creating micro-environments within larger spaces. These objects influence gameplay by constraining sightlines, but they do not define the overall openness or confinement of the area they inhabit. Similarly, certain elements such as *interactive* features (like *portals* or *garage doors*) and vertical transitions (like *ramps* or *stairs*) operate independently of spatial classification. These elements offer unique gameplay mechanics or facilitate movement across different levels, yet they do not conform to the binary distinction of open versus confined spaces.

368 James Murff, "How FPS Architecture Makes Us Think," *Fanbyte* (blog), 2023, https://www.fanbyte.com/legacy/how-fps-architecture-makes-us-think.

369 Christopher W. Totten, "Designing Better Levels Through Human Survival Instincts," *Game Developer* (blog), 2011, https://www.gamedeveloper.com/design/designing-better-levels-through-human-survival-instincts.

370 Game designer, writer, and game professor.

371 Ibid.

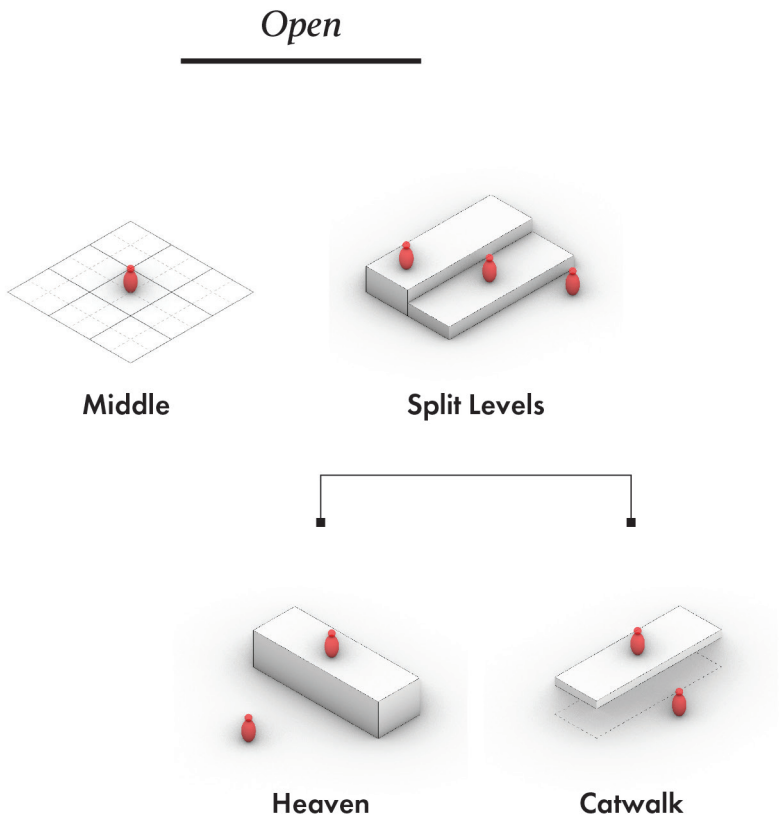


Fig. 74 Elements defined by their expansive openness

Afford long range engagements, where danger is attributed to long sightlines
Image by author.

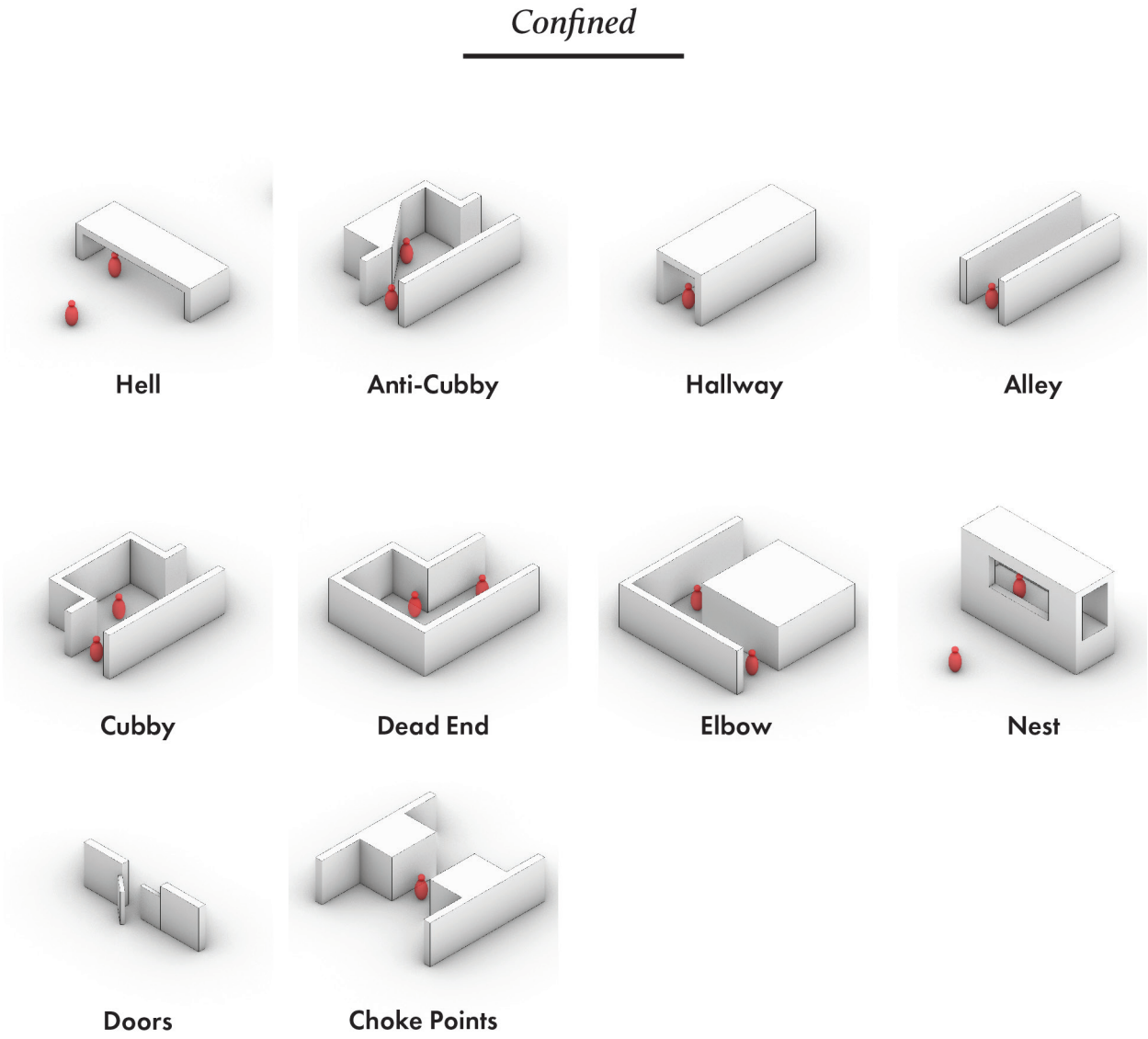


Fig. 75 Elements defined by their spatial confinement

Afford short range, and perhaps unexpected, engagements, where danger is attributed to the restriction of movement and hidden areas

Image by author.

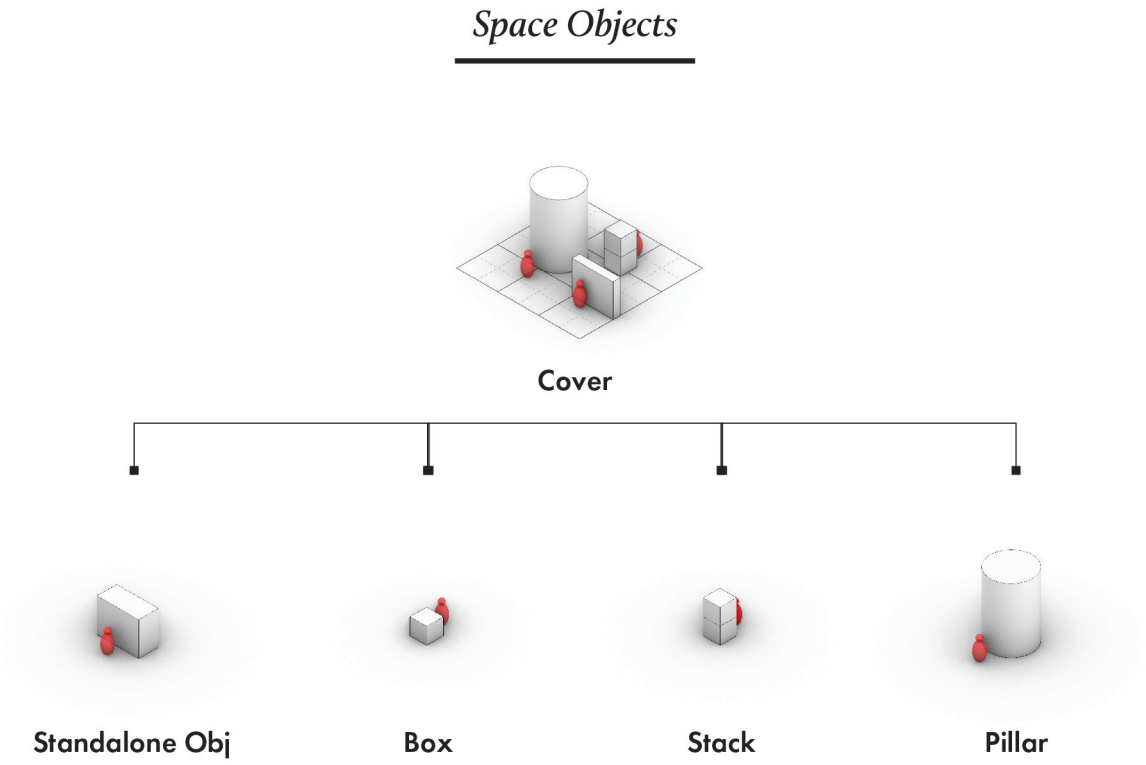


Fig. 76 Elements defined as object in space

Acting as cover to provide safety by breaking sightlines

Image by author.

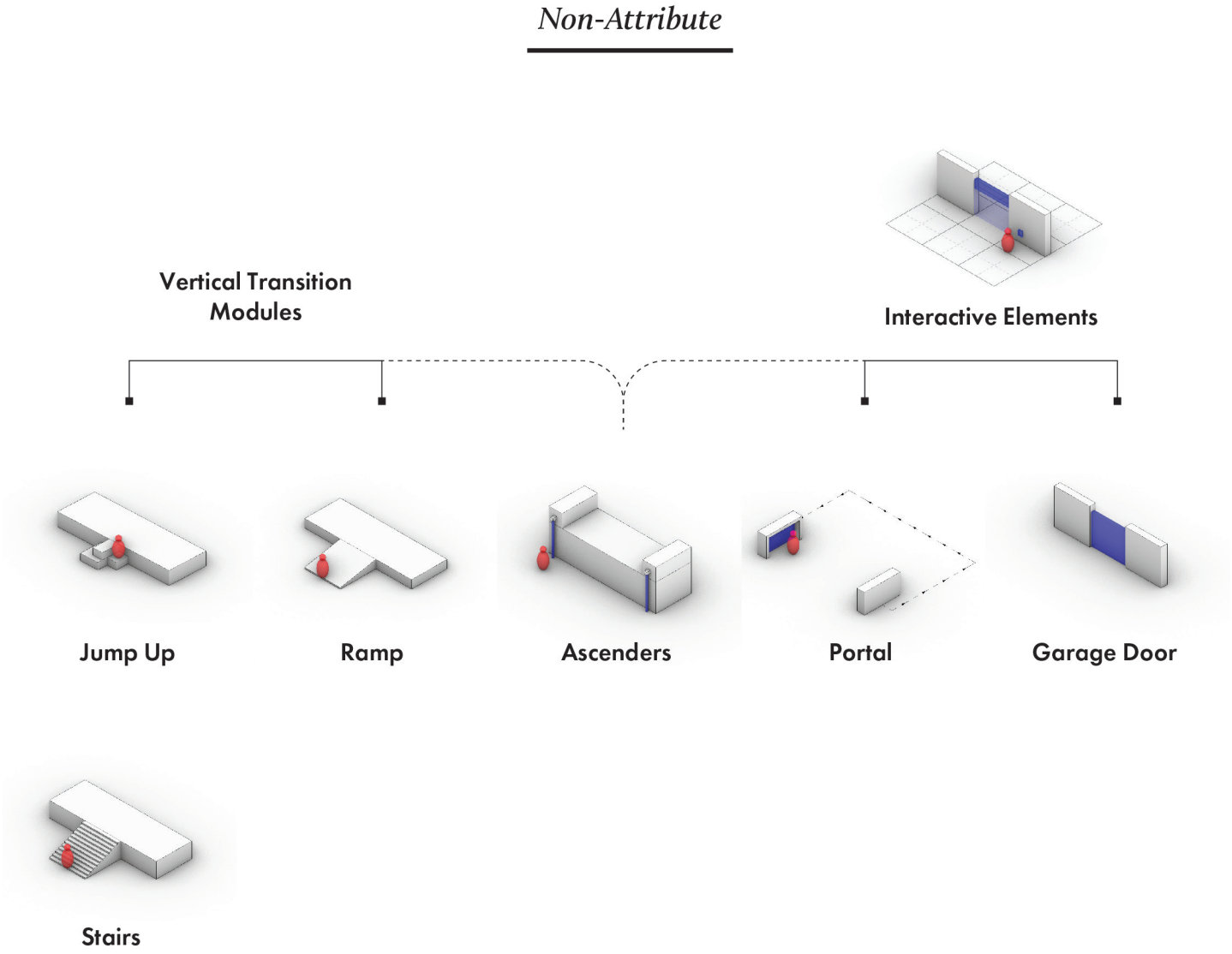


Fig. 77 Elements that can not be defined spatially

But can be identified through their nature of interaction or through modulating access and transitioning between other elements

Image by author.

Scale and Size Types of Elements

The previous chapter categorized elements based on their general spatial attributes, such as open, confined, or as space-objects within the game environment. Another important lens through which to analyze these elements is by considering their scale and size types. This section will focus on organizing elements according to the dimensions they occupy within the game world—narrow, intimate, or prospect spaces—and how these scales impact player experience. By examining elements through the framework of scale, it becomes possible to understand how the size of spaces dictates the conditions of gameplay, from the constraints of tight corridors such as *hallways* to the expansive openness of large fields such as *middle*.

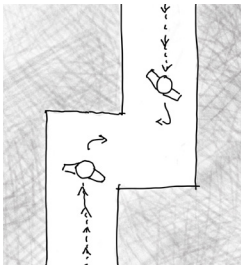


Fig. 78 Narrow Space

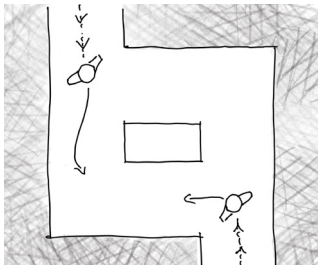


Fig. 79 Intimate Space

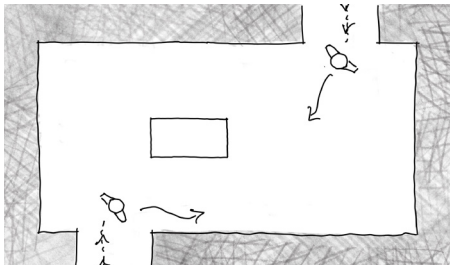


Fig. 80 Prospect Space

Images by author.

Narrow space (small)

> *The narrowing of space close to the limits of player metrics creates a sense that the player cannot perform many of the actions he or she could under other conditions. This is significant for the other function of narrow spaces —evoking vulnerability by limiting player movement options.*[372]

Narrow spaces are defined by their confined dimensions, creating environments that limit movement and visibility. These spaces can be places of refuge, where players can tuck away from the sight of enemies, or places of combat where restricted width of narrow spaces limits player movement, forcing them to proceed cautiously and often in a single file. These spaces can include tight corridors, alleyways, and narrow passages between structures. For example, In *Resident Evil*[373], many *hallways* are barely wide enough to accommodate two characters standing side by side. Therefore, a single enemy in these *hallways* can become a significant threat for players trying to

372 Christopher W. Totten, *An Architectural Approach to Level Design* (Florida: A K Peters/CRC Press, 2014), 119, https://doi.org/10.1201/b21989.

373 Developed by Capcom. Published by Capcom. Released for Playstation. 1996.

get past. Additionally, the narrow space heightens the claustrophobic atmosphere and contributes to a feeling of tension and anxiety.

> *Tension is the mental strain a game can create in the player as they struggle to survive or complete objectives. Level designers use tension to affect pacing.*[374]

In this case, 90-degree corners within *hallways* become more than just the turning of direction, they are extremely dangerous spaces due to the way they constrict sightlines and therefore are strategic hiding spaces for enemies. Due to this, 90-degree corners, or *elbows* as classified in this thesis, can be seen in abundance in stealth games[375] where strategic hiding plays a core part in gameplay, such as *Metal Gear Solid*[376] where its environment features many elbows so that players can sneak from one place to another without detection.[377]

Intimate Space (medium)

Intimate spaces are metric appropriate spaces, where it is neither overly large nor narrow in relation to the scale of the player. These spaces comfortably support the size and moment metrics of players, where everything within the space is accessible by the player and their inherent abilities.[378] This space can be considered as the default scale where its architectural properties do not give advantage to one team or the other.

Prospect Space (large)

> *Prospect spaces are similar to narrow spaces in their potential for creating fear in the player. They do so through opposite means, however. If narrow spaces create a sense of claustrophobia, prospects create a sense of agoraphobia, an anxiety disorder that includes a fear of wide-open spaces.*[379]

Although this space is the complete opposite of narrow spaces, it creates a comparable

374 Kenneth Hullett and Jim Whitehead, "Design Patterns in FPS Levels," FDG '10 (ACM, 2010), 3, https://doi.org/10.1145/1822348.1822359.

375 A genre of video games that emphasize avoiding detection by enemies and completing objectives through the use of stealth tactics rather than direct confrontation. Players are often required to use a combination of sneaking, hiding, and strategic planning to navigate through levels or missions.

376 Developed by Konami. Published By Konami. Released for PlayStation. 1998.

377 Totten, *An Architectural Approach to Level Design,* 81.

378 Ibid., 121.

379 Ibid., 124.

effect. Coined by architectural theorist Grant Hildebrand,[380] this space emphasizes the visibility and exposure inherent in such environments, where occupants can see and be seen over a vast area. *Prospect spaces* are often associated with large, open fields or expansive plazas that offer clear sightlines, creating both opportunities and vulnerabilities. The wide-open nature of these spaces allows for greater situational awareness, enabling occupants to detect threats from a distance. However, this same openness also means that occupants are more visible and, therefore, more susceptible to being targeted. In FPS games, prospect spaces manifest as *middle* areas of the map, where their large size and multiple openings create ambiguity and danger as players are exposed to potential threats from multiple directions.

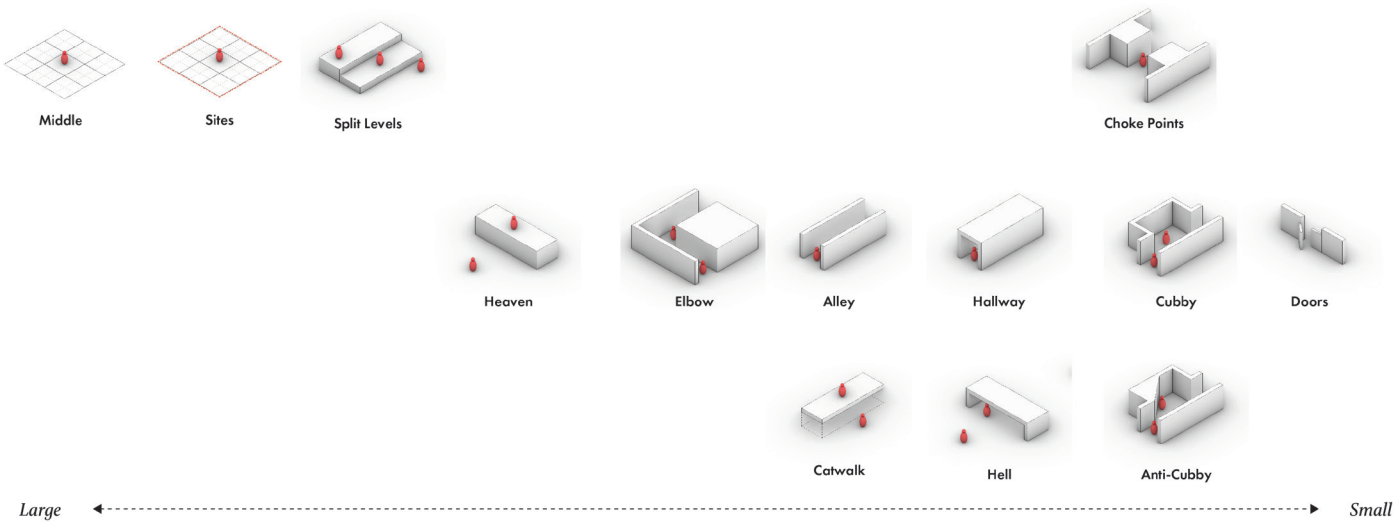


Fig. 81 Diagram of elements arranged on scale of small to large spaces
Image by author.

380 Hildebrand describes prospect space as that in which humans had to historically find food, water, and other necessities outside of the safety of caves and open to predators and the elements.
Grant Hildebrand, *Origins of Architectural Pleasure* (Berkeley, Calif. ; University of California Press, 1999).

Description of Rudimentary and Intermediate Elements

The following are in-depth descriptions of elements under the rudimentary and intermediate categories, placing them in relation to the four-square layout, and cross referencing where they occur on the map *Ascent*.

Spawn

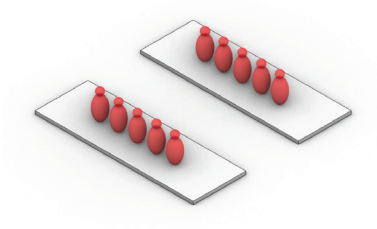


Fig. 82 Axon diagram of Spawn element

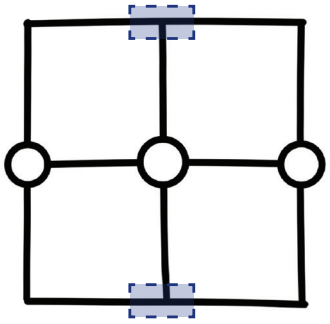


Fig. 83 Location of Spawns on the four-square

Images on this page are by author.

The spawn area in a game map is the starting point where players enter the game world, functioning as the origin point of movement and strategy within the game. These are secure zones where players are free from immediate threat, allowing them to strategize and prepare before engaging in combat. In *Valorant*, spawn areas are crucial for setting the initial pace and direction of gameplay. Before the round officially begins, players can freely move within their respective pre-round boundaries during the *buy phase*.[381] Pre-round barriers, which are transparent planes that cannot be interacted with or move through, are placed before the entrances of site and middle, and define the extent to which players can advance toward key areas on the map before the round officially begins. The design of spawn areas and their associated pre-round boundaries reflects an intentional separation from immediate conflict zones. This setup creates a psychological and spatial buffer, helping players transition from the safety of the spawn to more contested spaces. The boundaries ensure that players have time to orient themselves, plan their movements, and coordinate with teammates before the barriers drop and full gameplay commences. The spatial relationship between the spawn area and the rest of the map is carefully calibrated to balance the distance and time it takes for players to engage with opposing forces.

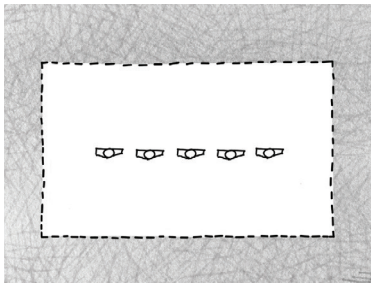


Fig. 84 Plan diagram of spawn

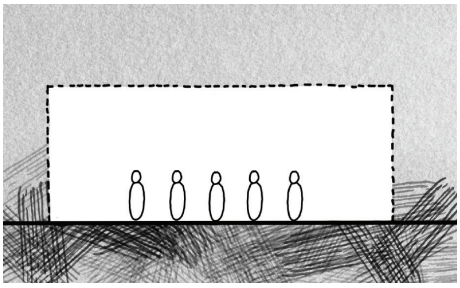


Fig. 85 Section diagram of spawn

381 The Buy Phase automatically emerges at the start of each round, lasting 30-seconds. The purpose of the Buy Phase is for players to purchase and equip their preferred arsenal, made possible with a complex economy and progression system, which allows players to earn and spend in-game currency to unlock new weapons, abilities, and other rewards.



Fig. 86 Ascent: pre-round barrier boundaries and team spawn areas

Image by author.



Fig. 87 Ascent: Attacker Spawn

Screencapture of Valorant, IP of Riot Games. Annotated by author.

Main (Paths)

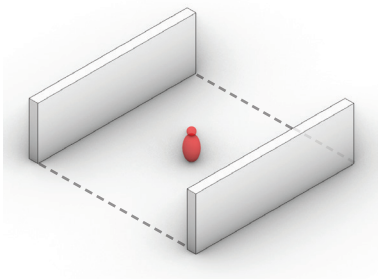


Fig. 88 Axon diagram of Main element

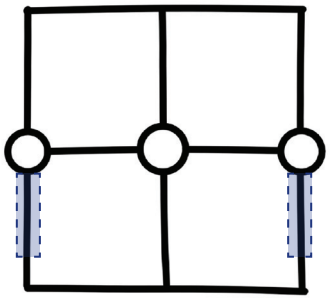


Fig. 89 Location of Mains on the four-square

Images on this page are by author.

Main paths in a game map are routes that connect key areas and can be considered as the primary paths of approach to *sites*. These routes provide direct access from attacker spawn to site, and are typically modulated through *hallways*, *alleys*, and *elbows*. *Choke points* will always be nested at the junction of *main* and *site*.

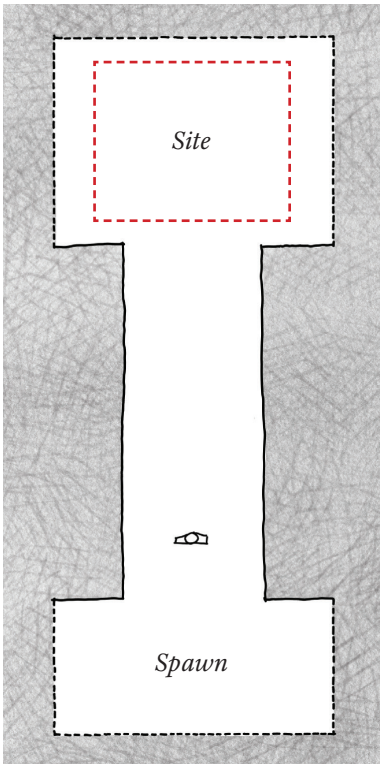


Fig. 90 Plan diagram of main

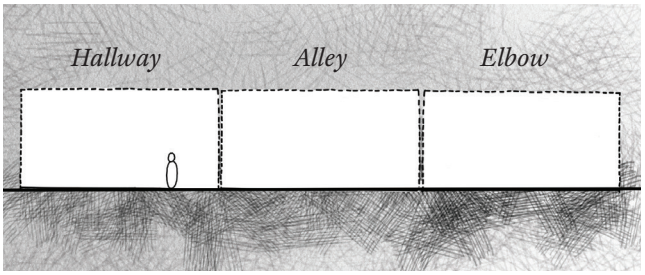


Fig. 91 Section diagram of main and its possible sub-elements

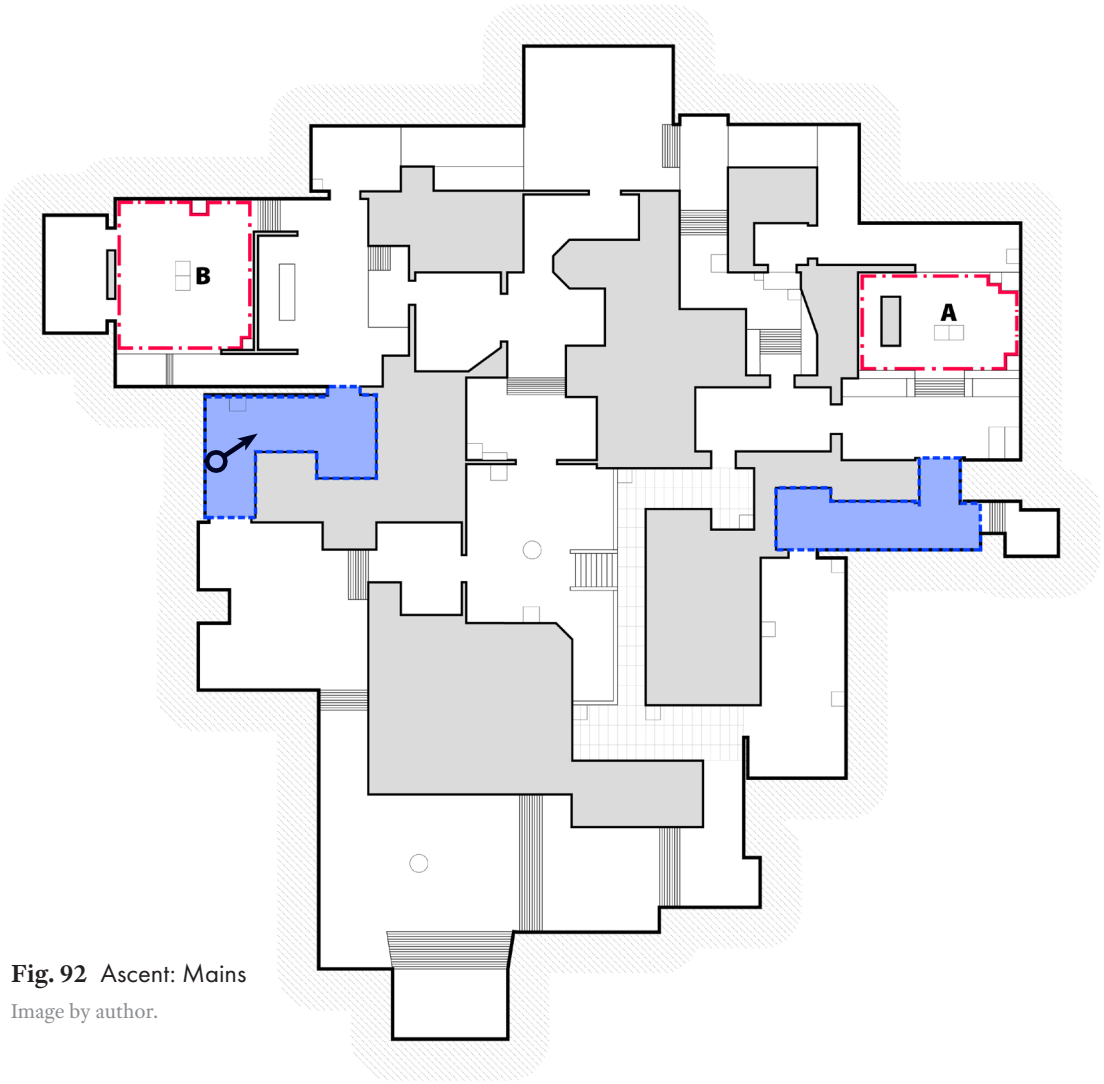


Fig. 92 Ascent: Mains
Image by author.



Fig. 93 Ascent: Main leading to entry of B Site
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Site

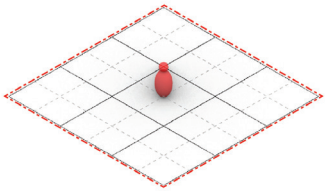


Fig. 94 Axon diagram of Site element

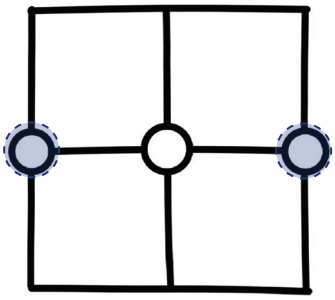


Fig. 95 Location of Sites on the four-square

Images on this page are by author.

Sites are large areas designed to be the focal points of gameplay, where attackers aim to overtake, and defenders focus on holding or retaking control. These *sites* are key nodes where multiple paths converge. These sites offer various forms of *cover*, allowing for dynamic firefights, while their multiple, yet limited, entry points ensure that teams must coordinate their approaches and defenses carefully.

Sites are designed to be the focal points of the map, where the majority of the action and player interaction occurs. The design of a *site* is crucial for balancing the gameplay; it must offer both opportunities for defense and challenges for attackers. *Sites* are often enclosed by multiple entry points, chokepoints, and areas of cover, allowing players to control or contest the space effectively.

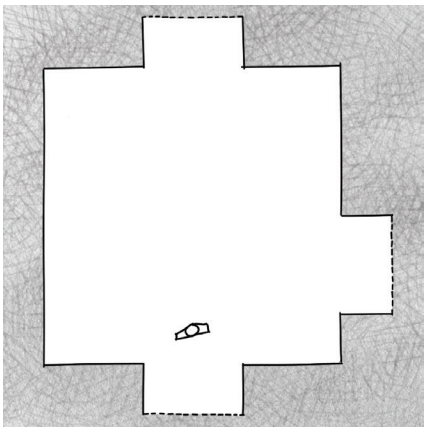


Fig. 96 Plan diagram of Site element

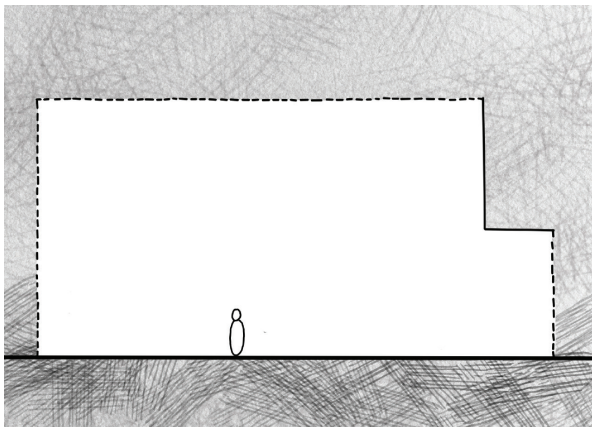


Fig. 97 Section diagram of Site element

Sites, due to its location at the two sides of the four-square, possess three entries at minimum.

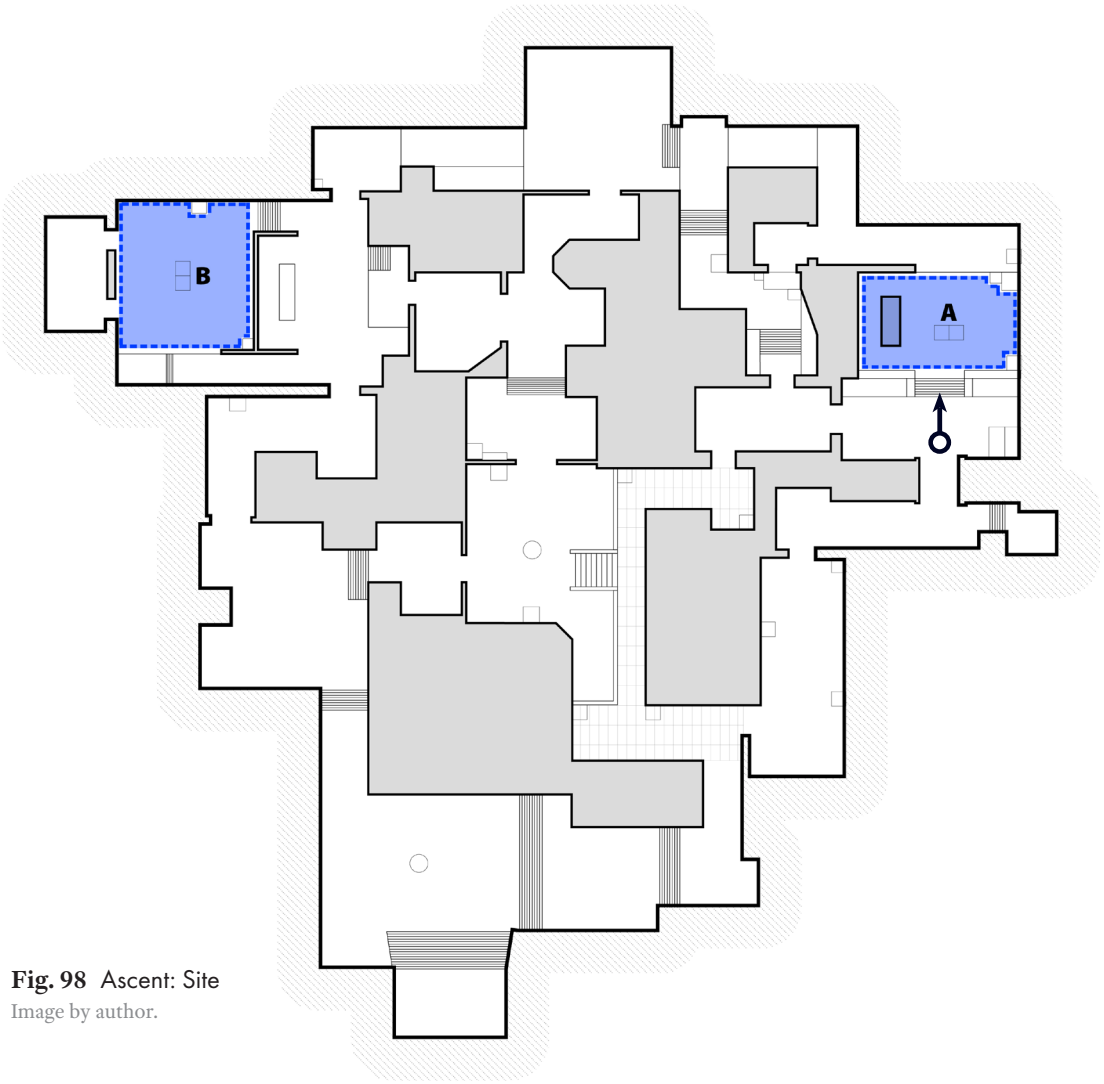


Fig. 98 Ascent: Site
Image by author.



Fig. 99 Ascent: Site A
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Middle

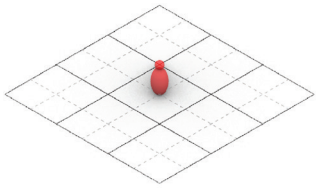


Fig. 100 Axon diagram of Middle element

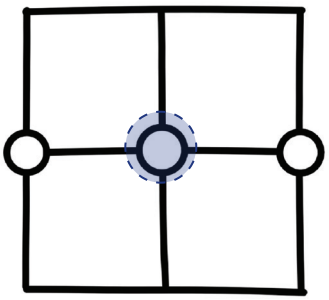


Fig. 101 Location of Middle on the four-square

Images on this page are by author.

The *middle* area of a game map, often referred to simply as "mid," is a central region that serves as a strategic control point — acting as a hub where multiple routes intersect and where control over the space can significantly influence movement and activity throughout the surrounding areas.

Controlling the middle is often key to dominating the map, as it provides players with sightlines into multiple areas, facilitates flanking routes, and offers strategic advantages in both offense and defense. The middle area is designed to be highly contestable, with clear visibility and limited cover, forcing players to carefully balance aggression with caution as they maneuver through or around it.

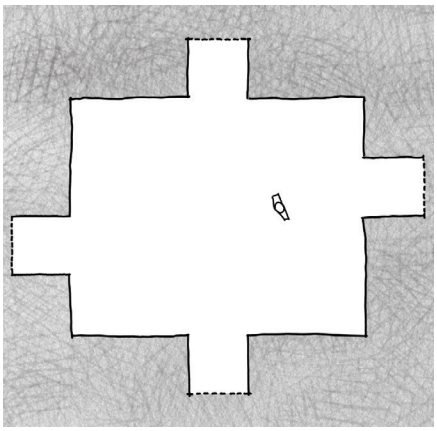


Fig. 102 Plan diagram of Middle element

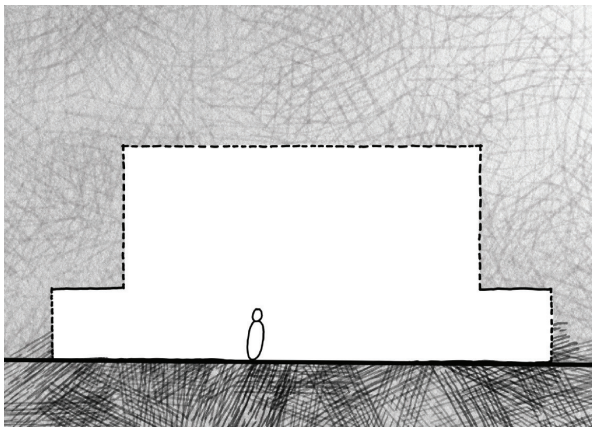


Fig. 103 Section diagram of Middle element

Middle, due to its location at the junction of circulation on the four-square, possess four entries at minimum.

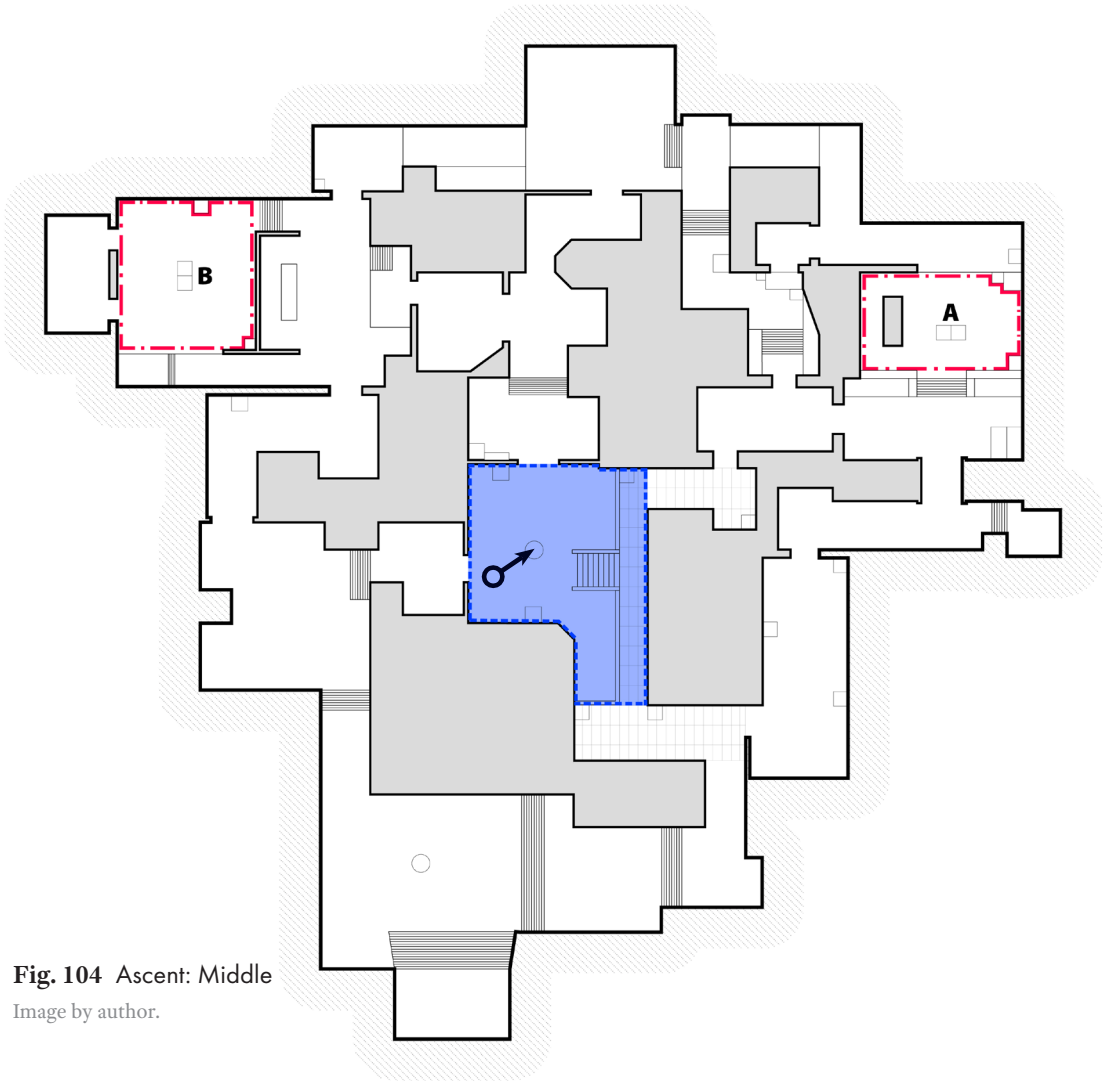


Fig. 104 Ascent: Middle
Image by author.



Fig. 105 Ascent: Middle
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Links

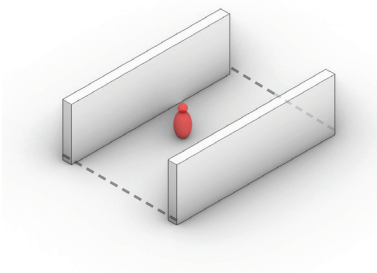


Fig. 106 Axon diagram of Link element

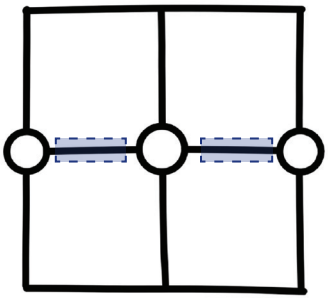


Fig. 107 Location of Links on the four-square

Images on this page are by author.

Links, or connection paths, are secondary routes that connect primary paths and other important areas. These transitional spaces offer players the opportunity to flank opponents, avoid heavily contested areas, or surprise the enemy by appearing from unexpected directions. The design of links is often less direct and more winding than main paths, encouraging exploration and tactical movement. Most often, they serve to connect *middle* to its adjacent *sites*.

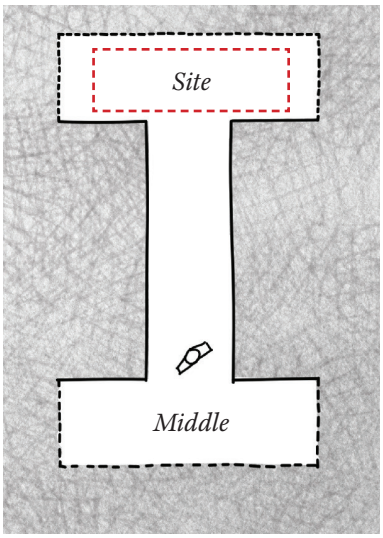


Fig. 108 Plan diagram of Link

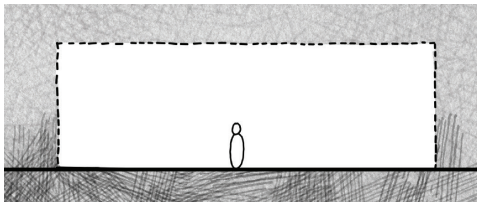


Fig. 109 Section diagram of Link

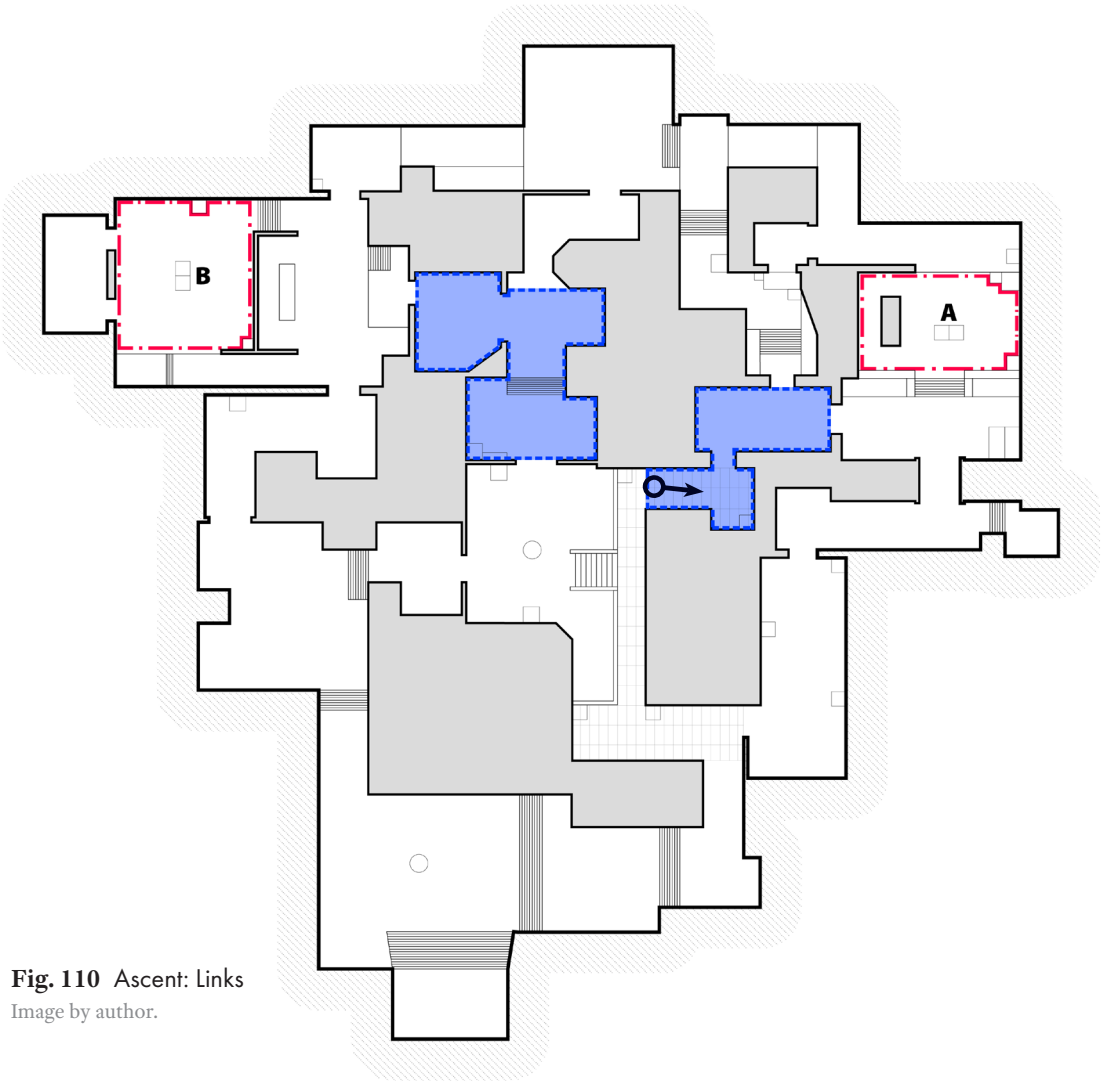


Fig. 110 Ascent: Links
Image by author.



Fig. 111 Ascent: Link from Middle to Site A
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Choke Point

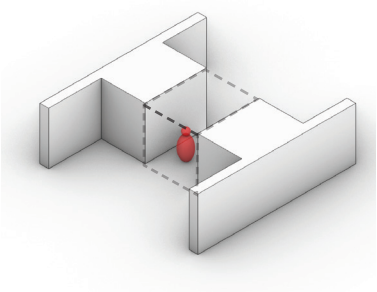


Fig. 112 Axon diagram of Choke Point element

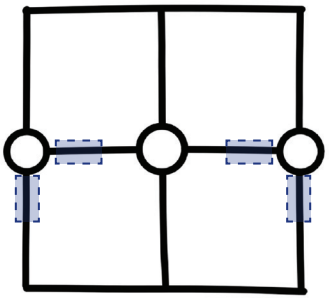
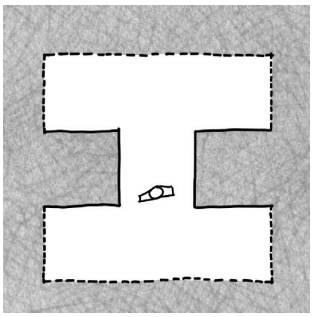


Fig. 113 Location of Choke Points on the four-square

Choke points[382] are specific areas in a game map that are narrow or constrained[383] connecting larger areas, causing player movement to be funneled through them. They act as the entrance of key spaces (*site*) and demark the outside (circulation spaces) from the inside (objective spaces). *Choke points* increase the likelihood of encounters and conflicts between players as they are the entry of *sites* — spaces that must be fought over to win the game. They control how players move through the map, ensuring that players can't easily rush from one end to the other without encountering resistance. By funnelling players through these areas, the game creates strategic points where action is likely to happen, which helps control the game's pacing and balance.[384] Holding a choke point allows a team to block the enemy's progress and control crucial areas. Defenders can set up positions to have a tactical advantage, making it challenging for attackers to push through. The placement of choke points is strategic, ensuring that the defending team can reach them before the attacking team.[385] This allows defenders to prepare and set up defences, ensuring that attackers can't simply rush through these points unopposed.



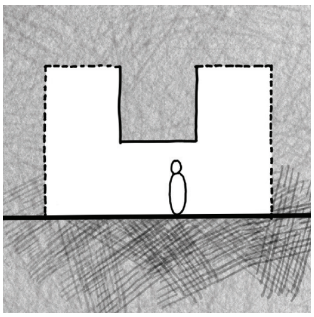


Fig. 114 Plan diagram of Choke Point

Fig. 115 Section diagram of Choke Point

Images on this page are by author.

382 Can also be considered as bottlenecks.

383 Hullett and Whitehead, "Design Patterns in FPS Levels," 4.

384 "6 Principles of Choke Point Level Design for Multiplayer Maps as Seen in CS:GO," *World of Level Design* (blog), accessed May 10, 2024, https://www.worldofleveldesign.com/categories/csgo-tutorials/csgo-principles-choke-point-level-design.php.

385 Ibid.

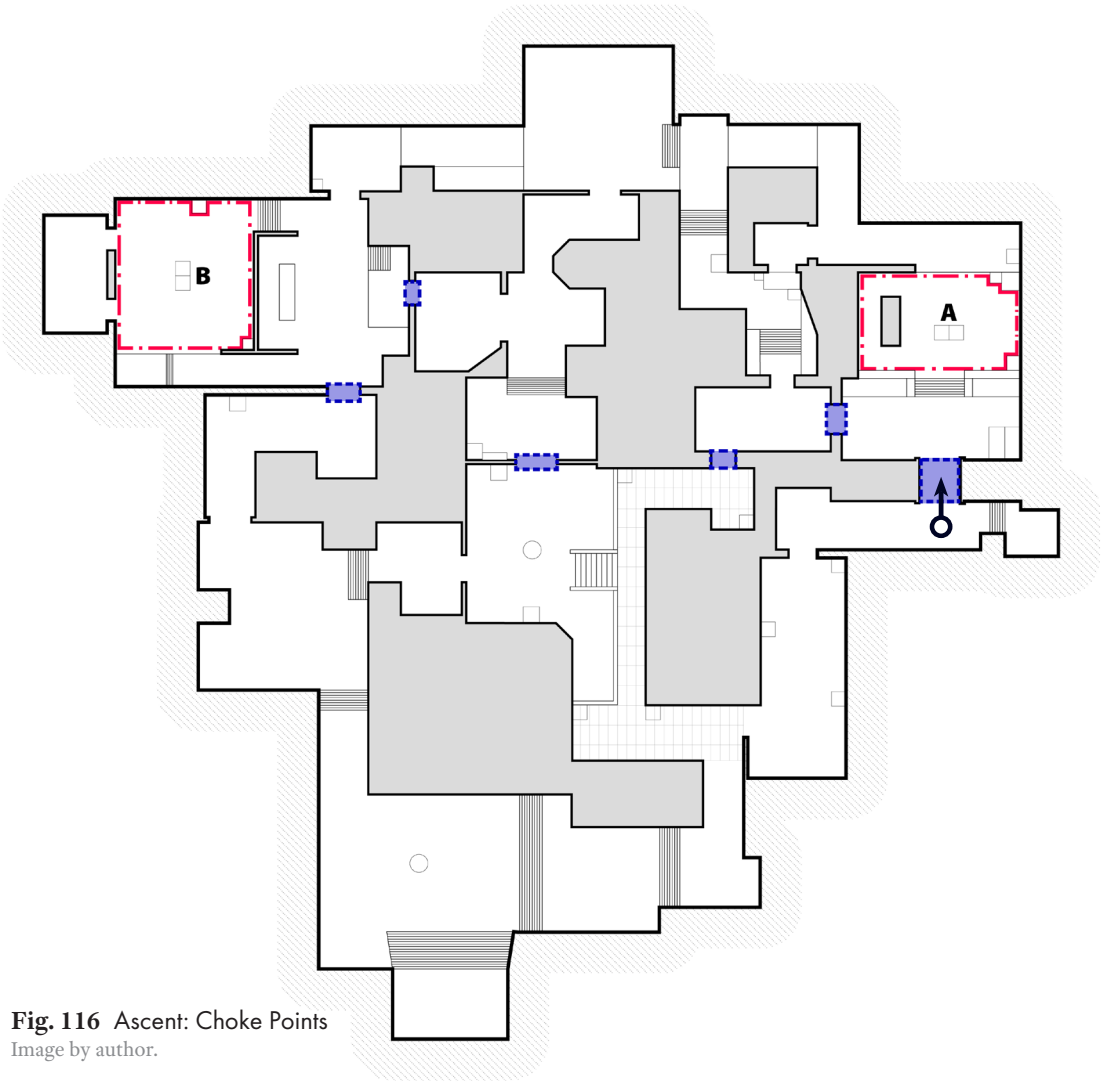


Fig. 116 Ascent: Choke Points
Image by author.



Fig. 117 Ascent: Choke Point at entry of A Site
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Cover

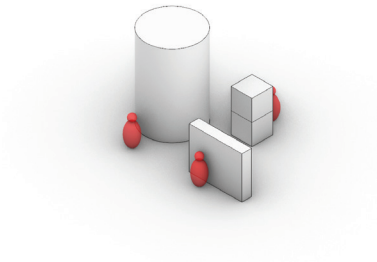


Fig. 118 Axon diagram of Cover element
Images on this page are by author.

Large open spaces should typically be segmented with ample full *cover*, which serves to reduce the vulnerability of players as they advance through these areas.[386] By breaking up open spaces, players are provided with opportunities to progress without being exposed to enemy fire for extended periods. *Cover* is equally important in smaller-scale spaces, where its presence can dictate the pace and flow of engagements. In confined areas, well-placed *cover* elements can create opportunities of danger, enable ambushes, and offer temporary protection during close-quarters combat.

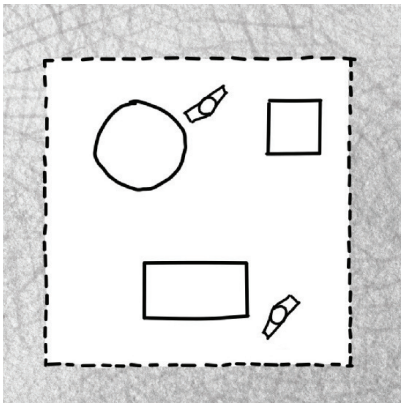


Fig. 119 Plan diagram of Cover

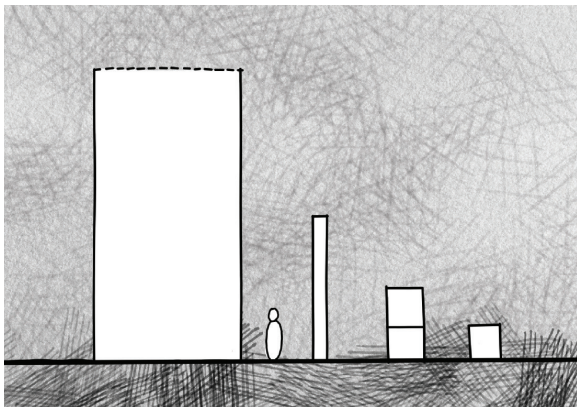


Fig. 120 Section diagram of Cover

386 Mike Stout, "Designing FPS Multiplayer Maps – Part 1," *On Game Design* (blog), August 1, 2008, https://www.ongamedesign.net/designing-fps-multiplayer-maps-part-1/.

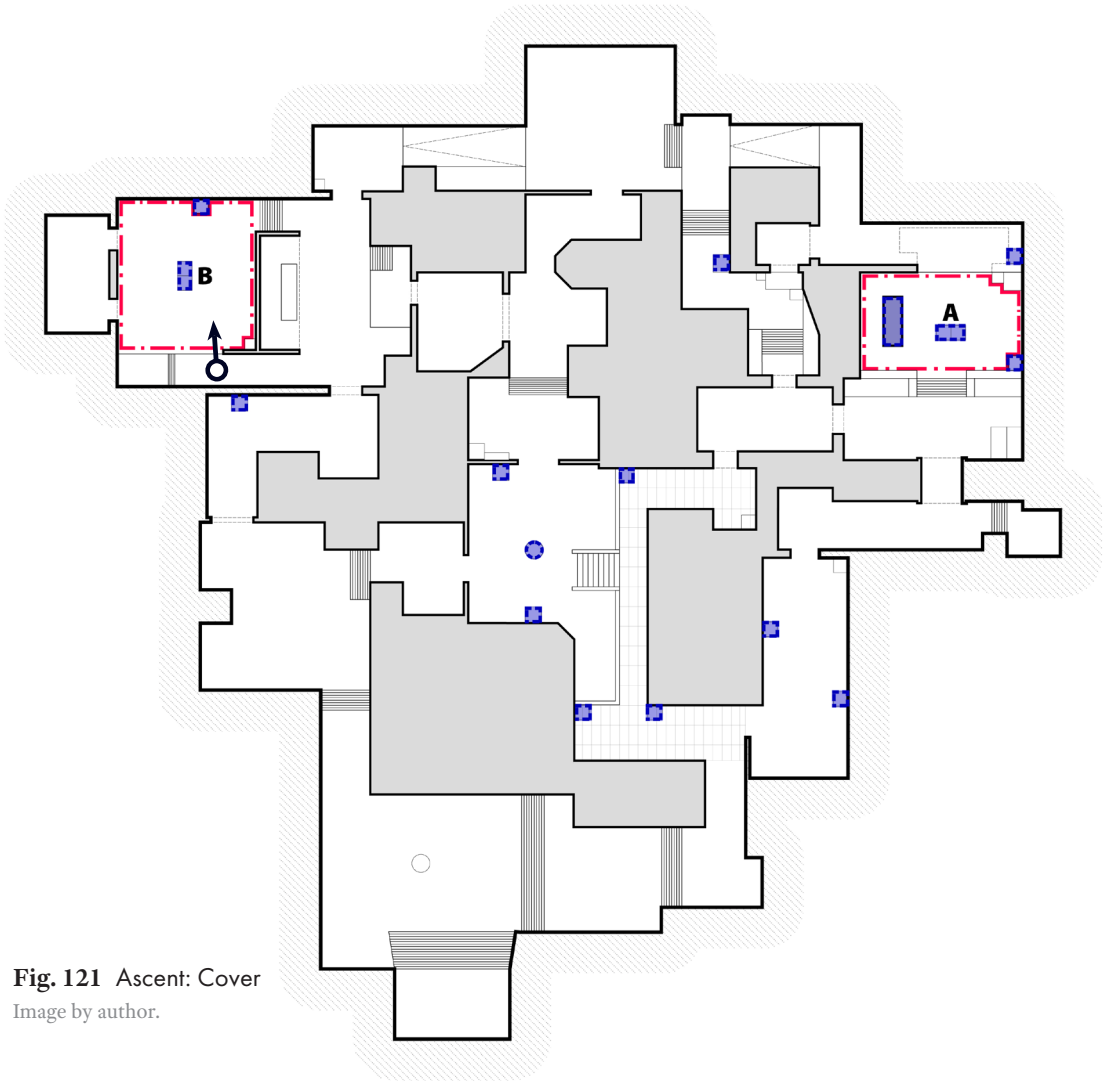


Fig. 121 Ascent: Cover
Image by author.



Fig. 122 Ascent: Cover on site B
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Interactive Elements

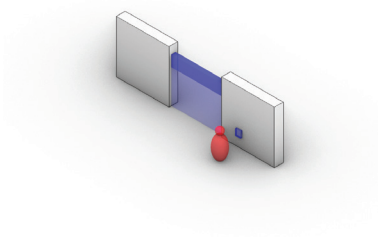


Fig. 123 Axon diagram of Interactive element
Image by author.

Interactive elements encompass a variety of elements such as *garage door, ascenders*, and *portals*, that introduce an additional level of player agency to directly engage and affect their environment. This is most evident in the case of the *garage door*, which is a door that can be opened or closed by player through interacting with its switch[387] through a designated key bind.[388] By default, the garage door is in the open position, providing a clear pathway between its adjacent spaces. However, when used tactically, the door can be closed to shut off a path of circulation for either defenders or attackers, depending on which team is closing the door. Other *interactive* elements such as *portal*, can instantly transport players across the map.

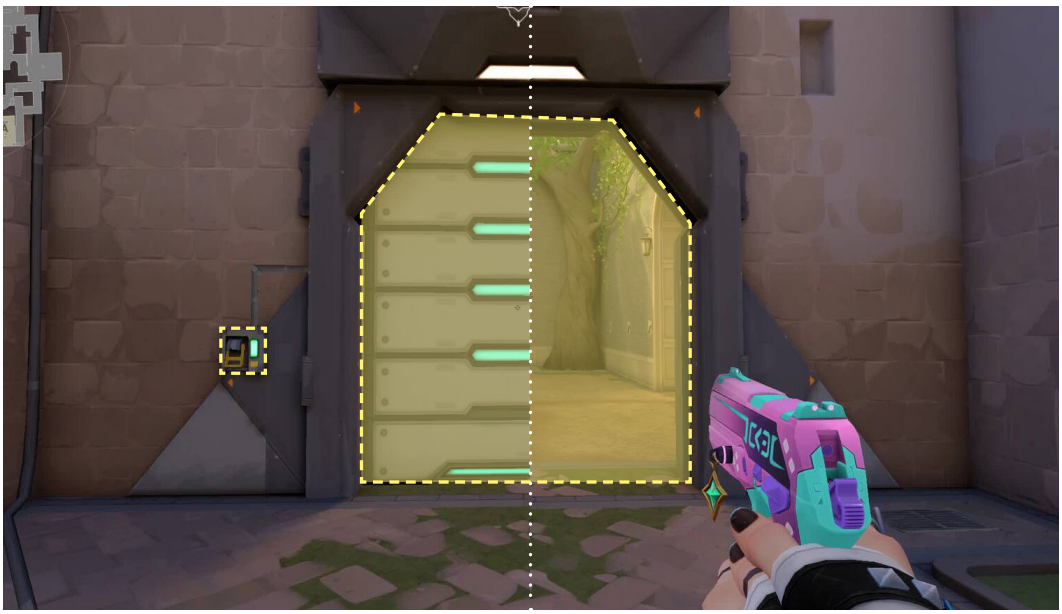


Fig. 124 Ascent: Garage Door on A site
Screencapture of Valorant, IP of Riot Games. Annotated by author.

387 Sometimes located directly beside the garage door, or other times located at a further distance to increase the risk of utilizing these doors.

388 By default, this is set to "F" on the keyboard.

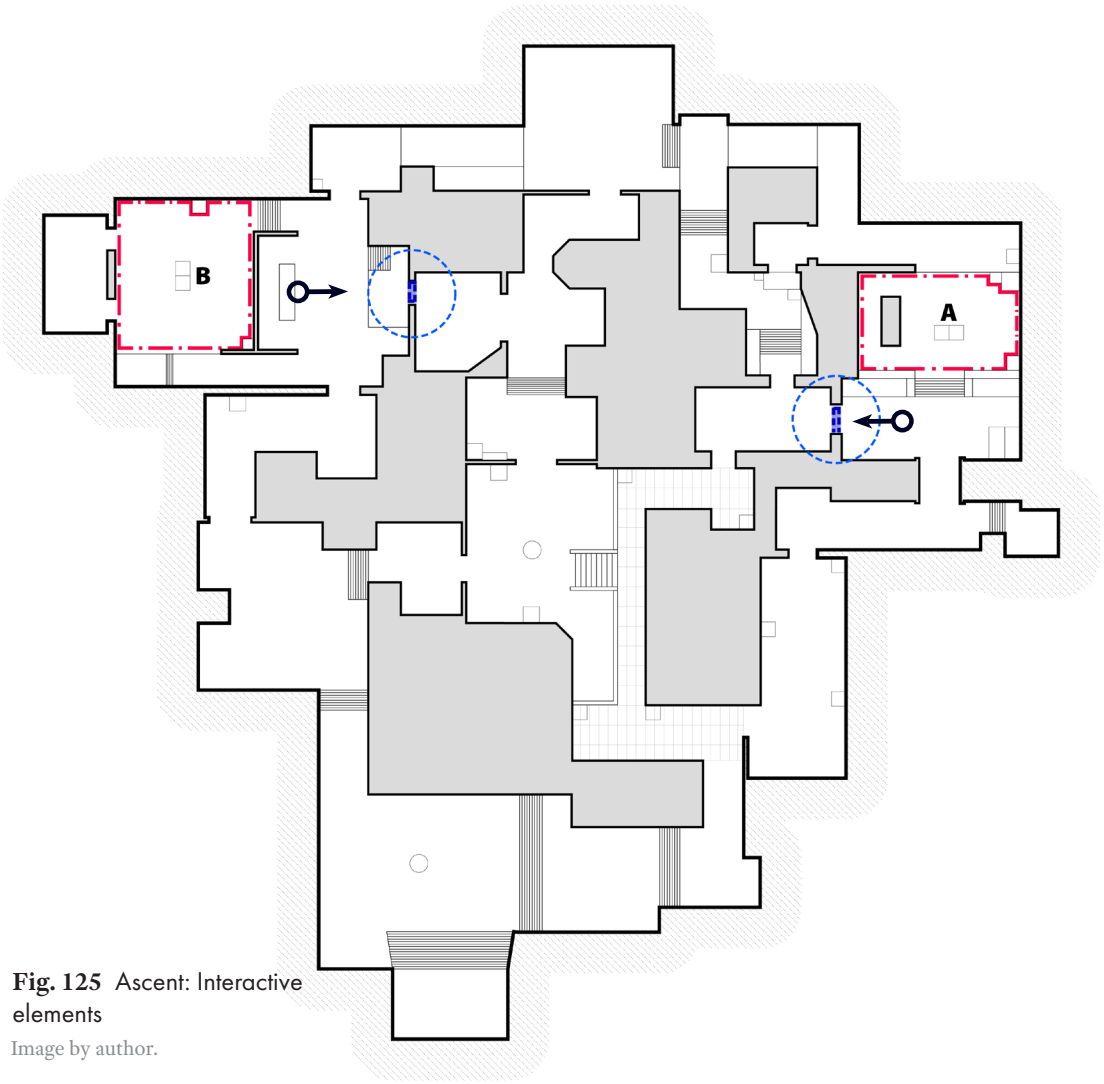


Fig. 125 Ascent: Interactive elements

Image by author.



Fig. 126 Ascent: Garage Door on B site

Screencapture of Valorant, IP of Riot Games. Annotated by author.

Split Levels

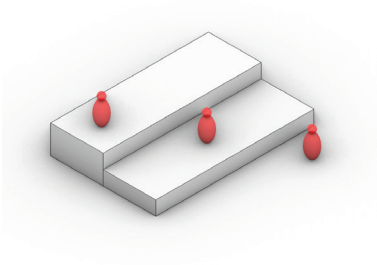


Fig. 129 Axon diagram of Split Levels element
Images on this page are by author.

Split levels are spaces that possess both an upper and lower section,[389] introducing vertical differentiation in the map and creating areas where players can gain superior sightlines and control over lower regions. *Split levels* are created through sub-elements of *catwalk*, *nest*, *heaven*, and *hell*. These elevated positions offer defenders significant advantages, enabling them to monitor key areas and engage attackers from above, adding a critical vertical dimension to the tactical play as well as increasing the choices available to players. Verticality not only adds depth to player interactions but also increases the density of play area within the map.[390]

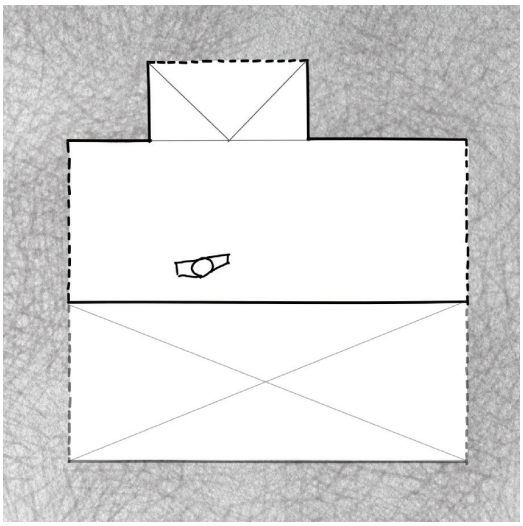


Fig. 127 Plan diagram of Split Levels

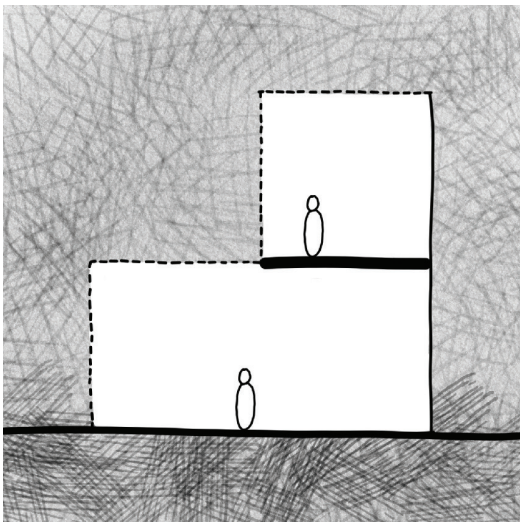


Fig. 128 Section diagram of Split Levels

389 Kenneth Hullett, "The Science of Level Design: Design Patterns and Analysis of Player Behavior in First-Person Shooter Levels" (PhD Thesis, Santa Cruz, USA, University of California, 2012), 40.

390 Stout, "Designing FPS Multiplayer Maps – Part 1."

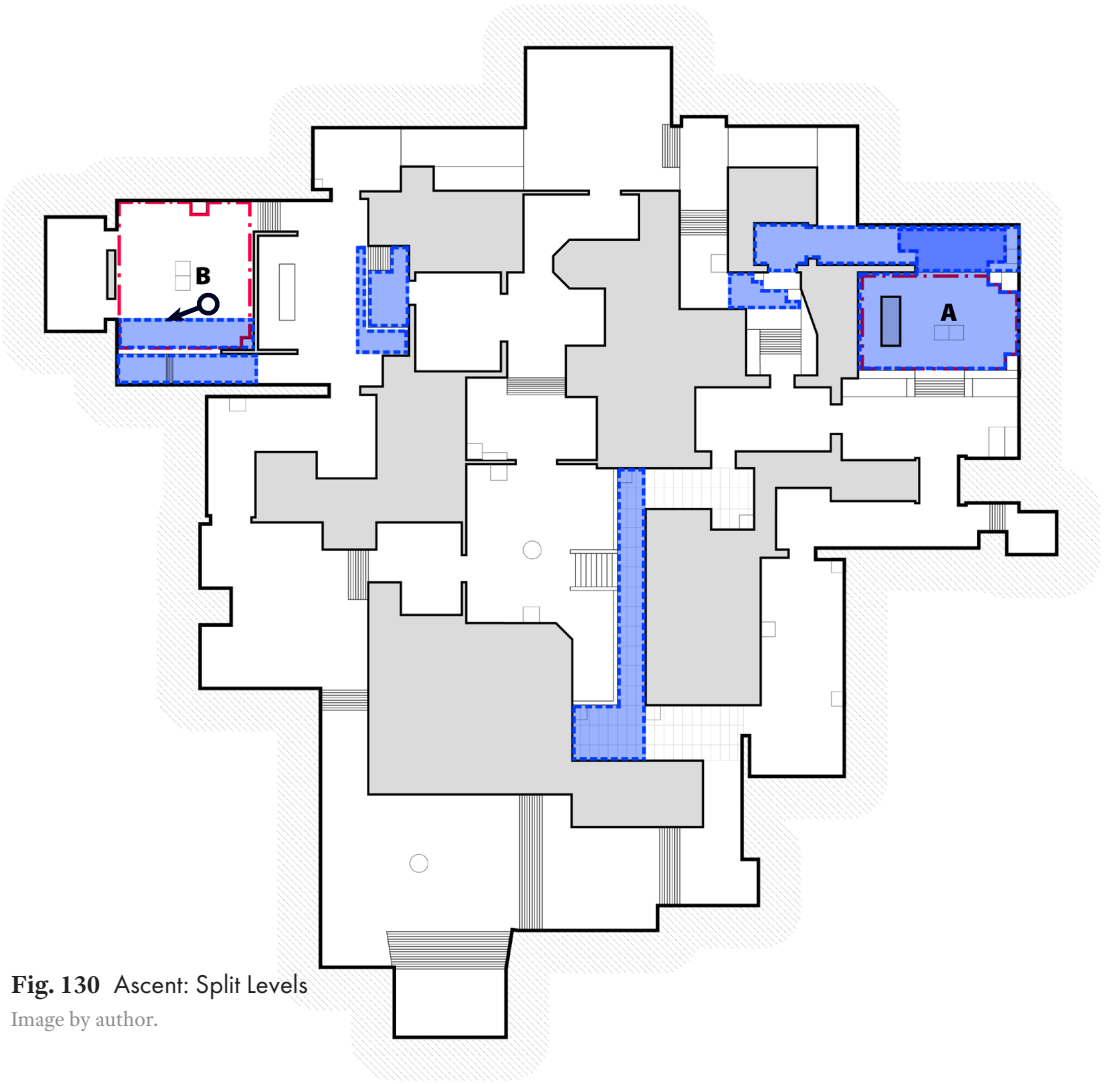


Fig. 130 Ascent: Split Levels
Image by author.



Fig. 131 Ascent: Split Levels on B site
Screencapture of Valorant, IP of Riot Games. Annotated by author.

Function of Elements: Affording and Breaking Lines of Sight

As outlined previously, the formal geometry of spaces plays a significant role in dictating the types of engagements players face in FPS games. One of the most critical functions of space in FPS games is managing lines of sight (LOS) to create balanced and engaging encounters. Lines of sight refer to the unobstructed visual path between players, determining visibility and engagement opportunities. This concept affects how players navigate the environment, spot opponents, and engage in combat. The distance of the line of sight between opposing players defines the boundaries of their occupied space. For instance, if two players can only see each other upon turning a corner, such as in the case of *elbow* corridors, the immediate space around that corner constitutes their area of effect. The boundaries of these spaces are a crucial factor in determining the extent of the spatial element it classifies as.

The primary functions of any object or architectural element with a physical presence in a video game environment are to constrain and enable movement and perception.[391] *Cover* elements break lines of sight, ensuring that players under fire can avoid damage. All FPS games implement *cover* objects that are impervious to projectiles, allowing players to seek refuge from enemy fire. Perspective, or which player sees the other first, is crucial in determining the advantage in encounters. For example, a player standing close to a wall with their shoulder sticking out can be seen by an opposing player farther from the wall, while the closer player cannot see their opponent. This principle of perspective plays a crucial role in encounters, giving one player the advantage of spotting and reacting to their opponent first without being vulnerable themselves.

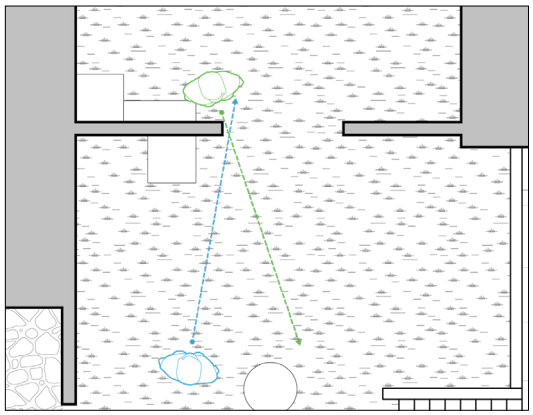


Fig. 132 Player blue sees player green, player green does not see player blue

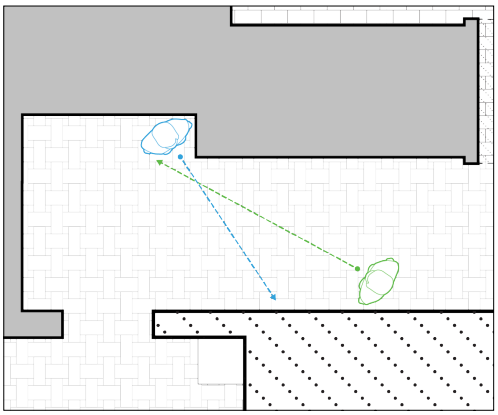


Fig. 133 Player green sees player blue, player blue does not see player green

Images on this page are by author.

391 Dan Pinchbeck, "An Affordance Based Model for Gameplay," in *Breaking New Ground: Innovation in Games, Play, Practice and Theory (*DiGRA 2009, DiGRA, 2009), https://dl.digra.org/index.php/dl/article/view/365.

Encounter distance in FPS games refers to the range at which engagements between players occur, significantly impacting combat strategies and outcomes. Sight lines not only initiate confrontations but also dictate the range of these encounters, promoting short-, medium-, or long-distance fights. This range, in turn, influences the effectiveness of the weapons employed by the players during these engagements. Short-distance encounters often lead to fast-paced, high-intensity battles where reflexes and close-quarters combat skills are crucial. Conversely, medium and long-distance encounters require players to leverage precision aiming and tactical positioning. The design of the game map, including the placement of obstacles and cover, directly influences the encounter distances by creating environments that either favour close-quarters combat or long-range engagements.

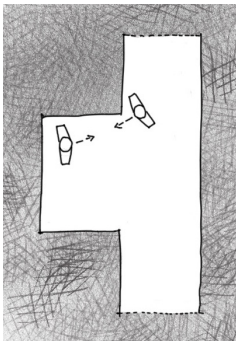


Fig. 134 Close-range combat

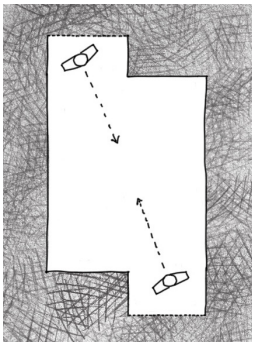


Fig. 135 Mid-range combat

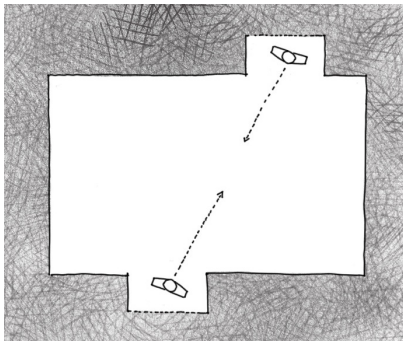


Fig. 136 Large-range combat

Images on this page are by author.

Arrangement of Elements: Pacing and Flow

As players move through the environment they transition between these different spaces, creating a rhythm and tempo. These elements, with their varying spatial attributes, scales, and functional roles, intricately weave together to create the pacing of a game map. Pacing in gameplay is based on the concept that to render action exciting, it must be juxtaposed with periods of quieter gameplay. These moments of slower action might involve puzzle-solving, exploration, or, more significantly, engaging with a character's movement capabilities.[392] Pacing can also be defined as the density of actions taken by the player as they move through the map.[393] Well-thought pacing interweaves elements of open and confined spaces, ensuring a dynamic flow between types of space and types of encounters. By stringing together open spaces, confined spaces, objects that disrupt sightlines, and various other elements, FPS game maps embed a rhythm that keeps players engaged and immersed in the game world.

> *Game pacing uses challenges and breaks to establish a rhythm and tempo. A well-paced game has a flow to it; tension and relaxation follow one another to draw the player through the game.*[394]

> *In addition to the elements that we use in a building, the dimensions of the human body also affect the volume of space we require for movement [and] activity[.]*[395]

Understanding these spatial dynamics requires precise measurements of gameplay metrics. Metrics in gameplay refer to measurements expressed in in-engine units that describe the size and movement properties of characters in games. These include the size of the character, the space traversed by jumps, the space taken up by attacks, the distance traveled over time when the character runs or walks, and many other movement-based actions.[396] These metrics are essential for measuring the player's scale in proportion to the scale of the space as well as how the player can interact with objects in-game. For example, the element *Jump-Up* requires players to navigate a series of boxes to reach higher elevations, and sometimes these jumps can be missed due to player-controlled movement mechanics.[397]

392 Totten, *An Architectural Approach to Level Design, 82.*

393 Hullett, "The Science of Level Design," 17.

394 John Feil and Marc Scattergood, *Beginning Game Level Design* (Boston, MA: Thomson Course Technology, 2005), 13.

395 Francis D. K. Ching, *Form, Space, & Order*, 3rd ed (Hoboken, N.J: John Wiley & Sons, 2007), 326.

396 Totten, *An Architectural Approach to Level Design*, 65.

397 Think platform games such as Super Mario Bros, where jumping off one platform to successfully reach the other requires precise timing and speed.

Ultimately, the interplay of formal geometry and spatial design in FPS games is crucial in shaping player experiences and engagement, as effective control of lines of sight determines visibility, interaction, and strategic depth. Cover elements create dynamic engagements by breaking lines of sight, influencing movement and perception, while the alternation between different types of spatial elements impacts pacing and tension, maintaining player interest. Encounter distance, defined by sight lines, affects combat style and intensity, influencing weapon choice and tactics. Metrics like character size and movement capabilities refine player-environment interaction and places the player in scale with the games virtual architecture.

Spatial Patterns in FPS Maps

Now that several isolated game space types—classified as elements—have been discussed, it is important to understand how to link these spaces together in interesting and meaningful ways. The arrangement and integration of these elements must be carefully planned to ensure a balance between tension and relief, as well as to provide strategic opportunities and challenges.

While other types of space use described by Mcgregor do occur in FPS maps, this thesis focuses on *contested space* and proposes that it is an umbrella term that can be further defined through a series of spatial sub-patterns that allow for different types of contest. This is done in a similar fashion to the hierarchical structure of patterns organized by Alexander in *A Pattern Language,*[398] where smaller patterns fit into broader patterns. In this analysis, it is evident that FPS maps feature complex arrangements of these patterns, which interconnect in intricate ways.

It is crucial to recognize that spatial patterns in video games are shaped by the game's rules, which invisibly constrain and direct player actions.[399] The architecture of game environments both limits and enables the range of possible actions. While rules establish a framework for potential gameplay, players may interact with that space in ways that diverge from the designers' original intentions. Just as real-world spaces can be repurposed in unexpected ways, the dynamics of game spaces can evolve through emergent gameplay.[400] Therefore, the spatial patterns discussed in this section are not prescriptive but rather provide documentation and insight into the current standards of architectural arrangements in FPS games.

This thesis proposes the following sub-patterns of contested space within FPS maps:

Establishing a stronghold

Creating spaces of anticipation

Situations of positional advantage

Creating flank opportunities

Creating a large scale combat arena

398 Christopher Alexander et al., *A Pattern Language: Towns, Buildings, Construction* (NY, USA: Oxford University Press, 1977).

399 Georgia Leigh Mcgregor, "Situations of Play: Patterns of Spatial Use in Videogames," in *Situated Play,* 2007, 539.

400 Ibid.

Establishing a Stronghold

Description

A stronghold is a strategically significant area built around and constitutes a *site* that is heavily fortified and offers a tactical advantage to the defensive team. Strongholds are designed to be defensible positions where players can effectively repel enemy attacks and maintain control over important sections of the map.[401] These areas typically feature elements such as *chokepoints*, *split levels*, and ample *cover*, allowing defenders to monitor and engage approaching enemies from a position of strength. Strongholds often serve as key objectives or control points in the game, where securing and holding these positions can significantly influence the outcome of the match.

Objective

The objective of a stronghold is to prevent the attacking team from easily entering and overtaking the defending team. The effectiveness of the stronghold is crucial for game balance, as it protects key objectives (*sites*) that can determine the outcome of the match.

Solution

To establish a stronghold, key elements include *choke points*, *split levels*, ample *cover*, and the specific objective being defended, such as a *site*.

Variables

Types, amounts, and positions of *cover*. The number and widths of *choke points*. Types and positioning of *split levels*.

Consequences

Choke points funnel attackers into dedicated narrow paths, increasing the likelihood of encounters at predictable areas and allowing defenders to control entry points effectively. *Split levels* provide defenders with high ground, offering vantage points that are crucial for monitoring and engaging enemies. *Cover* positions within the stronghold offer protection and strategic hiding spots, enabling defenders to repel attacks and launch counteroffensives. *Cubbies* can provide unexpected corners for players to hide and ambush from. Defender *spawn* also contributes to this pattern by positioning defending players close to the stronghold. Consequently, the placement of these elements within the stronghold dictates the flow of combat, requiring teams to develop coordinated strategies to either defend or breach the area.

■

401 Hullett, "The Science of Level Design," 35.

Diagram

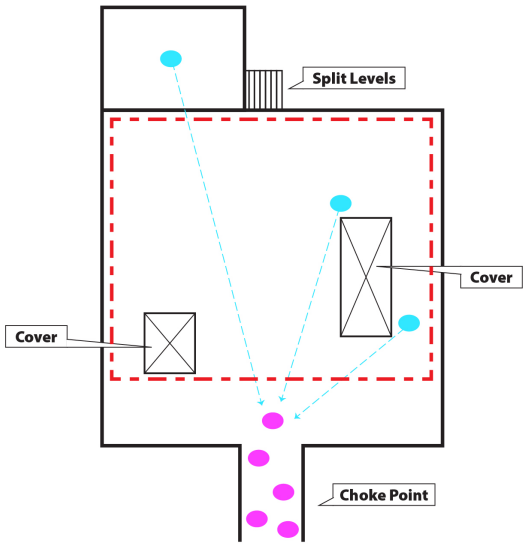


Fig. 137 Concept Diagram of a Stronghold

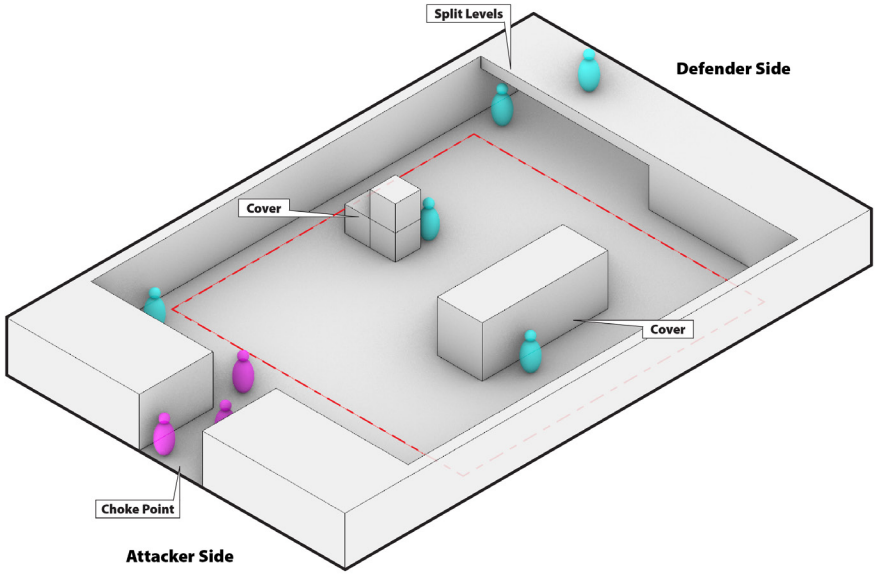


Fig. 138 Schematic Diagram of a Stronghold

Images on this page are by author.

Relationships

Positional Advantage Pattern: Utilizes high ground and cover to create strategic positions.

Anticipation Space Pattern: Areas leading to the stronghold may be designed to build tension and prepare players for conflict.

Examples

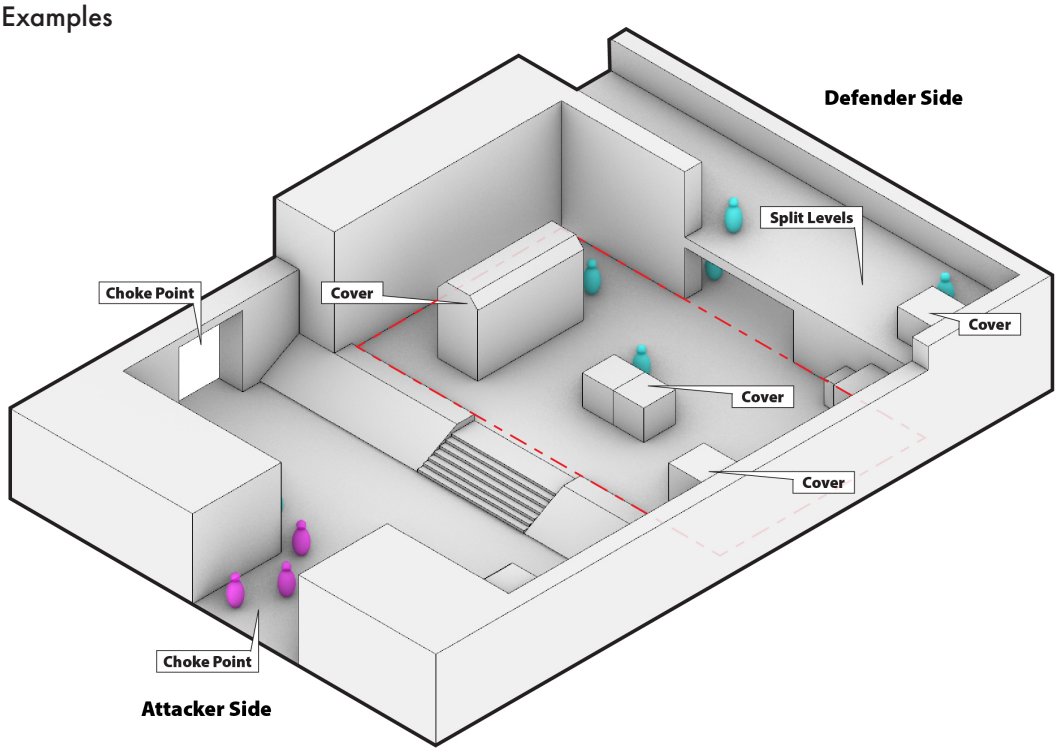


Fig. 139 Example of a Stronghold on Ascent Site A

Image by author.



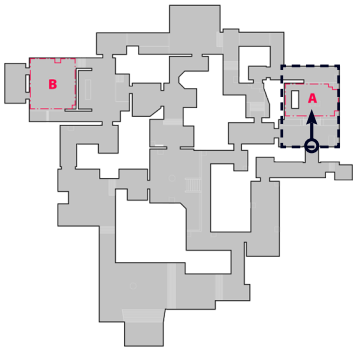


Fig. 140 Example of a Stronghold on Ascent Site A

Screencapture of Valorant, IP of Riot Games.



Fig. 141 Stronghold patterns on Ascent

Image by author.

Creating Spaces of Anticipation

Description

Spaces of anticipation are zones within a map where players are likely to encounter the enemy but are not yet fully engaged in combat. These spaces are crucial for building tension and preparing players for imminent conflict. Typically, these areas are just before major *choke points* and nodes, and afflict players with heightened anxiety, encouraging them to approach with caution.

Objective

The primary goal of this pattern is to create a heightened sense of awareness and caution among players. These spaces slow down player movement and decision-making, allowing for strategic considerations before entering high-stakes areas. The pattern increases the psychological engagement of players by amplifying the tension just before a conflict at a collision point.

Solution

To create spaces of anticipation, key elements include *alley* or *hallways*, *elbows*, *cover*, *dead ends* and *cubbies*.

Variables

Width of *alley* and *hallways*. Number and position of *cubbies*. Types and density of *cover*.

Consequences

Alleys and *hallways* slow down player progression by creating elongated routes that limit visibility, compelling players to approach with caution. *Cubbies* and *elbows* in these spaces further restrict sightlines, forcing players to check these areas meticulously, often leading to tense standoffs. *Cover* objects strategically placed within these spaces provide protection while increasing the psychological tension as players anticipate encounters. The interaction of these elements turns spaces of anticipation into critical zones where players must decide whether to proceed cautiously, wait for enemies, or set up an ambush.

Diagram

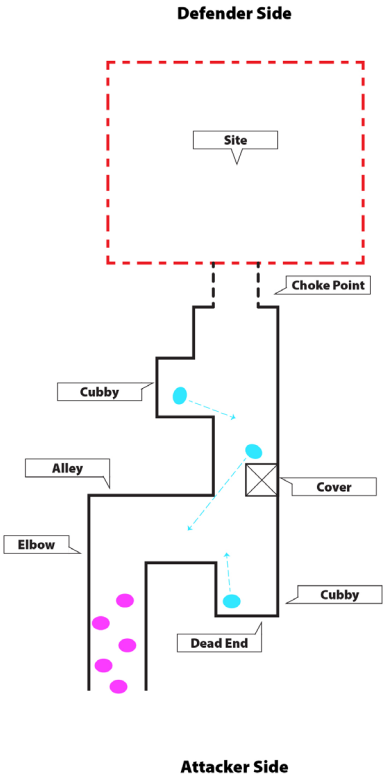


Fig. 142 Concept Diagram of a Space of Anticipation

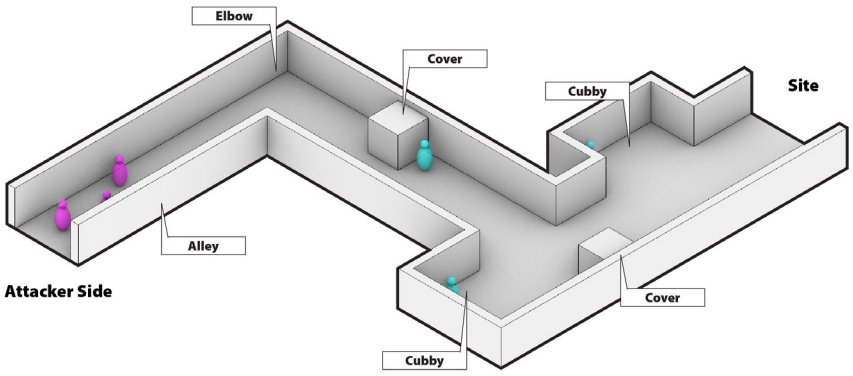


Fig. 143 Schematic Diagram of a Space of Anticipation

Images on this page are by author.

Relationships

Establishing a Stronghold: Often precedes strongholds, allowing players to prepare for control of key areas.

Creating Positional Advantage: Can feed into positional advantage by funneling players into advantageous or disadvantageous positions.

Creating Flank Opportunities: May be vulnerable to flanking, as players focusing on anticipated threats might miss incoming enemies from side paths.

Examples

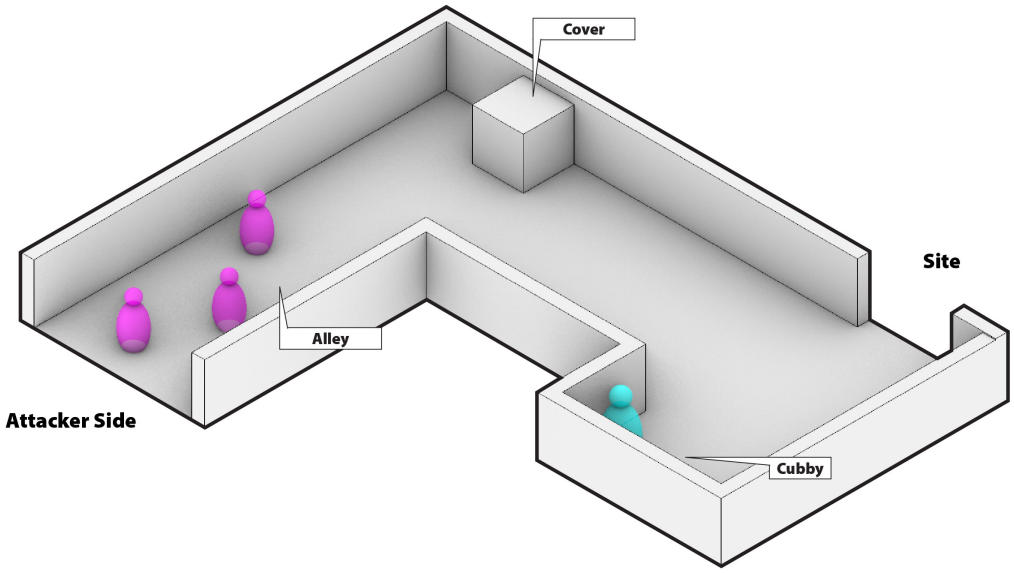


Fig. 144 Example of a space of anticipation in B Main of Ascent
Image by author.



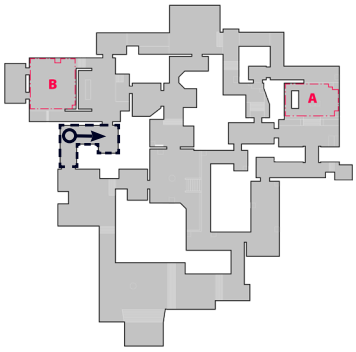


Fig. 145 Example of a space of anticipation in B Main of Ascent
Screencapture of Valorant, IP of Riot Games.



Fig. 146 Space of Anticipation patterns on Ascent

Image by author.

Situations of Positional Advantage

Description

Positional advantage refers to areas of the map that provide players with superior positioning, often through higher ground, better cover, or advantageous sightlines.[402] These positions are key to controlling gameplay by allowing players to engage enemies from a dominant location.

Objective

The objective is to provide strategic areas where players can hold a superior position over their opponents. This is crucial in competitive gameplay, where controlling such areas can lead to tactical dominance, easier defense, or more effective offense.

Solution

To create positional advantage, essential elements include *split levels*, sniper locations such as *nest*, and *cover*. These elements provide superior sightlines and control over key areas.

Variables

The height and accessibility of high ground and *split levels*. The width and length of *catwalks*. The types, amounts, and positioning of *cover* elements near advantageous positions.

Consequences

High ground through *split levels* offer superior sightlines, allowing players to control significant portions of the map and engage opponents from above. *Heaven* positions, in particular, dominate key areas, giving defenders the ability to monitor and engage enemies with minimal exposure. *Cover* near these elevated areas enhance the defender's ability to hold their ground while making it difficult for attackers to approach without being seen.

■

402 Ibid., 27.

Diagram

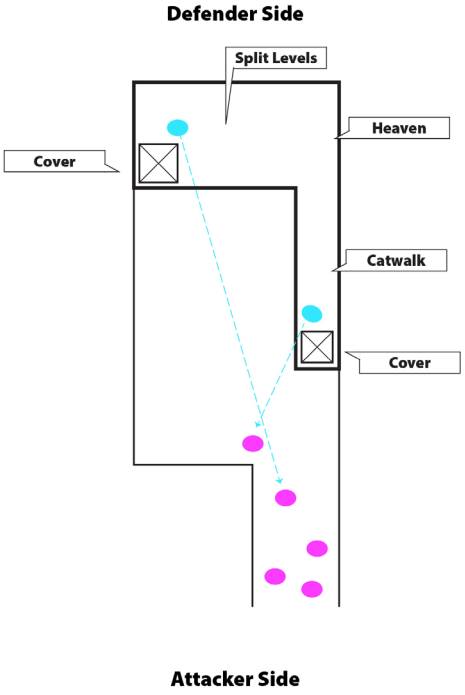


Fig. 147 Concept Diagram of a Positional Advantage Situation

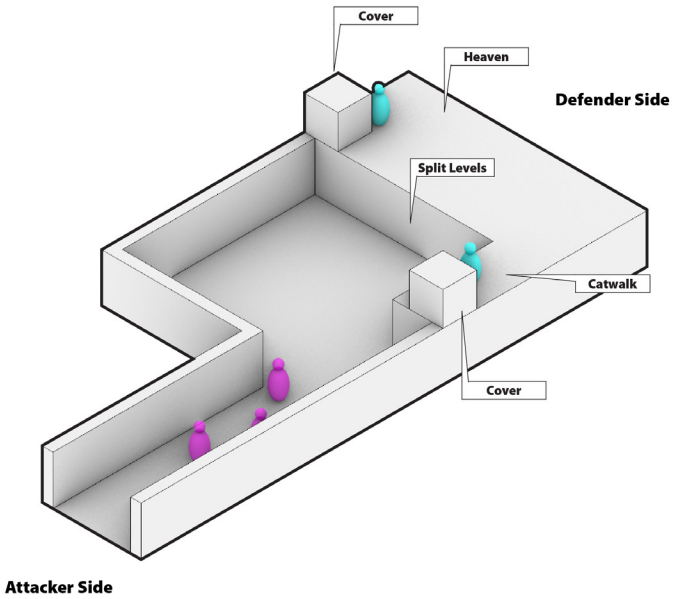


Fig. 148 Schematic Diagram of a Positional Advantage Situation

Images on this page are by author.

Relationships

Establishing a Stronghold: Positional advantage is often part of a stronghold, where control of these areas is crucial.

Examples

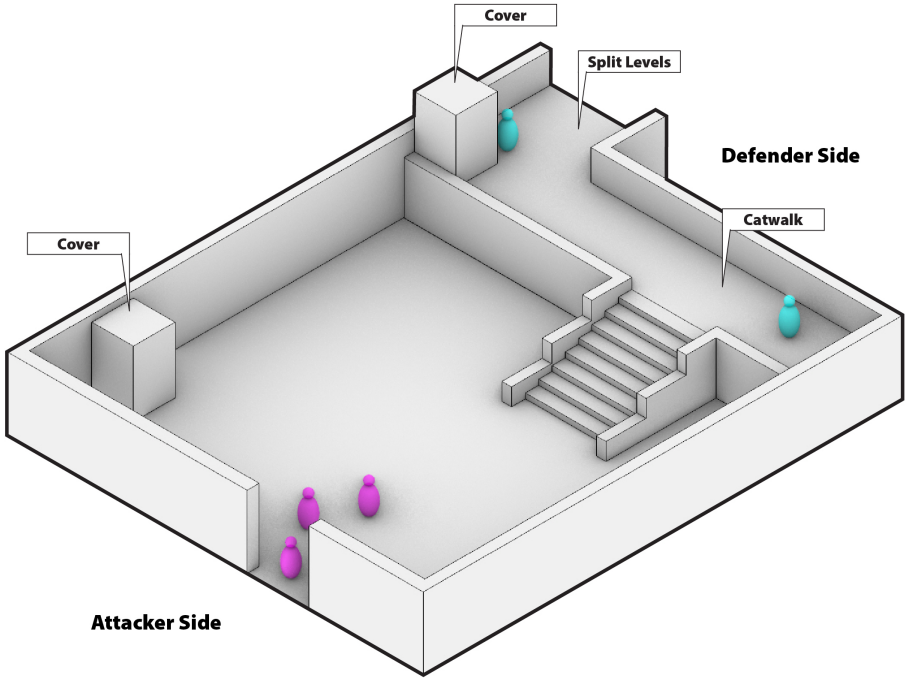


Fig. 149 Example of a Positional Advantage situation in Middle of Ascent
Image by author.



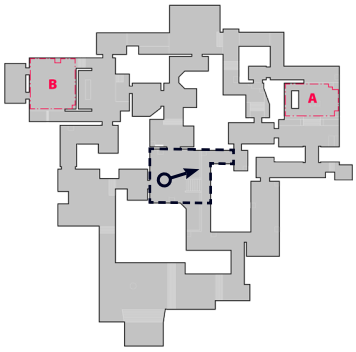


Fig. 150 Screenshot example of a Positional Advantage situation in Middle of Ascent
Screencapture of Valorant, IP of Riot Games.

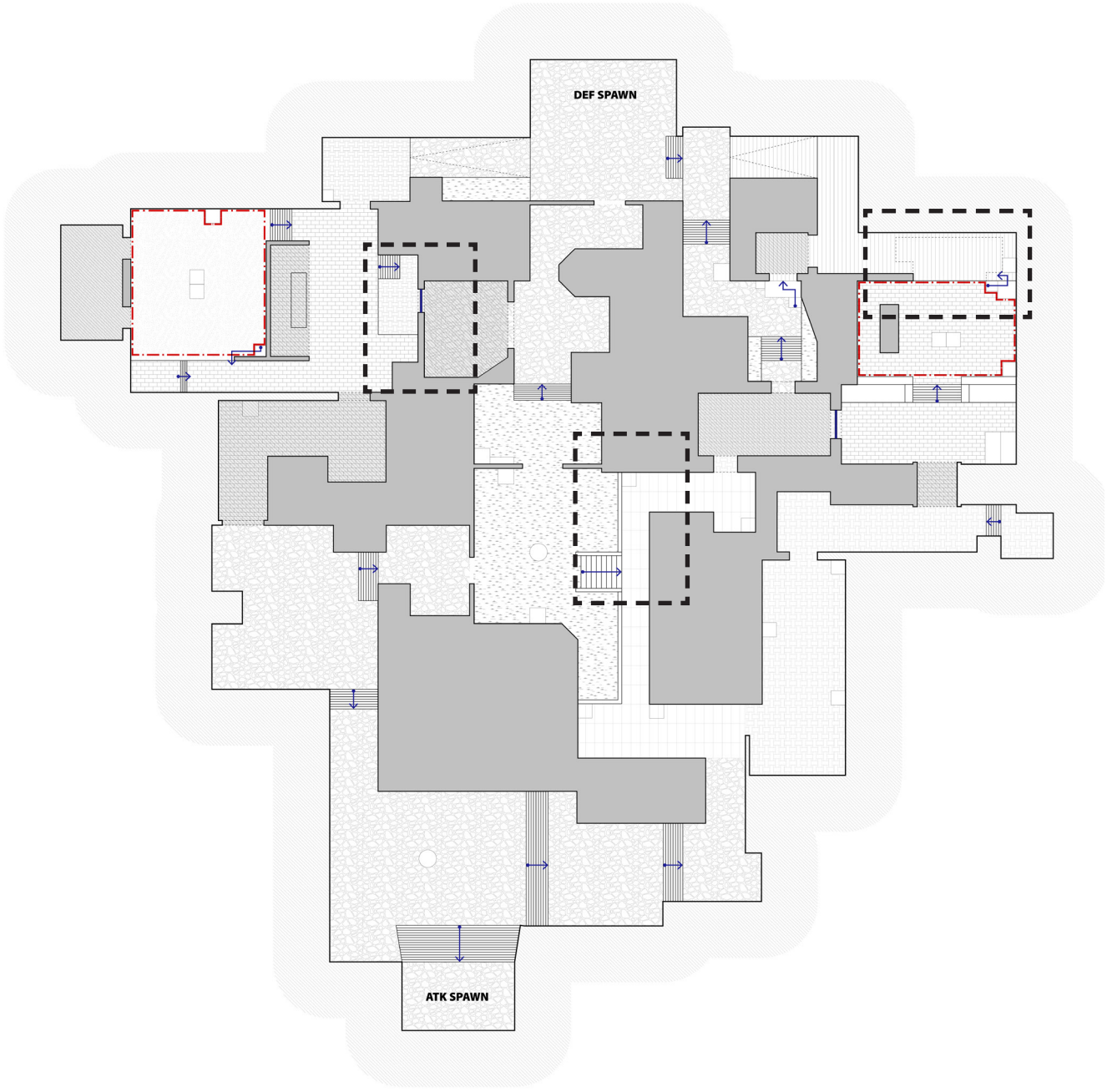


Fig. 151 Positional Advantage patterns on Ascent

Image by author.

Creating Flank Opportunities

Description

Flank[403] opportunities are secondary paths or routes that allow players to bypass main engagements and attack enemies from unexpected directions.[404] These are essential for dynamic gameplay, enabling teams to outmaneuver opponents who are focused on more direct confrontations by catching them off guard from behind or the side.

Objective

The purpose of creating flank opportunities is to introduce alternative strategies for attacking or defending, optimizing the interconnected layout of FPS maps. Flanking can disrupt enemy plans, create confusion, and shift the momentum of a match.

Solution

Key elements that promote successful flanking attempts include *links*, *elbows*, and interactive elements like *garage doors* and *portals*. These elements allow players to bypass main engagements and surprise enemies.

Variables

The length and visibility of secondary *main* paths and *links*. The connection points between flank routes and *main* paths.

Consequences

Secondary paths and *links* create diverse movement options that bypass direct confrontation, enabling players to outmaneuver opponents. These flank routes often connect to high-traffic areas, allowing players to surprise enemies focused on the *main* paths. *Elbows* and *cubbies* within these routes provide hiding spots for players to set up ambushes, while interactive elements like *garage doors* and *portals* can open up or close off flanking possibilities, adding to the unpredictability.

403 "Flanking involves a player's ability to bypass opponents with the aim of attacking from behind or the side. Flanking is a method of creating surprises for opponents, putting you and your allies in a favorable position and can be a decisive factor in many game moments."
"Valorant Flanking Guide to Dominating with Stealth and Strategy," bo3, 2024, https://bo3.gg/valorant/articles/valorant-flanking-guide.

404 Hullett, "The Science of Level Design," 44.

Diagram

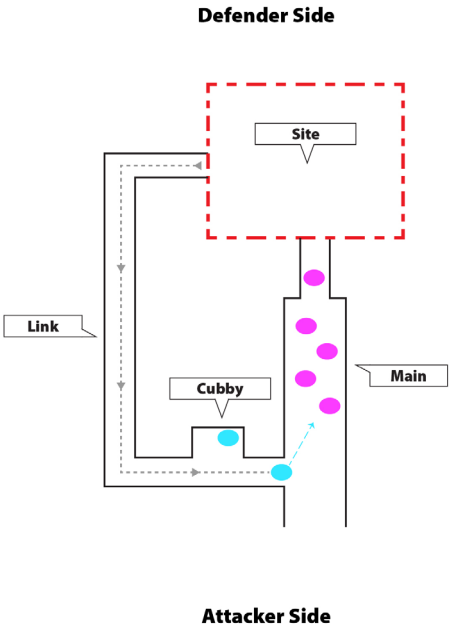


Fig. 152 Concept Diagram of a Flank Opportunity

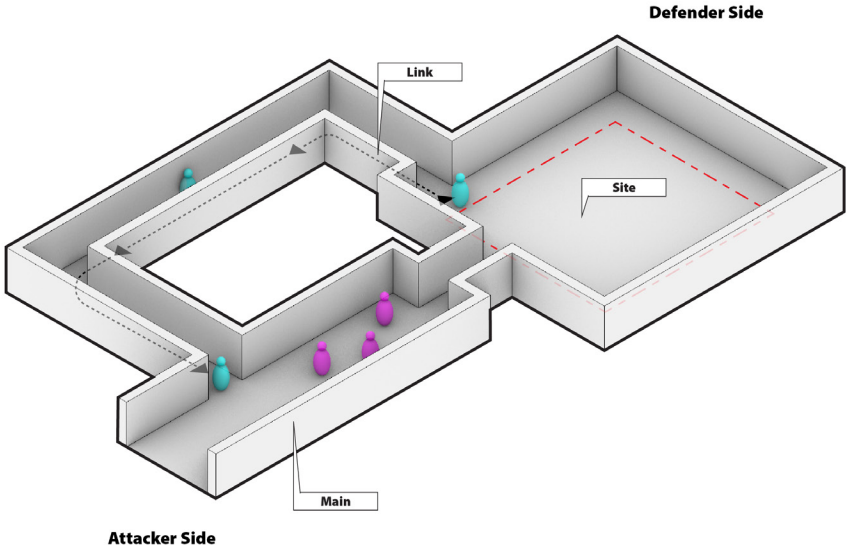


Fig. 153 Schematic Diagram of a Flank Opportunity

Images on this page are by author.

Relationships

Creating Positional Advantage: Flanks can be used to challenge or counter positional advantages held by the enemy.

Examples

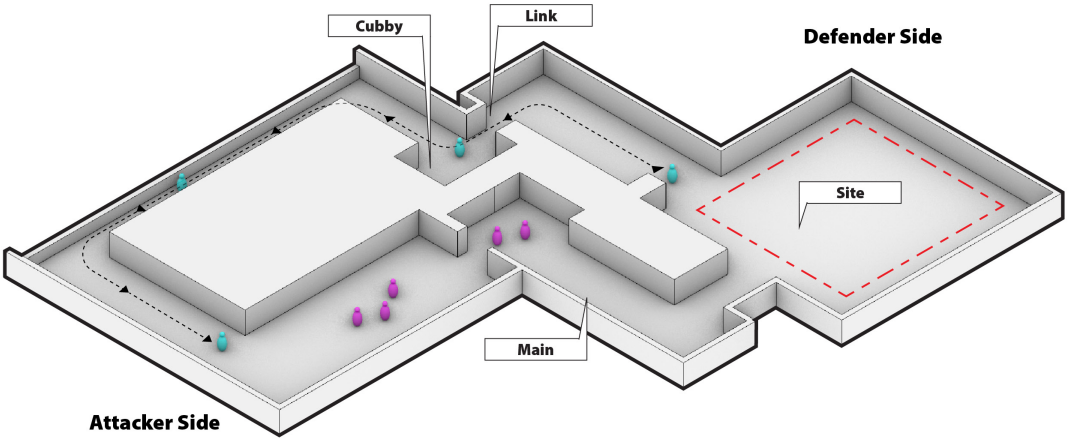


Fig. 154 Example of a Flank Opportunity on A site side of Ascent

Defenders can flank through link and wrap around to ambush attacking players targeting A site.

Image by author.



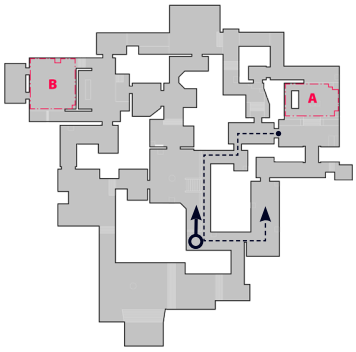


Fig. 155 Screenshot example of a a Flank Opportunity on A site side of Ascent

Screencapture of Valorant, IP of Riot Games.

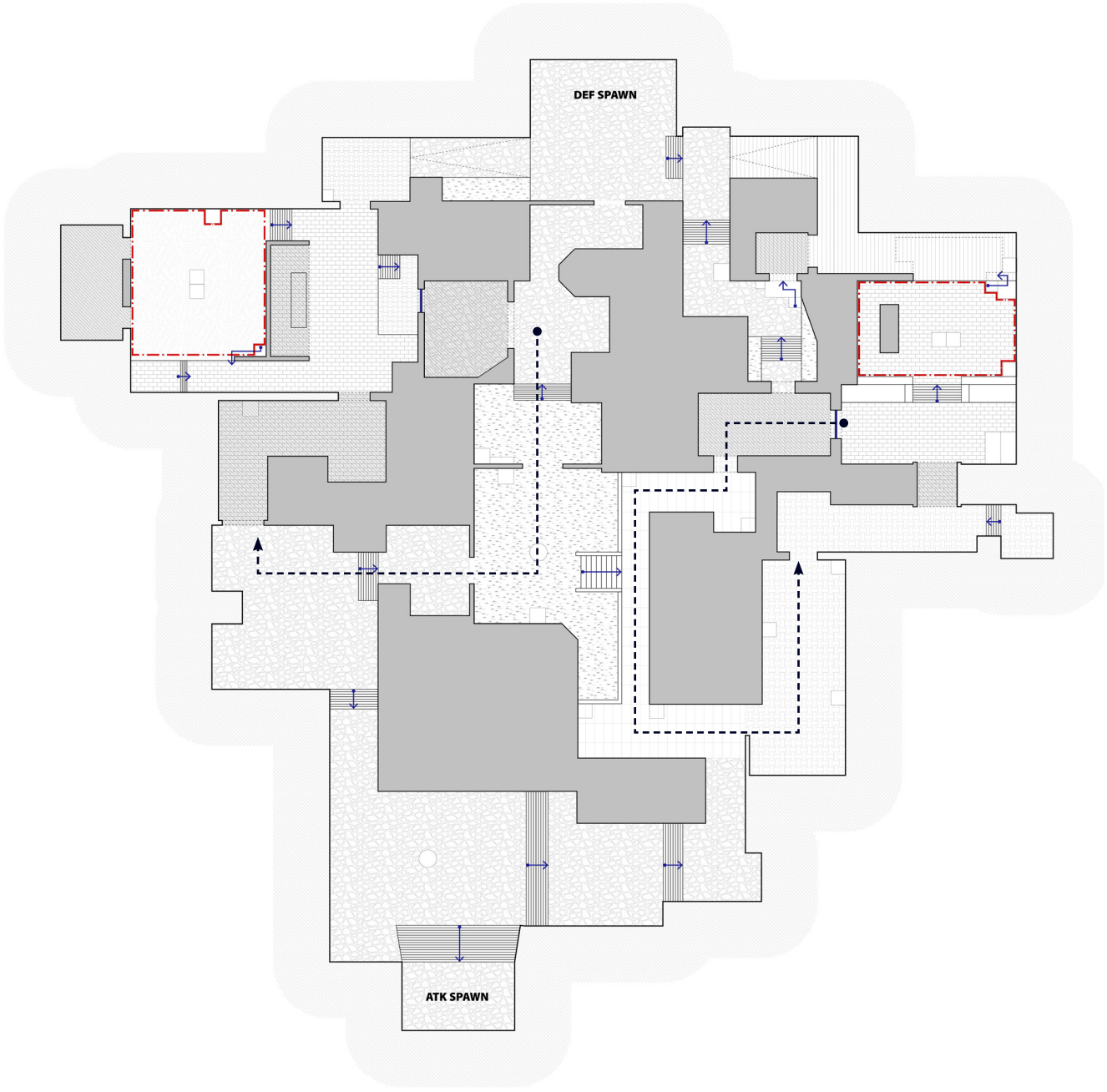


Fig. 156 Flank Opportunity patterns on Ascent

Image by author.

Creating a Large Scale Combat Arena

Description

An arena for deathmatch is a space designed to facilitate constant, high-intensity combat encounters between players.[405] These arenas are characterized by open areas that allow for frequent engagement, minimal cover that necessitates continuous movement, and strategically placed elements that ensure dynamic and fluid combat. The design focuses on encouraging aggressive playstyles and creating an environment where players must remain vigilant and reactive at all times.

Objective

The objective of this pattern is to create a balanced, engaging space where players are continuously engaged in combat. The arena should minimize downtime and maximize opportunities for player encounters, ensuring a fast-paced and action-oriented gameplay experience. Ideally, arenas should be positioned at critical junctions of the map, where gaining control of the arena opens up further opportunities to dominate surrounding areas.

Solution

To create an arena for deathmatch, essential elements include large open areas such as *middle*, ample but dispersed *cover*, and *split levels* that introduce verticality. These elements ensure continuous combat and strategic positioning.

Variables

The size and openness of the arena. The types, amounts, and placement of *cover*. The height and placement of *split levels*. The spacing between *cover* elements and the sightlines they create. The overall layout of the arena, which influences player movement and the frequency of engagements.

Consequences

In arena deathmatch scenarios, open areas such as a large *middle* encourage frequent and direct engagements, leading to fast-paced and high-intensity combat. *Cover* objects scattered throughout these open spaces provide essential protection, forcing players to constantly move between them to avoid being pinned down. Elevated structures created through *split levels* add verticality, allowing players to control areas from above or engage enemies from unexpected angles. The combination of these elements ensures that the arena promotes aggressive playstyles, with players needing to remain mobile and adaptive to survive.

■

405 Ibid., 26.

Diagram

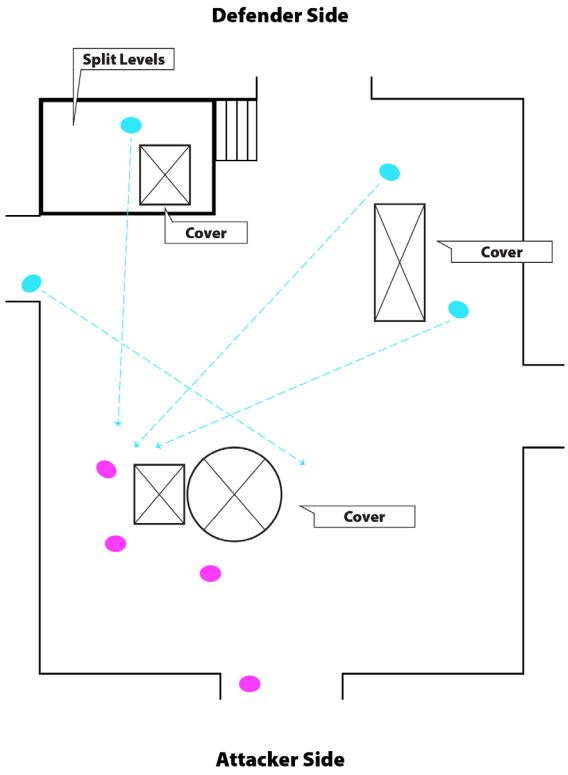


Fig. 157 Concept Diagram of a Large Scale Combat Arena

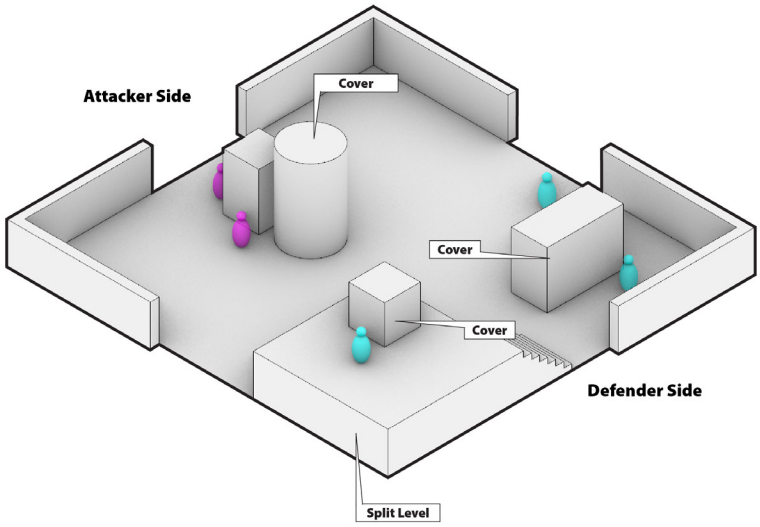


Fig. 158 Schematic Diagram of a Large Scale Combat Arena

Images on this page are by author.

Relationships

Creating Positional Advantage: Elevated structures within the arena can serve as points of positional advantage, where players can gain control over large portions of the map.

Creating Flank Opportunities: The open nature of the arena combined with dispersed cover can allow for sudden flanking maneuvers, catching opponents off guard.

Examples

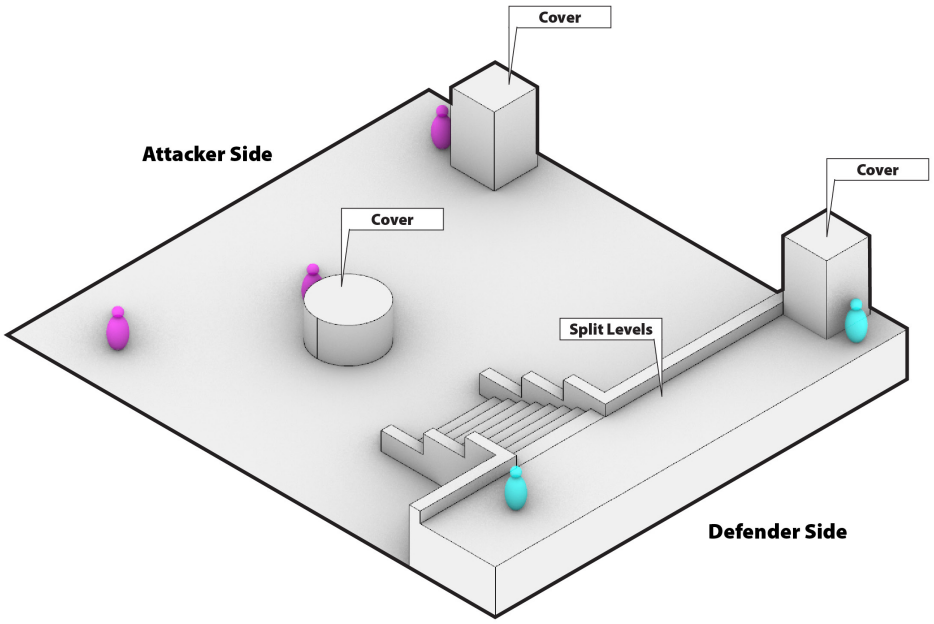


Fig. 159 Example of a Large Scale Combat Arena in Middle of Ascent
Image by author.



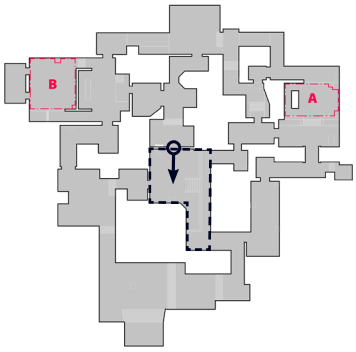


Fig. 160 Screenshot example of a Large Scale Combat Arena in Middle of Ascent
Screencapture of Valorant, IP of Riot Games.

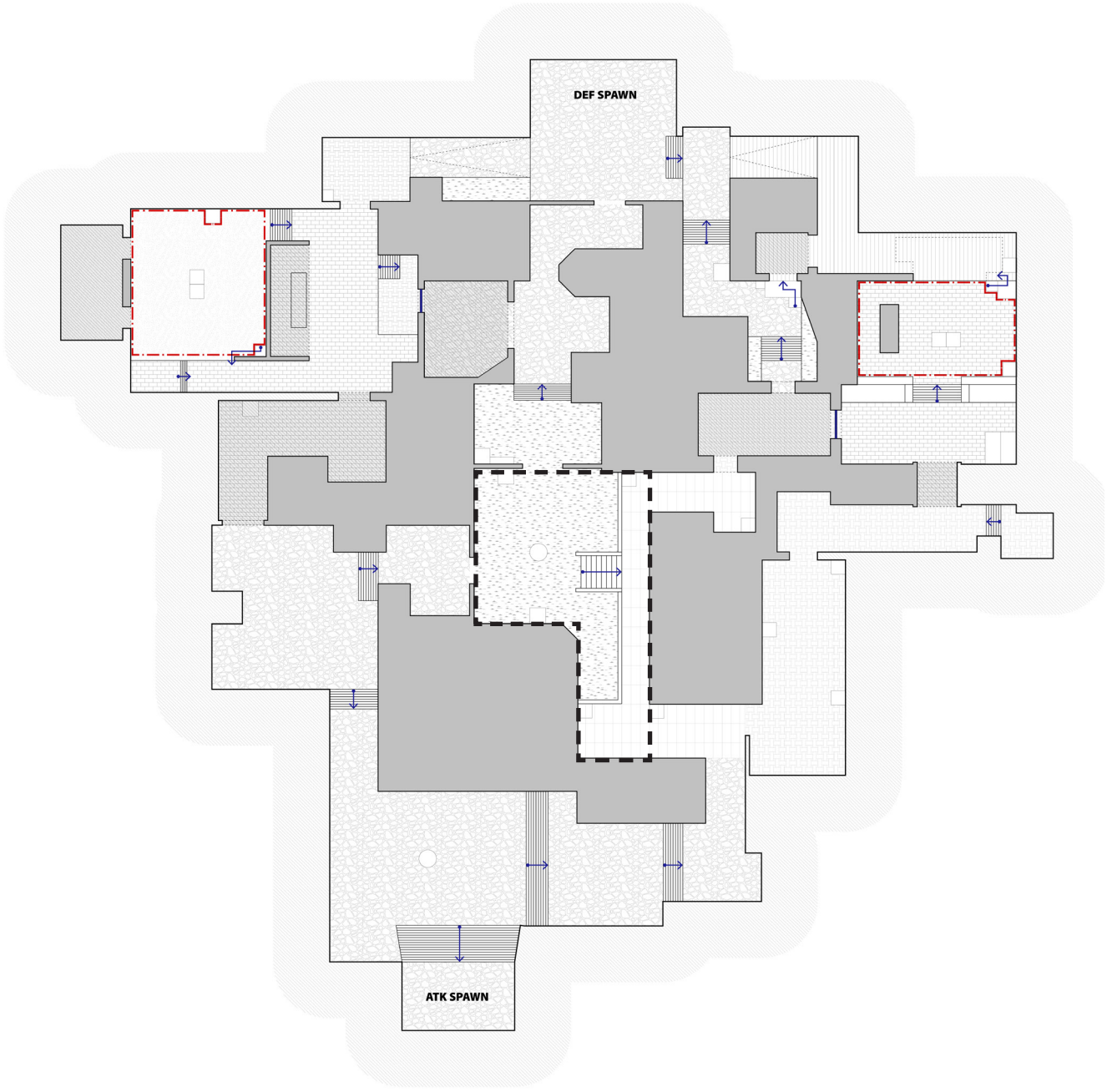


Fig. 161 Large Scale Combat Arena patterns on Ascent

Image by author.

07

DISCUSSION

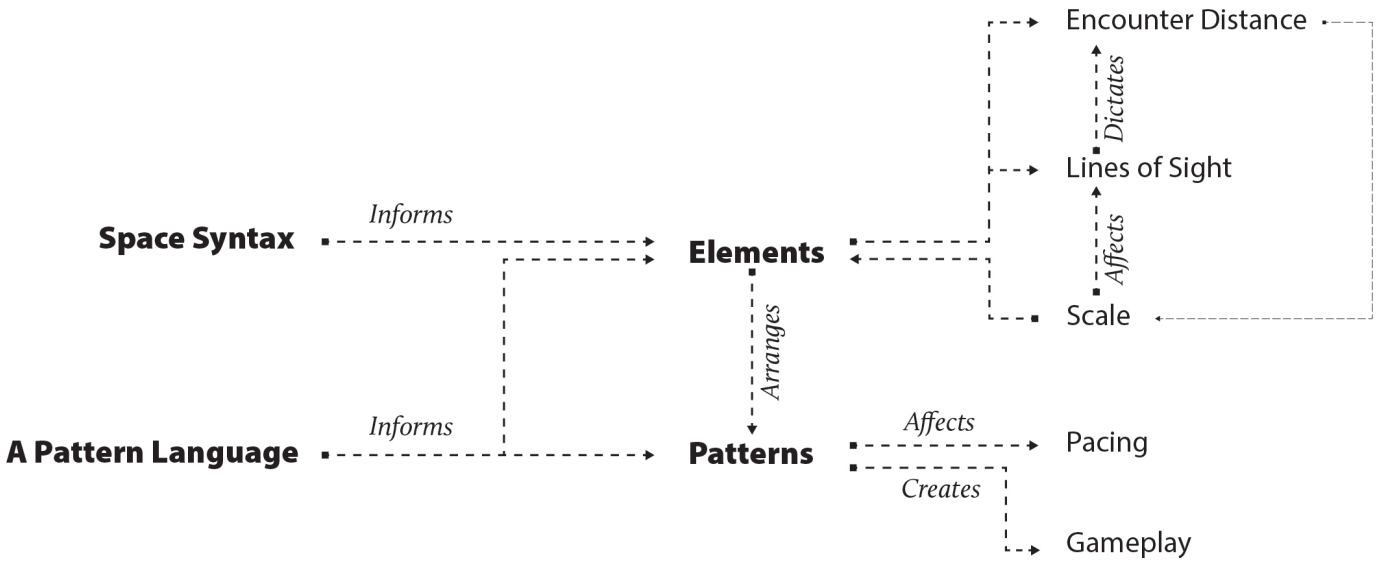


Fig. 163 Summary of research and analysis of FPS game maps
Image by author.

Discussion of Elements and Patterns

This thesis provides a detailed examination of the spatial anatomy within competitive multiplayer FPS games using the complementary theories of *space syntax* and *pattern theory* to understand elements and patterns that constitute game maps. Spatial elements were identified based on their ability to produce gameplay through their functional hierarchy, spatial attribute or lack of, and their scale types. These elements were organized across multiple lenses: the macro-scale focuses on the overall layout and strategic flow, akin to an architectural parti diagram; the meso-scale introduces spaces that enhance connectivity and add complexity to player movement; the micro-scale zooms in on details impacting close-quarters combat and individual interactions. By categorizing spatial elements into rudimentary, intermediate, and sophisticated collections, this analysis reveals the intricate layers of architectural design in FPS games. However, it is not just the individual elements themselves that define the player experience; it is how these elements are arranged and integrated into broader spatial patterns that ultimately shape the pacing and flow of the game. Just as Alexander's *A Pattern Language* illustrates the importance of interconnecting smaller patterns within larger ones, the arrangement of spatial sub-patterns of contested space within FPS maps is crucial in determining the rhythm and tempo of gameplay. These patterns, such as establishing strongholds, creating spaces of anticipation, allowing situations for positional advantage, providing flanking opportunities, and creating large scale combat arenas, form the core of contested spaces. These patterns utilize spatial elements of varying scales, functions, and attributes to create arrangements where the dynamic interplay of tension and relief keeps players engaged. The careful balance of open and confined spaces, along with the strategic use of cover and sightlines, creates a rhythm that alternates between moments of intense action and quieter periods of tactical positioning. This balance is essential for maintaining player interest and ensuring that the gameplay remains dynamic and unpredictable. The pacing of a game map is therefore a product of both the individual elements and the larger patterns they form, with each contributing to the creation of a coherent and engaging experience that challenges players both individually and as a team. Through this lens, FPS maps are seen not just as static environments but as active participants in the gameplay, with their architecture playing a pivotal role in shaping the player's journey from start to finish.

Limitations

This thesis recognizes that the elements and patterns extracted from FPS maps do not constitute a comprehensive or holistic capture of all possible elements and patterns within the genre. Christopher Barney,[406] in *Pattern Language for Game Design*, specifies that at least "50 or 100 patterns would be needed to shape the beginnings of a language."[407] This thesis currently identifies thirty elements and five patterns, which, while foundational, represent only a fraction of the potential spatial and tactical configurations within FPS games. The scope of a pattern language should "exists on at least three axes,"[408] which consists of breadth, depth, and density. Breadth refers to the range of game design aspects covered, depth as the variety of patterns from abstract to specific, and density as the number of patterns collected and their interconnections. Given this framework, the current research offers a preliminary exploration rather than a fully developed language.

Moreover, the ability to comprehensively analyze game environment is limited by external factors, such as the proprietary restrictions imposed by game developers. In the context of this research, Riot Games' limitations on data accessibility have restricted the depth of analysis. Access to more granular data, such as coordinates for every instance of PvP elimination can allow these points to be plotted within the map, illustrating maps as a spectrum of safety and danger through its various spatial conditions that constrain and afford sightlines. These metrics would allow for a more precise evaluation of how specific spaces within maps function relative to each other.

406 Game designer and professor of game studies and design.

407 Christopher Barney, *Pattern Language for Game Design*, 1st edition (Boca Raton: CRC Press, 2021), 314.

408 Ibid., 318.

08

CONCLUSION

The progression of architectural thought has extended from the physical into the virtual realm, where the design of game spaces has become a significant field of study. Video game space studies reflect the ongoing expansion of architecture itself, which must continuously adapt to new technological, social, and cultural paradigms.

Unlike physical architecture, which is bound by natural laws and practical functions, virtual architecture offers the freedom to create *impossible spaces*, prioritizing the play experience over conventional constraints. Video game spaces challenge traditional architecture by existing in a state of transformation, transcending physical constraints. The FPS genre exemplifies this architectural complexity, with its immersive environment and first-person perspective, fostering a sense of embodied presence and encouraging players to deeply explore and engage with the spatial design of the game world. *Valorant's* environments are strategically designed to promote diverse strategies and team coordination, building on the maze-like spatial complexity that has been a hallmark of FPS games since their inception. FPS maps, while simpler than traditional mazes, are systematically designed to create dynamic, contested spaces where players vie for control. This design fosters *emergent gameplay*, where players develop complex responses to space within the map's static framework.

By dissecting maps into elements and patterns, FPS game spaces can be understood as configurational systems where distinct spatial elements, identified through *space syntax*, come together in patterns that enhance gameplay, as described by *pattern theory*. Each element, by virtue of its size, shape, and configuration, carries with it an inherent balance of safety and danger, influencing how players perceive and interact with their environment. The sightlines afforded by these elements dictate the distances over which encounters take place, shaping combat strategies and the intensity of engagements. Additionally, these elements control the speed of movement, and the tension experienced by players, contributing to the overall pacing of the game.

When strung together, these elements form patterns that create a rhythmic flow within the game environment. This flow, akin to the movement of the body through physical architecture, guides players through a series of spaces that ebb and flow in intensity. It is precisely this rhythm, of composition and pacing, which FPS games exhibit well, that pleasure and attachment is derived from the virtual space.[409]

Just as in real-world architecture—where the movement of the body in space, exemplified in skateboarding or parkour, generates a dynamic interaction between the individual and their surroundings—FPS games construct a similar experience. Here, the player's virtual avatar becomes the vessel through which this spatial engagement is

409 Kristina Egumenovska, "Disorienting the Logical: On the Gestural Poetics of Video Games," *Teorija In Praksa* 51, no. 1 (January 1, 2014): 8–21.

realized, navigating a world that, though digital, feels tangible and immersive.

The design of virtual space can greatly benefit from looking at precedents of virtual environments within video games. Currently, many architectural designs for virtual spaces, such as Zaha Hadid's *Metaverse Liberland*,[410] often appear more as static artifacts rather than as dynamic environments that facilitate interaction. Gabrielle Schwarz,[411] in "Land of the Free Market," comments that "Liberland appears to suffer from some of the same computational design affectations and user-interface flaws that leave so many other [virtual space] concepts lacking."[412] The navigation of the environment feels "awkward and lacks a compelling reason to exist. The function of Liberland Metaverse sounds more like a traditional architectural rendering: sketches of possible futures, which may or may not be realized as buildings."[413] Given how common these sentiments are, it is clear that Liberland, and other virtual spaces like it, was not designed with virtual metrics in mind. These spaces, while visually impressive, frequently fail to engage users in the same way that video game spaces do. This disconnect stems from a fundamental difference in design philosophy: while video game environments are designed with the movement, interaction, and engagement of virtual avatars in mind, many architectural designs for virtual spaces, especially those conceived by architects unfamiliar with the medium, do not fully account for the unique metrics of digital environments or the absence of a physical body.

The challenge of translating real-world architectural principles into virtual spaces often lies in the lack of a tangible, physical body to ground the experience. In the physical world, architecture is deeply connected to the human body, with spaces designed to accommodate human scale, movement, and perception. In virtual spaces, however, this connection is mediated through avatars, and the sense of immersion and presence must be achieved through other means—primarily through the careful design of spatial rhythms and pacing.

The interplay between elements and patterns in FPS maps demonstrates valuable insights into the design of virtual spaces that prioritize connectivity and interaction. As virtual environments continue to evolve, the lessons drawn from the contested spaces of FPS games may offer a new direction for digital architecture—one that embraces the unique opportunities of virtual space to connect and engage users in ways that traditional architecture cannot. The notion of pacing within these maps—how players transition from one space to another, how tension is built and released, and how strategies emerge

410 "World – Liberland Metaverse," accessed August 20, 2024, https://world.liberland.org/.

411 Curator, editor, and writer.

412 Gabrielle Schwarz, "Land of the Free Market," Outland, February 24, 2023, https://outland.art/liberland-metaverse/.

413 Ibid.

from the spatial layout—parallels the strategies of traditional architecture but is tailored to suit the embedded perspective, game metrics, and experience of space through the screen.

The research presented not only contributes to a deeper understanding of FPS game maps, but also positions these digital spaces within the larger discourse of architecture. By analyzing the role of elements and patterns in shaping gameplay and pacing, this study illuminates the role of architecture as an active agent in virtual space.

Outlook

The insights drawn from the spatial anatomy of FPS maps extend beyond the realm of gaming. As digital environments grow in complexity, the lessons learned from video game architecture could have profound implications for future urban and virtual design. Just as architects in the physical world design spaces to facilitate specific behaviors, game designers craft maps to influence movement, strategy, and interaction. By studying how virtual contested spaces generate emergent play and user engagement, we can begin to envision how these principles might be applied to the design of virtual workplaces, social platforms, and digital public spaces. In these environments, architects will have the opportunity to shape not just the aesthetics of a space but the very experience of time, movement, and interaction, offering new ways to connect people across digital landscapes.

By designing spaces that evolve in response to user interaction, virtual environments can become more immersive and community-driven. Additionally, the blend of competition and cooperation seen in FPS games can inspire new dynamics in collaborative spaces, encouraging real-time problem-solving and strategic thinking. For example, future virtual social platforms—spaces where people gather to interact, collaborate, and socialize—can draw heavily from the interactivity seen in FPS maps. Rather than creating static environments, virtual spaces can be designed to respond dynamically to user input, much like FPS maps do in response to player strategies. Nodes and collision points, which are central to FPS map design, can become strategic social gathering spaces where users are naturally drawn into interaction. These social spaces can also facilitate organic encounters by encouraging users to navigate and move through the environment, just as FPS players are guided to strategic points on a map. Such spaces would function less as fixed meeting points and more as dynamic, interactive zones that evolve depending on how users engage with them. The emergent behavior seen in FPS games—where users must constantly adjust to their environment and the actions of others—can translate into virtual environments where social interactions are fluid and continually shaped by user decisions.

The future of virtual architecture hinges on the idea of interactive space, where the environment adapts to users as much as they adapt to it. By prioritizing connectivity, interaction, and engagement, virtual architects can craft spaces that are not only visually stunning but also responsive and meaningful.

Even beyond virtual applications, the study of game spaces calls into question the role of architecture in real space. What if interactivity was the foremost function of architecture, as it is in game design? How might our cities change if physical spaces were

designed to actively respond to their inhabitants, shaping behavior, movement, and interaction? If the principles of interactive design found in virtual spaces were applied to urban architecture, we could envision cities that adapt dynamically to the people who move through them, fostering connection, collaboration, and engagement at every turn. This shift suggests a future where architecture, both virtual and real, is no longer about creating static structures, but about crafting living, evolving environments that interact with their inhabitants, shaping the way we experience space.

Final Remarks

Just as architecture has historically evolved in response to shifts in societal values, beliefs, and behaviors, video games—by translating these values into "virtually mediated action"[414]—serve as a contemporary medium with profound "personal, social, and political"[415] significance. Video games are influential for shaping and expressing collective and individual experiences. In today's digital age, these games have become a dominant form of recreation, with over fifty percent of adults and more than ninety percent of teenagers actively participating in gaming.[416] Among these, FPS games are particularly notable for their impact on players' spatial awareness. Several visual attentional, perceptual, and cognitive skills have been shown to improve after playing first-person shooter (FPS) video games.[417] Players that partake in FPS gaming show "faster and more accurate attention allocation, higher spatial resolution in visual processing, and enhanced mental rotation abilities."[418] The virtual environments encountered in these games, with their spatial complexities, not only heighten in-game performance but also translate into improved spatial awareness and navigation in the real world. As society becomes increasingly intertwined with digital media, the creation of tangible virtual spaces represents a new frontier in architecture. Given the success of video game environments, designers of future virtual spaces stand to benefit from playing and understanding these game spaces.

This thesis concludes with a final remark, presented by Dan Pinchbeck:

> *If you haven't played any [type of] FPS, your life is poorer as a result, and you should stop reading this and get in on the action immediately.*[419]

GG WP, go next.

■

414 Egumenovska, "Disorienting the Logical: On the Gestural Poetics of Video Games," 20.

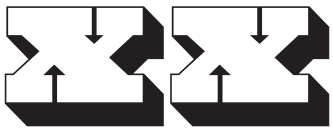
415 Ibid.

416 Amanda Lenhart Macgill Sydney Jones and Alexandra, "Adults and Video Games," *Pew Research Center* (blog), December 7, 2008, https://www.pewresearch.org/internet/2008/12/07/adults-and-video-games/.

417 Sijing Wu et al., "Playing a First-Person Shooter Video Game Induces Neuroplastic Change," *Journal of Cognitive Neuroscience* 24 (January 20, 2012): 1286–93, https://doi.org/10.1162/jocn_a_00192.

418 Isabela Granic, Adam Lobel, and Rutger C. M. E. Engels, "The Benefits of Playing Video Games," *American Psychologist* 69, no. 1 (2014): 68, https://doi.org/10.1037/a0034857.

419 Dan Pinchbeck, *Doom: Scarydarkfast*, Lanmark Video Games 3 (USA: University of Michigan Press, 2013), 3.



BIBLIOGRAPHY

Abbott, H. Porter. *The Cambridge Introduction to Narrative*. 2nd ed. Cambridge Introductions to Literature. Cambridge: Cambridge University Press, 2008. https://doi.org/10.1017/CBO9780511816932.

Adams, Ernest. "Designer's Notebook: The Role of Architecture in Videogames." *Game Developer* (blog), 2002. https://www.gamedeveloper.com/design/designer-s-notebook-the-role-of-architecture-in-videogames.

———. *Fundamentals of Game Design*. New Riders, 2013.

———. *Fundamentals of Shooter Game Design*. California: New Riders, 2014.

———. "The Construction of Ludic Space." In *2003 DiGRA International Conference: Level Up*, Vol. 2, 2003.

Alexander, Christopher, Sarah Ishikawa, Murray Silverstein, Max Jacobson, Ingrid Fiksdahl-King, and Shlomo Angel. *A Pattern Language: Towns, Buildings, Construction*. NY, USA: Oxford University Press, 1977.

Andrews, Sam. "The 'First Person Shooter' Perspective: A Different View on First Person Shooters, Gamification, and First Person Terrorist Propaganda." *Games and Culture* 19, no. 1 (January 1, 2024): 55–74. https://doi.org/10.1177/15554120231153789.

Barney, Christopher. *Pattern Language for Game Design*. 1st edition. Boca Raton: CRC Press, 2021.

Bartholl, Aram. "First Person Shooter: Everyday Counter-Strike." In *Space Time Play*, 318–19. Basel, Berlin: Birkhäuser, 2007.

Björk, Staffan, and Jussi Holopainen. *Patterns in Game Design*, 2005.

bo3. "Valorant Flanking Guide to Dominating with Stealth and Strategy," 2024. https://bo3.gg/valorant/articles/valorant-flanking-guide.

Borchers, Jan O. "A Pattern Approach to Interaction Design." In *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*, 369–78. DIS '00. New York, NY, USA: Association for Computing Machinery, 2000. https://doi.org/10.1145/347642.347795.

Borden, Iain. *Skateboarding, Space and the City: Architecture and the Body*. Oxford: Berg, 2001.

Boron, Dariusz Jacob. "Infinite Regress: The Blurring of an Architectural Game-Space." MA Thesis, Carleton University, 2006. http://www.pqdtcn.com/thesisDetails/70B1F8F31C3B3FA97D0EC01209A61A9E.

Branigan, Edward. *Narrative Comprehension and Film*. 1st edition. Sightlines. London ; Routledge, 1992. https://doi.org/10.4324/9781315003108.

Burciu, Andreea. "Information Architecture and User Experience in First-Person-Shooter (FPS) Video Games." MA Thesis, Aalborg University, 2019.

Carney, Chris. "The Creation of Split." Riot Games, June 17, 2020. https://playvalorant.com/en-us/news/dev/the-creation-of-split/.

Ching, Francis D. K. *Form, Space, & Order*. 3rd ed. Hoboken, N.J: John Wiley & Sons, 2007.

Cohen, Julie E. "Cyberspace as/and Space." *Columbia Law Review* 107, no. 1 (2007): 210–56.

Corner, James. "The Agency of Mapping: Speculation, Critique and Invention." In *Mappings*. Critical Views. London: Reaktion books, 1999.

Costikyan, Greg. "Where Stories End and Games Begin." Personal. *Greg Costikyan* (blog), 2000. http://www.costik.com/gamnstry.html.

Crawford, Chris. *The Art of Computer Game Design*. Berkeley, Calif: Osborne/McGraw-Hill, 1984.

Dariusz, Jacob Boron. "A Short History of Digital Gamespace." In *Space Time Play*, 26–31. Basel: Birkhäuser, 2007.

Du, Matthew. "Valorant vs. CSGO Compared: Which One Is Better?" *Medium* (blog), May 2, 2023. https://mattkendu.medium.com/valorant-vs-csgo-compared-which-one-e432e65d7601.

Egumenovska, Kristina. "Disorienting the Logical: On the Gestural Poetics of Video Games." *Teorija In Praksa* 51, no. 1 (January 1, 2014): 8–21.

Espinosa, Michael. "The Best Part About 'Valorant'? Its Potential." *The Stanford Daily* (blog), September 1, 2020. https://stanforddaily.com/2020/09/01/the-best-part-about-valorant-its-potential/.

Fagerholt, Erik, and Magnus Lorentzon. "Beyond the HUD: User Interfaces for Increased Player Immersion in FPS Games." Master of Science Thesis, Chalmers University of Technology, 2009.

Feil, John, and Marc Scattergood. *Beginning Game Level Design*. Boston, MA: Thomson Course Technology, 2005.

Feireiss, Lukas. "New Babylon Reloaded." In *Space Time Play*, 218–21. Basel: Birkhäuser,

2007.

Fernández-Vara, Clara. “Labyrinth and Maze: Video Game Navigation Challenges.” In *Space Time Play*, 74–87. Basel, Berlin: Birkhäuser, 2007.

Fernández-Vara, Clara, Jose Zagal, and Michael Mateas. “Evolution of Space Configuration in Videogames,” 2005.

“FPS Games.” Accessed August 7, 2024. https://gamesight.io.

Galloway, Alexander R. *Gaming: Essays on Algorithmic Culture*. Electronic Mediations 18. Minneapolis: University of Minnesota Press, 2006.

Gee, James Paul. *What Video Games Have to Teach Us About Learning and Literacy*. 1st ed. Education. New York: Palgrave Macmillan, 2004.

GeeksforGeeks. “Binary Space Partitioning,” June 26, 2020. https://www.geeksforgeeks.org/binary-space-partitioning/.

Godfrey-Evans, Henry. “Why Have ‘Three Lane Maps’ Endured in Call of Duty?” *Medium* (blog), December 17, 2021. https://medium.com/super-jump/why-have-three-lane-maps-endured-in-call-of-duty-9d3d2837efc9.

Goel, Payushi. “Space Syntax.” *RTF | Rethinking The Future* (blog), March 25, 2021. https://www.re-thinkingthefuture.com/architectural-community/a3701-space-syntax/.

Götz, Ulrich, and Andri Gerber. *Architectonics of Game Spaces: The Spatial Logic of the Virtual and Its Meaning for the Real*. 1st ed. Bielefeld: transcript Verlag, 2019.

Graham, Stephen. “War Play: Practicing Urban Annihilation.” In *Space Time Play*, 420–23. Basel, Berlin: Birkhäuser, 2007.

Granic, Isabela, Adam Lobel, and Rutger C. M. E. Engels. “The Benefits of Playing Video Games.” *American Psychologist* 69, no. 1 (2014): 66–78. https://doi.org/10.1037/a0034857.

Grimshaw, Mark. “The Resonating Spaces of First-Person Shooter Games.” In *Games Computing and Creative Technologies: Conference Papers*. University of Bolton, 2007.

Grosz, E. A. *Architecture from the Outside: Essays on Virtual and Real Space*. Writing Architecture Series. Cambridge, Mass: MIT Press, 2001.

Günzel, Stephan. “‘Eastern Europe, 2008’ Maps and Geopolitics in Video Games.” In *Space Time Play*, 444–49. Basel, Berlin: Birkhäuser, 2007.

———. “The Space-Image. Interactivity and Spatiality of Computer Games.” In

Conference Proceedings of the Philosophy of Computer Games, 170–88. University Press, 2008.

Güttler, Christian, and Troels Johansson. "Spatial Principles of Level-Design in Multi-Player First-Person Shooters." NetGames '03. ACM, 2003.

Heath, Stephen. "Narrative Space." *Screen* 17, no. 3 (October 1, 1976): 68–112. https://doi.org/10.1093/screen/17.3.68.

Hildebrand, Grant. *Origins of Architectural Pleasure*. Berkeley, Calif. ; University of California Press, 1999.

Hillier, Bill. *Space Is the Machine: A Configurational Theory of Architecture*. NY, USA: Cambridge University Press, 1996.

Hillier, Bill, and Julienne Hanson. *The Social Logic of Space*. Cambridge (GB) New York: Cambridge University Press, 1984.

Hodent, Celia. *The Psychology of Video Games*. 1st ed. Routledge, 2020. https://doi.org/10.4324/9781003045670.

Holloway, James. "Deathmatch Map Design: The Architecture of Flow." *Game Developer* (blog), 2013. https://www.gamedeveloper.com/design/deathmatch-map-design-the-architecture-of-flow.

"How to Develop a Map That Works - Valve Developer Community." Accessed August 13, 2024. https://developer.valvesoftware.com/wiki/How_to_Develop_a_Map_That_Works.

How We Shaped Pearl // Dev Diaries - VALORANT. Youtube Video. Dev Diaries - VALORANT, 2022. https://www.youtube.com/watch?v=nrJDA0ZcwrQ.

Hullett, Kenneth. "The Science of Level Design: Design Patterns and Analysis of Player Behavior in First-Person Shooter Levels." PhD Thesis, University of California, 2012.

Hullett, Kenneth, and Jim Whitehead. "Design Patterns in FPS Levels," 78–85. FDG '10. ACM, 2010. https://doi.org/10.1145/1822348.1822359.

Jenkins, Henry. "The War Between Effects and Meaning: Rethinking the Video Game Violence Debate." In *Digital Generations: Children, Young People, and New Media*, 19–31. Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers, 2006.

Jensen, K. Thor. "Knee Deep in the Dead: The History of First-Person Shooters." *PCMAG*. Accessed February 27, 2024. https://www.pcmag.com/news/the-complete-history-of-first-person-shooters.

Joson, Jullia. “Map Design and Built Environments in Video Games: Exploring The World of VALORANT.” ArchDaily, April 11, 2022. https://www.archdaily.com/979934/map-design-and-built-environments-in-video-games-exploring-the-world-of-valorant.

Juul, Jesper. “Games Telling Stories?” Journal Archive. Game Studies, July 2001. https://www.gamestudies.org/0101/juul-gts/.

Kappraff, Jay, Ljiljana Radović, and Slavik Jablan. “Meanders, Knots, Labyrinths and Mazes.” *Journal of Knot Theory and Its Ramifications* 25, no. 09 (August 2016): 1641009. https://doi.org/10.1142/S0218216516410091.

Khalifa, Ahmed. “Level Design Patterns in 2D Games.” *Game Developer* (blog), 2019. https://www.gamedeveloper.com/design/level-design-patterns-in-2d-games.

Khong, En Liang. “Unreal Cities: Urban Architecture in Video Games and Anime Films.” *TLS. Times Literary Supplement*, no. 6149 (February 5, 2021): 14–16.

Klimentov, Mikhail. “Here’s How Breeze, ‘Valorant’s’ Newest Map, Was Built.” *Washington Post* (blog), April 26, 2021. https://www.washingtonpost.com/video-games/2021/04/26/heres-how-breeze-valorants-newest-map-was-built/.

Koh, Wanzi. “How Valorant Map Designers Create a New Map.” ONE Esports, March 11, 2022. https://www.oneesports.gg/valorant/valorant-map-design-explained-riot-devs/.

Kokonis, Michalis. “Intermediality between Games and Fiction: The ‘Ludology vs. Narratology’ Debate in Computer Game Studies: A Response to Gonzalo Frasca.” *Acta Universitatis Sapientiae, Film and Media Studies* 9, no. 1 (December 1, 2014): 171–88. https://doi.org/10.1515/ausfm-2015-0009.

Kontour, Kyle. “War, Masculinity, and Gaming in the Military Entertainment Complex: A Case Study of Call of Duty 4: Modern Warfare,” 2011.

Kreimeier, Bernd. “The Case For Game Design Patterns.” *Game Developer* (blog), 2002. https://www.gamedeveloper.com/design/the-case-for-game-design-patterns.

Le Corbusier. *Towards a New Architecture*. Translated by Frederick Etchells. New York: Dover Publications, 1986.

Lefebvre, Henri. *Rhythmanalysis: Space, Time and Everyday Life*. Translated by Stuart Elden and Gerald Moore. Athlone Contemporary European Thinkers. New York: Continuum, 2004.

———. *The Production of Space*. Translated by Donald Nicholson-Smith. Reprinted. Oxford: Blackwell, 1997.

Leitner, Helmut. *Pattern Theory: Introduction and Perspectives on the Tracks of Christopher Alexander*. Graz: HLS Software, 2015.

Luke Pearson and Sandra Youkhana, *Videogame Atlas: Mapping Interactive Worlds* (London: Thames & Hudson Ltd, 2022).

Lynch, Kevin. *The Image of the City*. Cambridge, Massachusetts ; London, England: The MIT Press, Massachusetts Institute of Technology, 1996.

Macgill, Amanda Lenhart, Sydney Jones and Alexandra. "Adults and Video Games." *Pew Research Center* (blog), December 7, 2008. https://www.pewresearch.org/internet/2008/12/07/adults-and-video-games/.

Manovich, Lev. *The Language of New Media*. 4th ed. Leonardo. Cambridge, Mass.: MIT Press, 2002.

Mcgregor, Georgia Leigh. "Situations of Play: Patterns of Spatial Use in Videogames." In *Situated Play*, 537–45, 2007.

Medal of Honor News. "Medal of Honor Video Games," February 12, 2011. https://medalofhonornews.com/medal-of-honor-video-games.

Mistakidis, Alexander. "Level Design on Element Arena." Alexander "Zone" Mistakidis, June 10, 2021. https://amist.co/level-design-on-element-arena/.

Mitchell, William J. "Action in the Hands of the User." In *Space Time Play*, 407–9. Basel: Birkhäuser, n.d.

Murff, James. "How FPS Architecture Makes Us Think." *Fanbyte* (blog), 2023. https://www.fanbyte.com/legacy/how-fps-architecture-makes-us-think.

Murray, Janet. *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. Cambridge, Mass: The MIT Press, 2017.

Nascimento, Adriana, and Ana Cristina Faria. "The Pattern in The Social Logic of Space (1984) and in A Pattern Language (1977)." In *Urban Form and the Sustainable and Prosperous Cities*, 315–22. Glasgow: University of Strathclyde Publishing, 2022. https://strathprints.strath.ac.uk/80459/.

Nerurkar, Martin. "Archetypical Spaces, Part 3: The Maze." *Game Architecture* (blog), September 16, 2012. https://www.gamearch.com/2012/09/16/archetypical-spaces-part-3-the-maze/.

Nichiporchik, Alex. "The Five Pillars of Emergent Gameplay." Games Industry, 2023. https://www.gamesindustry.biz/the-five-pillars-of-emergent-gameplay.

Nitsche, Michael. *Video Game Spaces: Image, Play, and Structure in 3D Game Worlds*. Cambridge: The MIT Press, 2008.

Olivia. "CS:GO vs. VALORANT: Which Game Is More Balanced?" *Abios Newsroom* (blog), 2023. https://abiosgaming.com/press/csgo-vs-valorant-which-game-is-more-balanced/.

Paul, Christopher A. *Wordplay and the Discourse of Video Games: Analyzing Words, Design, and Play*. Routledge Studies in New Media and Cyberculture 10. New York: Routledge, 2012.

Pinchbeck, Dan. "An Affordance Based Model for Gameplay." In *Breaking New Ground: Innovation in Games, Play, Practice and Theory*. DiGRA, 2009. https://dl.digra.org/index.php/dl/article/view/365.

———. "Counting Barrels in Quake 4: Affordances and Homodiegetic Structures in FPS Worlds." In *Proceedings of DiGRA 2007 Conference: Situated Play*, 2007. https://dl.digra.org/index.php/dl/article/view/344.

———. *Doom: Scarydarkfast*. Lanmark Video Games 3. USA: University of Michigan Press, 2013.

Post, David. "Pooling Intellectual Capital: Thoughts on Anonymity, Pseudonymity, and Limited Liability in Cyberspace." *University of Chicago Legal Forum* 1996, no. 1 (December 7, 2015). https://chicagounbound.uchicago.edu/uclf/vol1996/iss1/5.

Pozo, Diana. "War Games at Home Home Games at War Geography and Military First Person Shooting Gamers." *Mediascape: UCLA's Journal of Cinema and Media Studies* Winter 2011 (2011).

Rachel. "Analyzing Map Design in FPS Environments." The Dogood Press, December 13, 2023. https://thedogoodpress.com/technology/5303/analyzing-map-design-in-fps-environments/.

"Sal Garozzo." Accessed September 3, 2024. http://www.garozzo.net/.

Salen, Katie, and Eric Zimmerman. *Rules of Play: Game Design Fundamentals*. Cambridge, Mass: MIT Press, 2003.

Schwarz, Gabrielle. "Land of the Free Market." Outland, February 24, 2023. https://outland.art/liberland-metaverse/.

Seamon, David. "Revealing Environmental and Place Wholes: Lessons from Christopher Alexander's Theory of Wholeness & Bill Hillier's Space Syntax." *Environmental Philosophy* 1, no. 1 (2004): 13–33.

Sin, Terry Hon-Tai. "Architecture at Play: The Magic Circle and Flow in Video Game Spaces." MA Thesis, University of Waterloo, 2012. http://hdl.handle.net/10012/6660.

Squire, Kurt, and Henry Jenkins. "The Art of Contested Spaces." In *Game On: The History and Culture of Video Games*, 64–75. NY, USA: Universe Publishing, 2002. https://web.mit.edu/~21fms/People/henry3/contestedspaces.html.

Stewart, Bart. "Environmental Storytelling." Game Developer, 2015. https://www.gamedeveloper.com/design/environmental-storytelling.

Stout, Mike. "Designing FPS Multiplayer Maps – Part 1." *On Game Design* (blog), August 1, 2008. https://www.ongamedesign.net/designing-fps-multiplayer-maps-part-1/.

Straub, Nicholas. "What the First FPS Game REALLY Was (Not DOOM or Wolfenstein)." *ScreenRant* (blog), October 11, 2020. https://screenrant.com/first-fps-first-person-shooter-game-3d/.

"The Birth of Ascent," July 20, 2020. https://playvalorant.com/en-us/news/dev/the-birth-of-ascent/.

Totten, Christopher W. *An Architectural Approach to Level Design*. Florida: A K Peters/CRC Press, 2014. https://doi.org/10.1201/b21989.

———. "Designing Better Levels Through Human Survival Instincts." *Game Developer* (blog), 2011. https://www.gamedeveloper.com/design/designing-better-levels-through-human-survival-instincts.

Ung, Jonathan. "How Valorant's Game Design Enhances Competition and Player Experience." *Medium* (blog), August 1, 2024. https://medium.com/@jua10/how-valorants-game-design-enhances-competition-and-player-experience-9451c488222e.

"VALORANT Maps: Explore Icebox, Bind, Haven, Split and Ascent," July 31, 2020. https://playvalorant.com/en-us/maps.

Waggoner, Zach. *My Avatar, My Self: Identity in Video Role-Playing Games*. Jefferson, N.C: McFarland & Co., 2009.

Walz, Steffen P. "Approaches to Space in Game Design Research." *DIGAREC Lectures 2008/09*, DIGAREC, no. 2 (2009): 228–54.

———. *Toward a Ludic Architecture: The Space of Play and Games*. Zurich: ETC Press, 2010.

Wang, Yiou. "Minotaur Plays Ludius Loci." *On Site Review*, no. 44 (2024): 64.

Wang, Yiou, and Yujie Wang. "Moving Architecture, Animated Maze: The Intertextuality

Between Player and Environment Agents." In *Creativity and Cognition*, 1–5. Virtual Event Italy: ACM, 2021. https://doi.org/10.1145/3450741.3466806.

Whistance-Smith, Gregory Martin. "Spatial Communication in Videogame Environments: Exploring, Enacting, Perceiving." MA Thesis, University of Alberta, 2019.

Wilson, Johnathon. "Level Design: Understanding a Level." Game Developer, 2018. https://www.gamedeveloper.com/design/level-design-understanding-a-level.

Wolf, Mark J. P. "Space in the Video Game." In *The Medium of the Video Game*. University of Texas Press, 2001. https://doi.org/10.7560/791480.

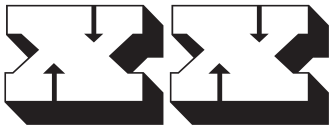
"World – Liberland Metaverse." Accessed August 20, 2024. https://world.liberland.org/.

World of Level Design. "6 Principles of Choke Point Level Design for Multiplayer Maps as Seen in CS:GO." Accessed May 10, 2024. https://www.worldofleveldesign.com/categories/csgo-tutorials/csgo-principles-choke-point-level-design.php.

Wu, Sijing, Cho Kin Cheng, Jing Feng, Lisa D'Angelo, Claude Alain, and Ian Spence. "Playing a First-Person Shooter Video Game Induces Neuroplastic Change." *Journal of Cognitive Neuroscience* 24 (January 20, 2012): 1286–93. https://doi.org/10.1162/jocn_a_00192.

Yiou Wang. "Moving Maze," March 26, 2021. https://yiouwang.org/portfolio/moving-maze/.

Zanotti, Lydia. "The Art of VALORANT Map Environments." Riot Games, November 16, 2020. https://playvalorant.com/en-us/news/dev/the-art-of-valorant-map-environments/.



APPENDIX

Pattern Templates in Game Design

The following are pattern templates utilized in game design research that have been used to inform the pattern template utilized in this thesis for the analysis of FPS game maps.

The Science of Level Design: Design Patterns and Analysis of Player Behavior in First-Person Shooter Levels by Hullett:[1]

Description
"A high level description of the pattern and the major design considerations."

Affordances
"Aspects of the pattern that can be varied by the designer. "

Consequences
"A description of the gameplay the pattern creates."

Relationships
"How the pattern interacts with other patterns."

Examples
"Some examples from popular commercial games that illustrate the pattern."

The Case for Game Design Patterns by Kreimeier:[2]

Name
"Names have to be mnemonic and evocative."

Problem
"This describes the problem, including its inherent trade-offs and the context in which the problem occurs. The description of the problem implies a goal that we want to accomplish, and the obstacles we encounter when we attempt to do so."

Solution
"A description of a general arrangement of entities and mechanisms

1 Hullett, "The Science of Level Design," 25.
2 Kreimeier, "The Case For Game Design Patterns."

that can be used to solve the problem. This is not a particular design or concrete implementation, but an abstract structure that describes an entire family of solutions that are essentially the same."

Consequences.
"Each solution has its own trade offs and consequences. Solutions can, in turn, cause or amplify other problems. The costs and benefits of a solution should be understood and compared against those of alternatives before making a design decision. Around this essential core, pattern templates often add other elements, or subdivide a core element."

Pattern Language for Game Design by Barney:[3]

Name
"This should be an easy to remember and evocative name."

Confidence
"This number rates the level of certainty you have that a pattern is viable for use in developing games."

Image
"An iconic image to represent each pattern. This image can help to convey the essence of the pattern and to serve as a mnemonic anchor for remembering it."

Author
"This is the name of the pattern creator or creators."

Design problem
"Each pattern exists to solve a problem. Describe that problem here."

Description
"Provide a detailed description of the pattern here. This section should go into as much depth as possible. It should be long enough to fully capture your pattern."

Games that use this pattern and how
"Name of Game. Description of how the game applies the pattern."

■

3 Barney, *Pattern Language for Game Design*, 54.

Seed

"This is the idea that was the starting point for the pattern."

Related patterns

Parent patterns: "A pattern or several patterns that are required by this pattern for it to function well."

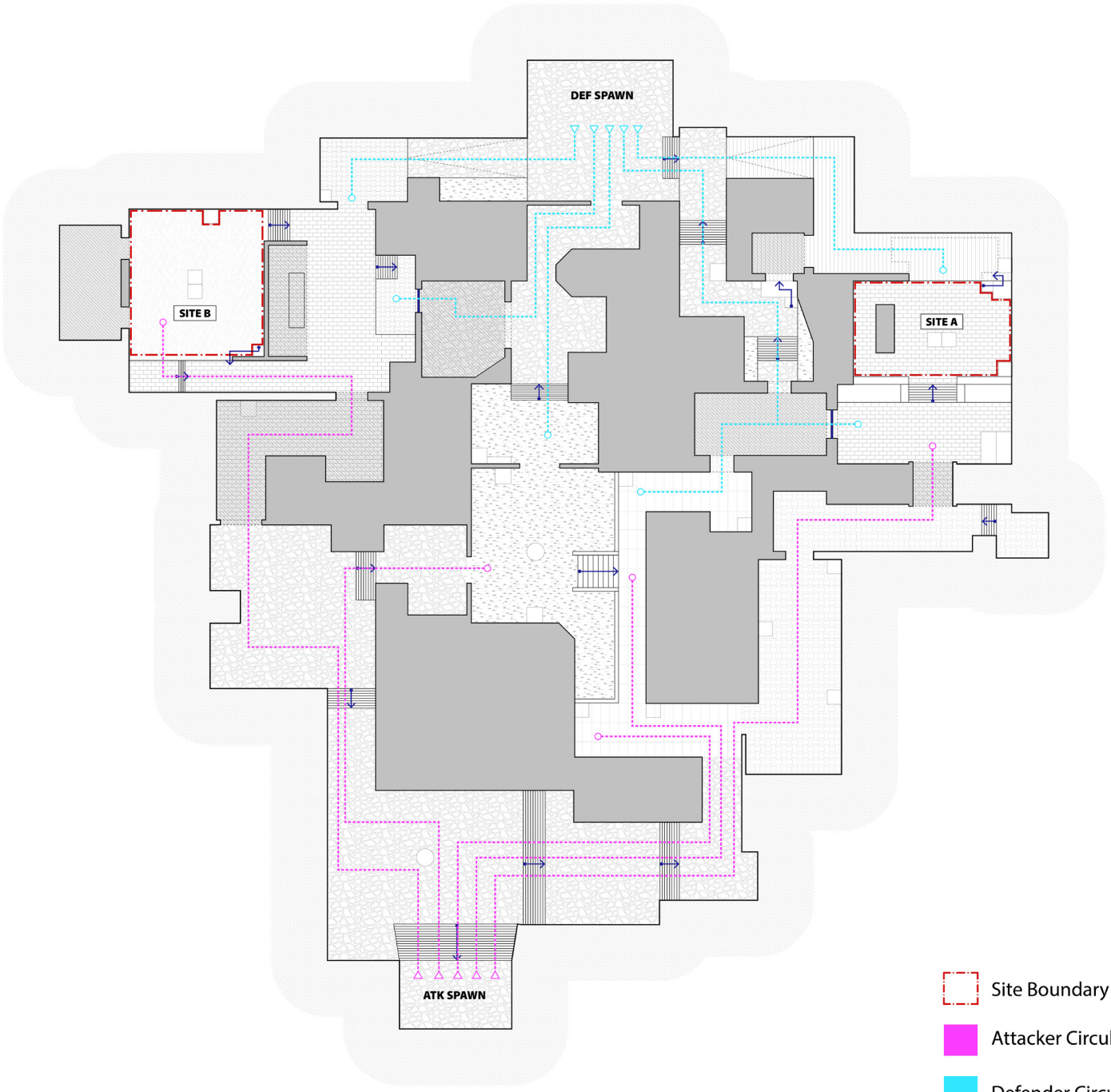
Child patterns: "Patterns that are suggested by this pattern or require it to function well."

Keywords

"Keywords that relate to this pattern."

Map Circulation and and Pre-Round Boundaries

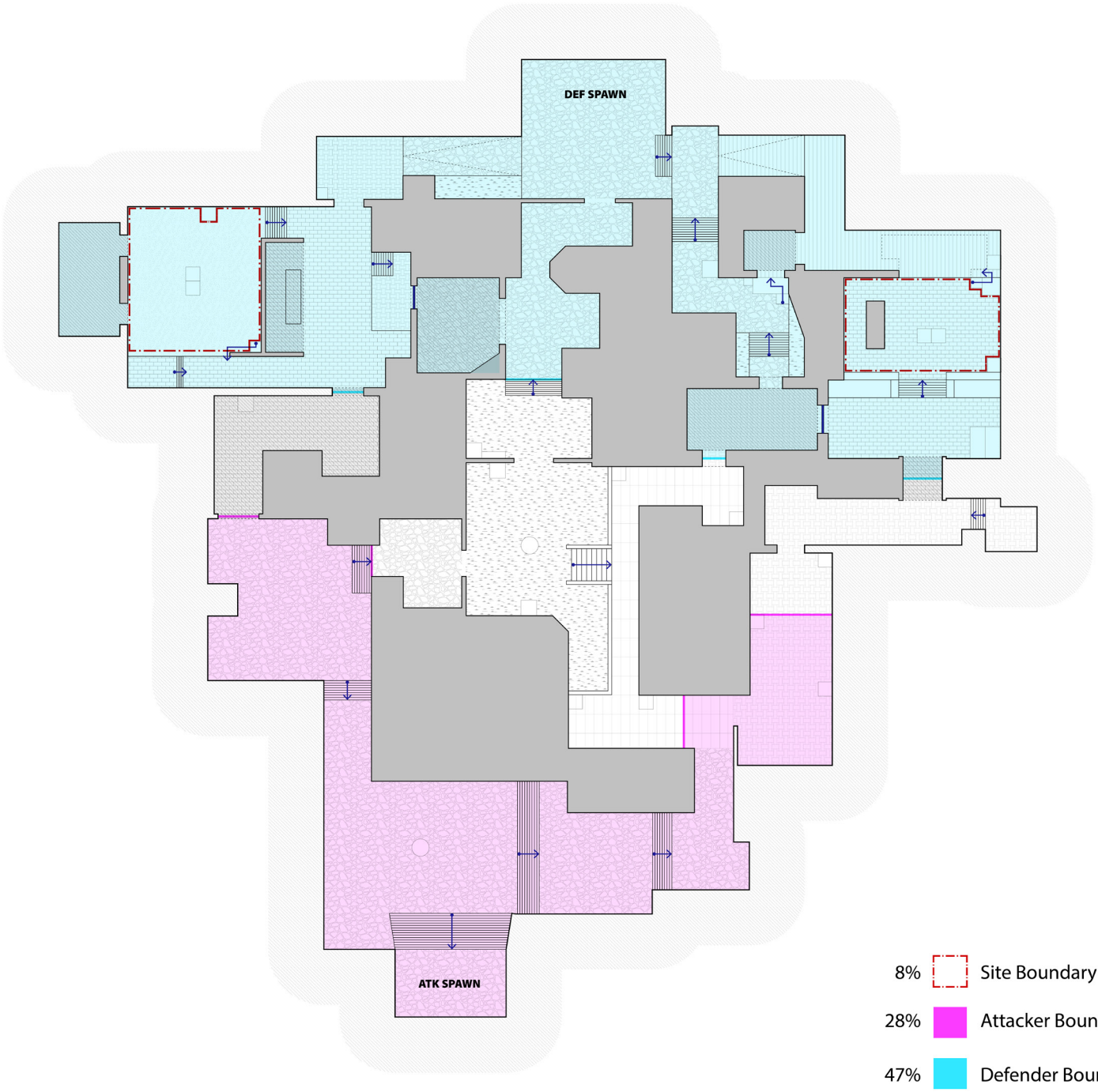
Ascent Map Circulation



0m ——— *10m*

34°2’0” N, 6°51’0” W

Ascent Map Pre-Round Boundaries



8% Site Boundary

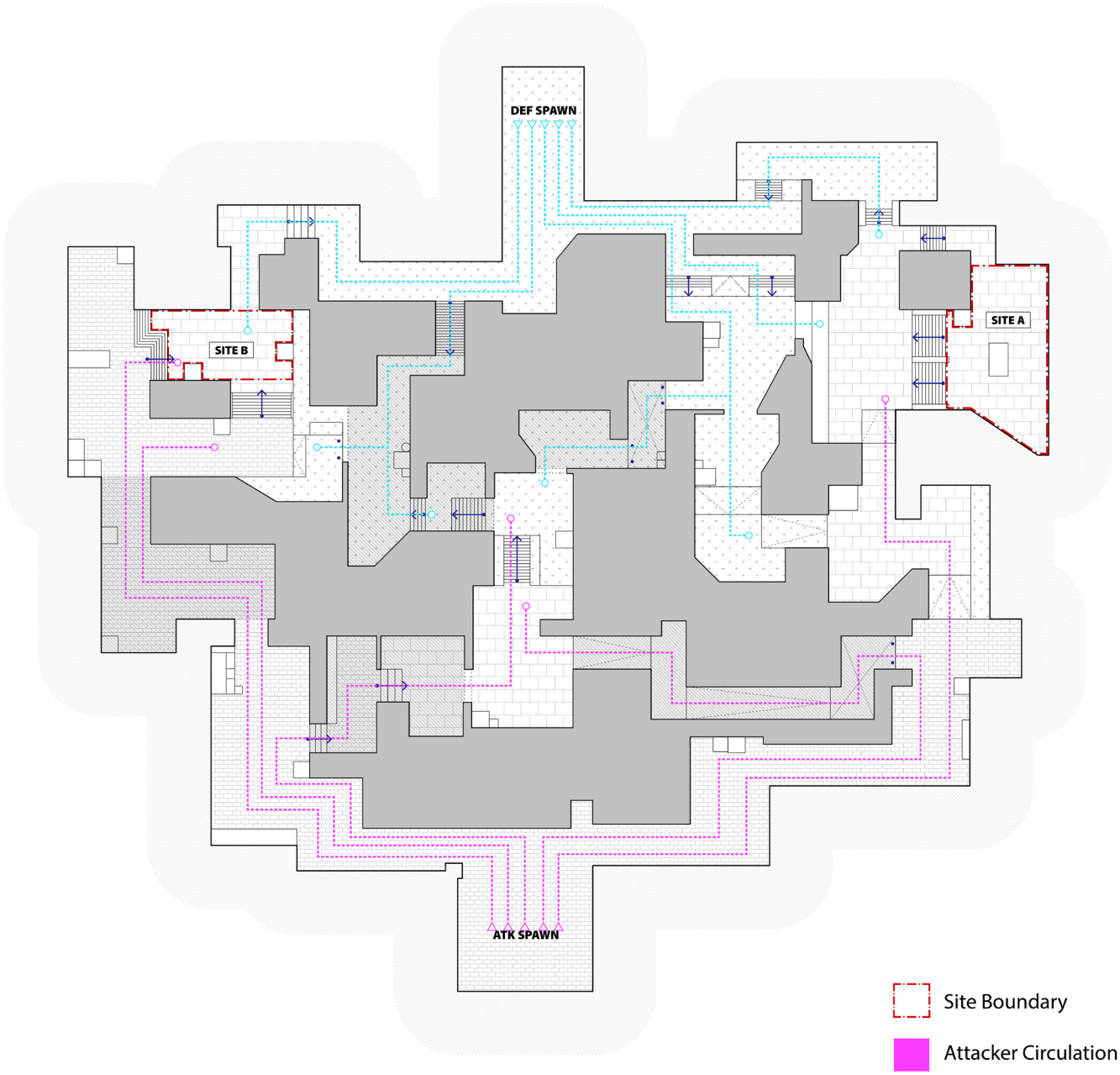
28% Attacker Boundary

47% Defender Boundary

0m ——— *10m*

34°2’0” N, 6°51’0” W

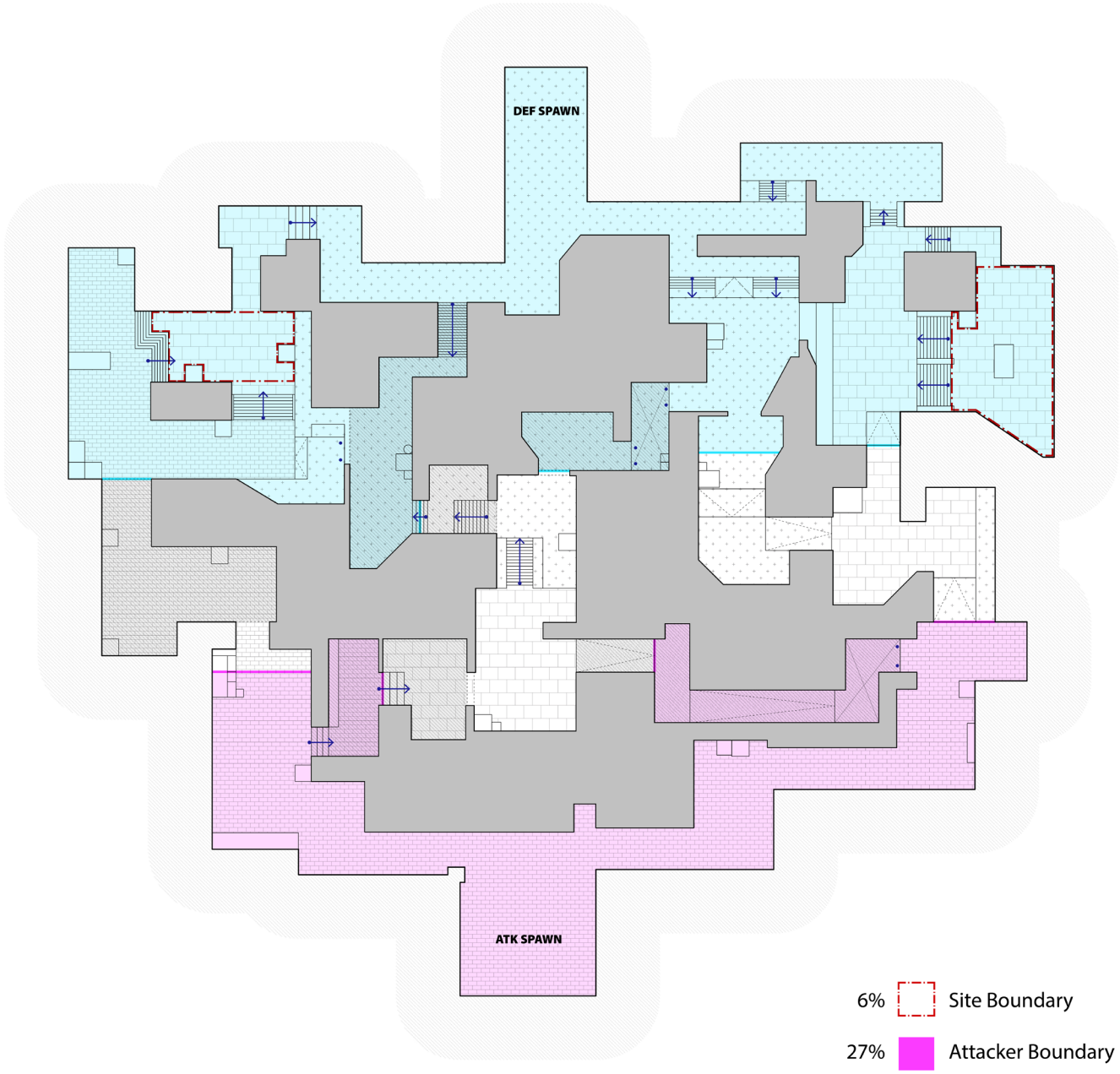
Split Map Circulation



0m ——— *10m*

34°2’0” N, 6°51’0” W

Split Map Pre-Round Boundaries



Sunset Map Circulation



Site Boundary

Attacker Circulation

Defender Circulation

0m ——— *10m*

34°2’0” N, 6°51’0” W

Sunset Map Pre-Round Boundaries



7% Site Boundary

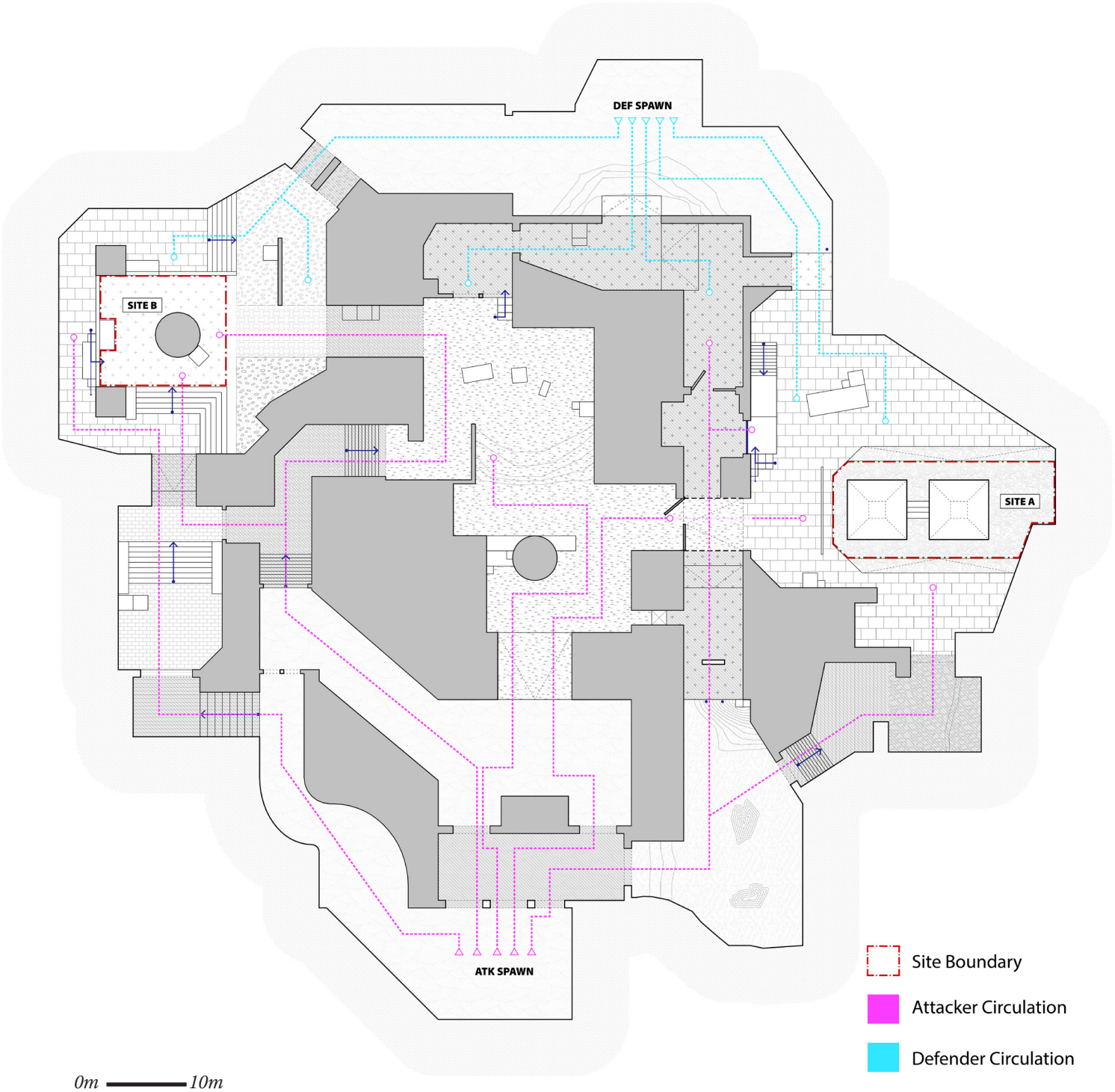
19% Attacker Boundary

51% Defender Boundary

0m ——— *10m*

34°2’0” N, 6°51’0” W

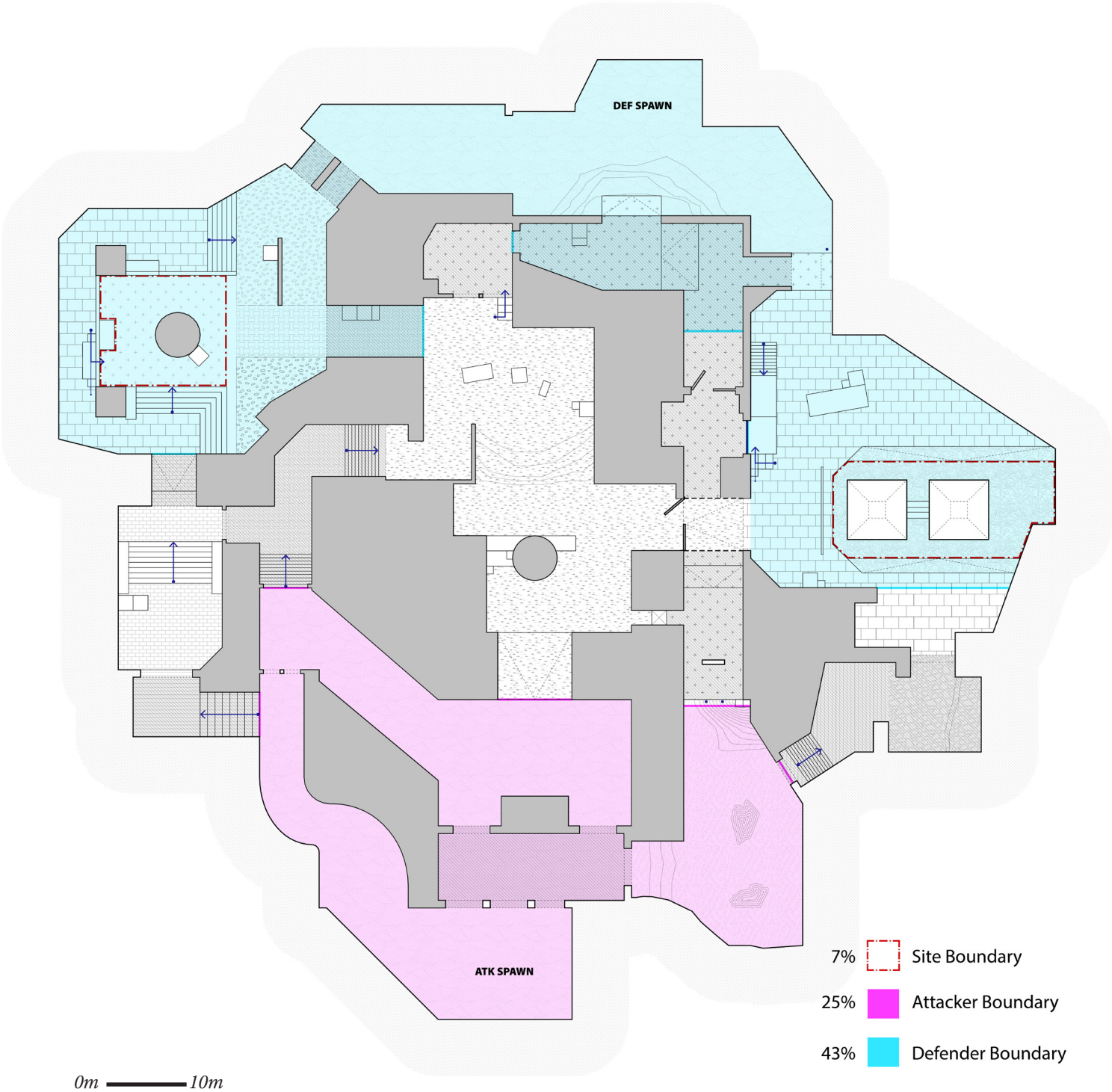
Breeze Map Circulation



0m ——— *10m*

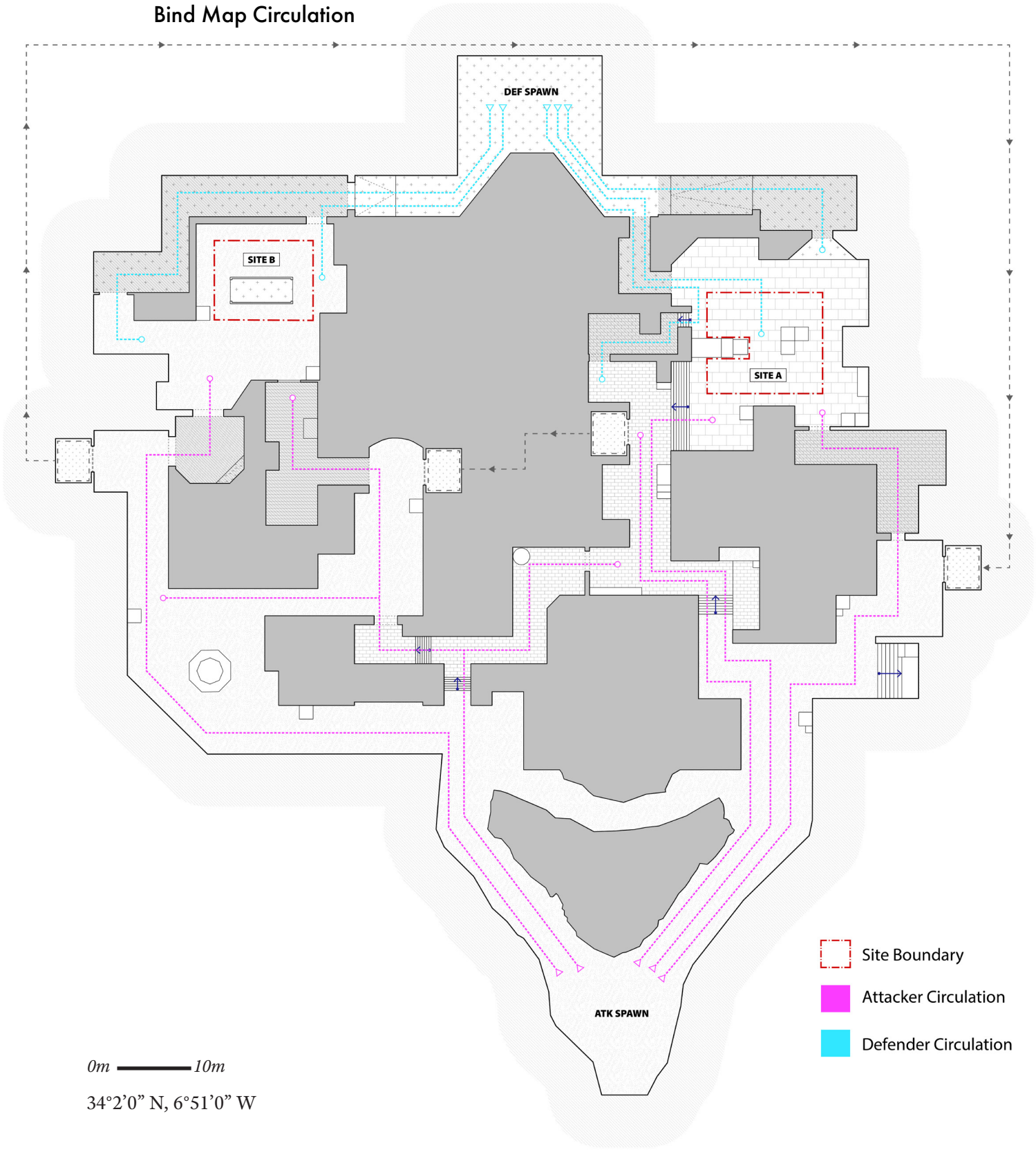
34°2’0” N, 6°51’0” W

Breeze Map Pre-Round Boundaries

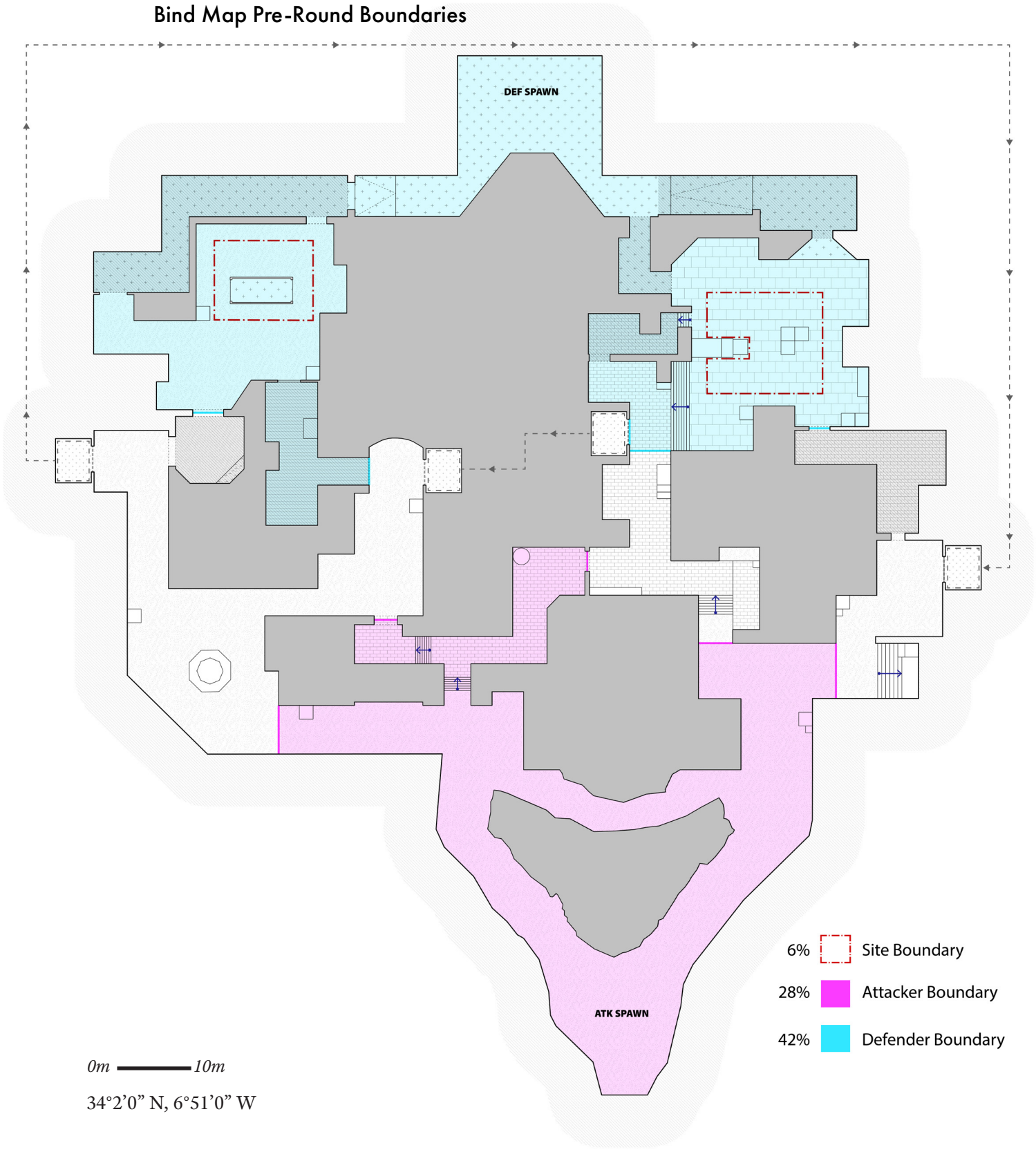


34°2’0” N, 6°51’0” W

Bind Map Circulation



Bind Map Pre-Round Boundaries



GLOSSARY

2D	Two Dimensional
3D	Three Dimensional
AR	Augmented Reality
FPS	First-Person Shooter
GPU	Graphics Processing Unit
LAN	Local Area Network
PC	Personal Computer
PvP	Player-versus-player
RPG	Role Playing Games
VR	Virtual Reality
Collision Point	A collision point refers to a specific location within a level where player interactions—typically combat—occur most frequently. These points are strategically significant areas where paths converge or objectives are located, often resulting in high player density and frequent encounters.
Esports	Esports refers to competitive video gaming where professional players and teams compete in organized tournaments and leagues, often for substantial prize money and fame. These events are widely followed by fans around the world, both in-person and through online streaming platforms.

Frag/Fragging	Frag/fragging refers to the act of eliminating an opponent in the game. The term originated from the word "fragmentation grenade," which was a common weapon used in early FPS games. However, "fragging" has evolved to become a general term for killing or scoring a hit against an opponent, regardless of the weapon used.
Gameplay	The interaction between the player and the game mechanics in a video game. It encompasses the rules, challenges, player control actions, and overall experience provided by a game.
Level	A specific environment or area where gameplay takes place.
Level Design	The process of creating the environment and structure through which players navigate and interact within the game. This includes the architectural layout, placement of objects, and integration of gameplay elements that define the interactive experience.
Ludic	Derived from the Latin word "ludus" meaning play.
Ludology	The study of games, particularly of computer games.
Match	A match in Valorant is composed of multiple rounds and is typically set up as a "best of 25" format. The first team to win 13 rounds wins the match. The match is divided into two halves, with each team playing 12 rounds as attackers and 12 rounds as defenders. After the first 12 rounds, teams switch roles during what is called "halftime." Matches are intended to test a team's tactical skills across a variety of rounds, requiring adaptability to both offensive and defensive strategies within the same match.
Metrics	Metrics is a term used in game design to encapsulate gameplay-based measurements that describe size and movement properties of player's avatars in-game.
Player	Space-User

Rounds

A round in Valorant is a segment of the game during which one team tries to plant the Spike at a designated site, and the other team attempts to prevent this or defuse the Spike if it has been planted. Each round is a self-contained battle with a fixed duration, beginning with a buy phase for purchasing equipment and followed by an action phase where the main objectives are pursued. Rounds end either when the Spike explodes, is defused, all members of a team are eliminated, or the time runs out. A typical round duration is about 100 seconds for the action phase, plus 30 seconds for the buy phase.

Spike

In Valorant, the "Spike" is an objective item that the attacking team must plant at a designated site, while the defending team aims to prevent this or defuse the Spike if it gets planted. The game mode is won by either the Spike detonating, successful defusal, or eliminating the opposing team.