Using a Capability Sensitive Design Approach to Support Newcomers Well-being

by

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Abstract

Newcomers transitioning to a new country face many challenges, and their well-being is impacted due to unfamiliarity with self-navigating in a new environment. This thesis explores how Capability Sensitive Design (CSD) can be operationalized to guide the end-to-end design and evaluation of technologies that support the well-being of newcomers during life transitions. While the CSD framework has recently been investigated in Human Computer Interaction (HCI) for its ethical focus on supporting what individuals have reason to value, there remains a gap in how it can be translated into concrete, scalable technology design processes. To address this, we present a multi-stage methodology that includes formative interviews, co-design sessions, prototype development, and a longitudinal field study to evaluate the application prototype.

We begin by mapping the lived experiences of newcomers using a capability-oriented interview protocol and with the use of a capability board to surface valued goals and challenges. This informed a co-design process using modified capability cards, where both newcomers and organizational stakeholders ideated design features aligned with the ten central capabilities. Drawing on these insights, we developed the Newcomer App—a multilingual mobile platform offering four core features: goal-oriented planning, capability-aligned suggestions, resource search and browsing, and reflective tracking. We evaluated this platform in an eight-week field study that included in-app activity logging and post-study interviews. Our findings show that newcomers were able to identify capability-aligned goals which they found helpful, translate them into intentional plans, and reflect on both their achievements and the conversion factors that influenced outcomes. Importantly, we observed how CSD-informed features constructed self-discovery, increased agency, and facilitated social contribution, particularly in the capabilities of social connection, emotional well-being, and community participation. The study also highlighted the importance of contextual and social barriers in determining whether users could turn suggestions into meaningful actions.

This thesis contributes an operational model for applying CSD across the full design lifecycle, offering insights for researchers and practitioners. By translating ethical commitments into deployable technologies, our work extends prior research in HCI and design social justice, demonstrating how technologies can support equitable pathways toward well-being for marginalized groups, such as newcomers in navigating complex transitions.

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Chapter 1

Introduction

Newcomers, who are immigrants and refugees, play a significant role in shaping the population and identity of a country. According to Statistics Canada (2016), immigrants represent 21.9% of the total population of Canada [19]. The federal government recently set a new record-high target for immigration, aiming to welcome 500,000 new immigrants per year by 2025 [21], but also recently curtailed immigration levels with stabilization of population growth and the housing market as key motivations for this change [45].

Research demonstrates that immigrants are generally healthier than the Canadian-born population upon arrival; however, across every immigration category, the longer they live in the country, the more their health deteriorates. This phenomenon of arriving with a health advantage and losing it over time is called the "healthy immigrant effect" [18, 126], which has not only been found in North America but also in Europe and Australia [68, 10, 111, 53]. Diverse factors contribute to the decline in health outcomes among immigrants, such as income levels, official language proficiency, circumstances of arrival (e.g., refugees who experienced oppression, conflict, violence and persecution), unfair treatment or discrimination, health literacy, ability to integrate and secure meaningful and fulfilling employment [126]. Prior research shows there are various social, cultural, and structural barriers that hinder newcomers from fully participating in their new communities [2].

To address these challenges, researchers have shared how technologies such as social media and online forums can act as mediators. However, to enhance the abilities of newcomers and to regain their sense of agency, connection, and fulfillment of their abilities within the new environment, there is a lack of technical solutions that can help newcomers to rebuild their lives with a positive mindset.

To provide a new perspective on newcomer health challenges, this thesis uses Capability

Sensitive Design (CSD) [47], a framework derived from Value Sensitive Design (VSD) [37] and Capability Theory [66, 76, 106], to inform and evaluate the design of a technological solution for access to health and social services. Capability Theory is a political philosophy and human rights theory grounded on the premise that all human beings are equal and entitled to have ten basic capabilities, e.g., to have a complete and satisfying life into old age, good health, control over one's material and political environment, social connections, etc.

There are a few key ideas behind Capability Theory. The first idea is *conversion factors*, factors that make it more likely for people to take advantage of certain resources or opportunities. Often, simply providing resources or opportunities is not sufficient to ensure well-being. Newcomers often express a desire to independently manage their integration journeys but face obstacles that prevent them from doing so. For instance, a healthcare program may offer free medical check-ups for newcomers, but if a newcomer lacks transportation, childcare, or an understanding of the healthcare system, they may still be unable to access these services. The conversion factors here include personal (e.g., language skills, education), social (e.g., discrimination, community support), and environmental (e.g., transportation, accessibility) conditions that influence whether an individual can transform available resources into meaningful outcomes.

The second idea is that capabilities are also intricately dependent on one another—a weakened capability can negatively influence many other capabilities, causing *corrosive disadvantages*, and a strengthened capability can in turn boost many other capabilities, leading to *fertile functioning*. Likewise, it is important for newcomer-serving organizations to consider these conversion factors in their service delivery. For example, by offering a discounted bus pass and on-site child care, service organizations are providing the enabling conditions for a newcomer to take up regular exercise such as on- or off-site swimming. In this thesis, the term 'newcomer' refers to individuals who migrate to a new country, whether as immigrants or refugees.

These concepts give rise to two assumptions underlying this work: that (a) conversion factors need to be explicitly supported before newcomers can take advantage of available resources/opportunities, and (b) addressing fertile capabilities may be most impactful, because they can in turn positively impact many other capabilities. With these assumptions in mind, this work focuses on the following thesis statement:

> Capability Sensitive Design (CSD) approach can be used throughout a technology development cycle to allow designers to identify conversion factors and fertile capabilities in a personalized way, map resources that can enhance con-

version factors, and design functionalities that enable newcomers to take concrete and beneficial actions towards improving their capabilities during their transition to a new country.

To defend this statement, the remainder of this dissertation addresses the following research questions:

RQ1: What are the most important conversion factors and fertile capabilities in the newcomer settlement context?

RQ2: What technology interventions can help newcomers develop agency towards addressing their own capabilities?

RQ3: How can CSD be adapted to guide the end-to-end design of a capability-centered resource navigation system for newcomers?

1.1 Research Scope

In this thesis, I explore how CSD can be applied to design technological solutions that can address social determinants of health for newcomers. By framing this challenge through the lens of capabilities, this thesis examines the conversion factors—such as individual skills, societal norms, and environmental conditions—that influence the transformation of available resources into meaningful outcomes. The broader perspective lies in describing the process of designing and evaluating a mobile app, called the Newcomer App (Figure 5.8), that can be helpful to support equitable access to well-being by helping individuals navigate social determinants of health. This effort is grounded in a social justice approach, which recognizes that fair access to opportunities and support systems is essential for individuals to lead lives they have reason to value. By addressing disparities in access to health, education, and social resources, the app seeks to mitigate systemic barriers faced by newcomers. Capability Sensitive Design was used throughout the design process—including problem finding, feature definition, prototype design, system development, and field evaluation—to align technological interventions with users' real freedoms.

1.2 Thesis Overview

This thesis contributes to the growing field of Capability Sensitive Design (CSD) through the exploration of a nuanced understanding of capabilities and the possibilities and limitations of designing interventions to enhance them. Below is a summary of each chapter.

Chapter 2: The topics relevant to the idea of Capability Sensitive Design and technologies related to supporting newcomer settlement.

Chapter 3: A qualitative study that explored newcomers' important capabilities and conversion factors toward their well-being. By focusing on the well-being of newcomers, this work highlights the importance of bypassing the systemic barriers and individual conversion factors that influence their ability to transform resources into meaningful outcomes.

Chapter 4: I introduce an ideation-based method to generate capability-based planner for newcomers, specifically a digital journaling tool guided by newcomer-specific goals and priorities based on a list of capabilities for well-being.

Chapter 5: I describe the process of using Capability Sensitive Design (CSD) as a method from the beginning to the end of a technology design cycle and share the challenges of designing using capabilities.

Chapter 6: I present a field study of a resource navigation application to explore the different approaches newcomers take to address their conversion factors, specifically through navigation-based interventions and goal-setting. By framing as capability-based interactions, the research underscores the value of supporting individuals in identifying, accessing, and utilizing resources and opportunities that contribute to their physical, emotional, and social well-being.

Chapter 7: I discuss how CSD can be generalized with the implications and open questions to move forward, and conclude with future research directions.

Chapter 2

Related Work

This thesis builds on three areas of research: (1) capability and well-being, (2) capability-based goal setting during life transition, and (3) operationalizing Capability Sensitive Design (CSD) to design and evaluate technology.

2.1 Capability and Well-being

We first begin with background information related to social determinants of health for newcomer integration, the Capability Approach and Capability Theory, followed by examining the concepts of corrosive disadvantages and fertile functionings in shaping well-being, and discuss Capability-Sensitive Design (CSD) as a methodology for applying these ideas in technology design for newcomer well-being.

2.1.1 Social Determinants of Health and Newcomer Integration

Social determinants of health (SDoH) are factors beyond medical care that impact people's health and well-being [65, 91, 92]. Arguably, SDoH factors and their effects are more acute/pronounced for newcomers, as they need to quickly adjust to their new environment. Analyzing research on immigration over the last decade, Sabie et al. [98] and Krüger et al. [56] highlight the importance of deploying non-traditional methodologies for contextualizing health by understanding immigrants' daily lives. Holistic integration should address social factors (e.g., social connection, community welcome, adaptation of policies and services), interactional factors governing how individuals fit within a context (e.g., language,

cultural and functional integration), and subjective factors (e.g., sense of belonging, safety and security) [129]. Other integration strategies include place-based policies [128], services targeting food insecurities, unemployment, language barriers and healthcare [49, 72], as well as measures for fostering social connection, such as arranging for initial stay in housing with people from a similar background [70].

These social determinants highlight the need for design approaches that not only address structural barriers but also expand the real opportunities individuals have to lead lives they have reason to value—an essential step toward supporting newcomer well-being.

2.1.2 Capability Approach and Capability Theory

The Capability Approach, as developed by Sen in economics and Nussbaum in philosophy, offers a holistic framework for assessing human well-being by shifting the focus from traditional indicators, such as quantities of resources and accessible goods, to individuals' capabilities. While Gross Domestic Product (GDP) and Gross National Product (GNP) per capita have traditionally been used to measure a country's welfare, in 1980, Sen [108, 106, 109, 107] pioneered the Capability Approach, which was further developed by Nussbaum [66, 78, 79, 81] and many other scholars [28, 6, 95]. Within this framework, development is viewed as the process of "expanding capabilities, or giving individuals the freedom to realize more and better functionings" [35].

According to Sen, "capabilities are what people are actually able to do and to be." [108] These doings and beings, which Sen calls *achieved functionings*, together constitute what makes a life valuable. Nussbaum's Capability Theory [66, 76, 77] is a more structured version of the Capability Approach that provides a comprehensive framework for evaluating human well-being based on capabilities. According to this theory, all human beings are morally equal and deserve a life worth living. They are also entitled to have ten basic capabilities, such as being able to live a normal length of lifespan, maintain bodily integrity, have control over one's material and political environment, have social affiliations that are meaningful and respectful, etc.

Nussbaum emphasizes that capabilities should be understood as *freedoms*, where individuals have the choice of whether or not to utilize the available capabilities; and these freedoms are partly what determines the extent of one's functioning. For example, a Somali refugee and an Irish hunger striker are both severely undernourished, but the Irish hunger striker can be considered as having better functioning because he/she is exercising a choice in fasting to achieve a political purpose. [105]. As another example, imagine two individuals: Alice relies on specialized medical equipment to maintain mobility; this not

only addresses her medical needs, but enables her to pursue her interests, engage in social activities, and lead an independent life. In contrast, Bob, in good health, receives routine healthcare services. According to Robeyns [96], Alice fares better, because her healthcare provisions enhance her capabilities beyond health and align with her values.

These examples illustrates the implication of Capability Theory for service provision—well-being is not solely determined by access to services, but by the extent to which the services *enable* individuals to lead lives they value. It is important to note that Nussbaum's list of ten capabilities has faced some criticism for being paternalistic and bypassing democratic processes or public reasoning [25, 22]. In response to this criticism, Nussbaum argues that the list of capabilities is kept intentionally abstract to allow citizens and stakeholders to actively shape the definitions of these capabilities for their problem specific contexts [78].

2.1.3 Corrosive Disadvantage and Fertile Functioning Towards Well-being

To enable practical applications of Capability Theory, Wolff and de-Shalit [131] expand upon the Capability Approach by defining *disadvantage* as a genuine lack of opportunities to exercise one's functionings. They argue that true capabilities exist when the associated costs, including the impact on other functionings, are reasonable, and this is context-dependent. Their vision of a more equitable society involves not only targeting the most deficient functionings but also understanding why multiple disadvantages tend to cluster. They advocate for a "society of equals," where it becomes increasingly unclear who is the worst off. To achieve this, they emphasize identifying the least advantaged by comprehending the interconnected nature of their disadvantages.

Wolff and de-Shalit further propose a relational approach, with governments focusing on how patterns of disadvantages are created and sustained, distinguishing between *corrosive disadvantages* that exacerbate harm and *fertile functionings* that provide additional benefits [132]. Corrosive disadvantages represent obstacles that not only harm individuals directly but also tend to lead to further disadvantages, thereby restricting their ability to achieve other capabilities. For instance, physical violence is highly corrosive as it impacts physical and emotional health, the sense of safety/security and mobility [88]. Likewise, lack of access to quality healthcare is a corrosive disadvantage, impacting an individual's health and subsequently limiting their educational and employment opportunities. On the other hand, fertile functionings are valuable capabilities that hold intrinsic worth and also promote the development of other important capabilities [132]. Social affiliation is a fertile

capability that not only fosters well-being but leads to various advantages. In practice, when an individual from a low income family with limited access to quality education (a corrosive disadvantage) gains access to a fertile functioning like social affiliation through community support, it not only guides to support for their well-being. This also opens up a new paradigm to explore how these ethical values can be integrated into design.

2.1.4 Capability Sensitive Design

One of the most prominent ethics by design approaches is Value Sensitive Design (VSD): a design methodology that aims to address and account for values in a "principled and systematic manner throughout the technical design process" [38]. However, despite being a highly promising approach to ethics by design, VSD has been criticized for not providing enough practical guidance in actual design processes; as well as for taking stakeholder values as leading values in design processes without questioning whether these stakeholder values should be valued; and for not being able to provide normative justification for making value prioritizations and trade-offs in the design process [47, 48].

In recent years, many researchers have tried to complement VSD by adding other mid-level ethical theories. For example, Van Wynsberghe [125] connected VSD with care ethics, and later Cenci and Cawthorne [22] added a capability-based approach to ethics. Finally, Jacobs [47] proposed a framework called Capability Sensitive Design (CSD), which combines VSD [37] and Nussbaum's Capability Theory [80, 82]. CSD focuses on enhancing users' real opportunities to pursue lives they have reason to value. A key tenant of CSD is that the provision of resources/opportunities alone does not guarantee that people can actually take advantage of them, and that a host of conversion factors—personal factors (e.g., metabolism, physical condition, gender, intelligence, technical competence), social factors (e.g., public policies, social norms, societal hierarchies, power relations introduced by gender/race) and environmental factors (e.g., the physical or built environment in which a person lives, access to transportation, etc.)—are required to convert resources/opportunities into functionings, e.g., what people can achieve in terms of beings and doings. The importance of addressing conversion factors were mentioned by both Oosterlaken [86, 87] and Toboso [117, 118].

Claassen recommends that CSD practitioners follow the "philosopher-investigator" approach [26] of actively engaging with real-world contexts, learning from public debates, and conducting social scientific research to identify the capabilities that people value most, in line with Nussbaum's approach to open discussion and adaptation. These values can then be translated into technology features through the construction of a value hierarchy [123],

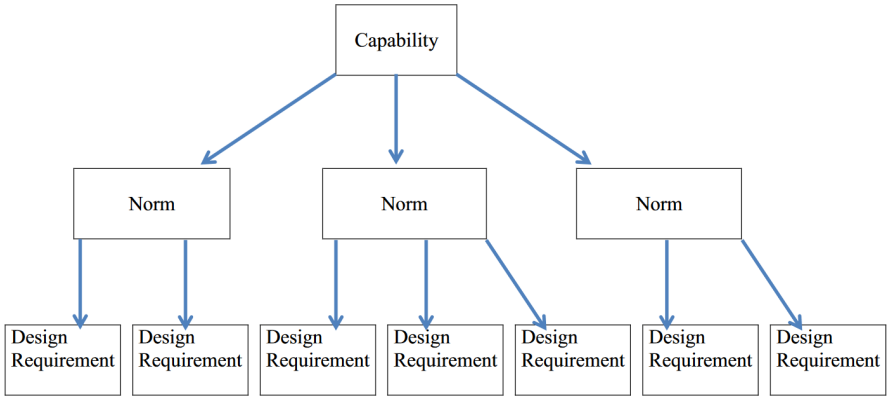


Figure 2.1: The Capability Hierarchy — at the top level are the core capabilities that are influenced by societal norms, which shape expectations, access, and constraints. Design requirements emerge from each norm to create interventions that support and enhance capabilities [47].

first translating values to norms (i.e., a set of prescriptions for and restrictions on action), and then translating the norms to design requirements. The translation from abstract values to specific norms adds context or domain-specific considerations, and the adequacy of this translation is assessed based on whether the norms sufficiently encompass, engage and respond to the values [122, 123]. Jacobs [47] extends the value hierarchy and proposes the use of a *capability hierarchy* for CSD practitioners (see Figure 2.1). As an example, in designing a technology for mental health, a path through the capability hierarchy can be "maintain bodily integrity" (capability), "have confidential conversations" (norm), "ability to choose between private and broadcast messaging in a group therapy platform." (design requirement)

As the goal of this thesis is to support newcomer well-being using CSD, building upon its foundations, we now turn to how these principles can be practically applied through capability-based goal setting, particularly during newcomer life transitions.

2.2 Capability-based Goal Setting During Life Transitions

In this section, we explore how goal setting with an underlying CSD framework can help individuals, such as newcomers, support their well-being.

2.2.1 Understanding Life Transitions and the Need for Support

According to Bridges, a life transition is not merely an event, but "the inner *re-orientation* and *self-redefinition* that people go through" [14]. Some researchers view life transitions as *turning points* [58] within the developmental framework. These turning points can lead to changes (e.g., changes in relationships, roles, routines, and wellness) as a result of a planned or unplanned event or a crisis. Adapting to new circumstances and identities can result in personal growth and development [67, 130]. A study by Brammer *et al.* [12] found that coping skills consisting of support networking, cognitive restructuring, problem solving, and stress management are key to determining the emotional intensity of the transition. The study also found that perceiving the event as a normal part of living can help to alleviate the stress of the transition. Other studies found that immigrants who move to a new environment from their home country require optimism [16], a positive view of self [57], and engagement in compassionate interactions (such as caring for others) [89] as useful coping mechanisms for transition.

Although these studies have looked at general coping strategies of people going through a life transition, self-understanding of one's impacted capabilities was not a primary focus, even though this knowledge can be crucial during the time of transition. In addition, how people prioritize and address the affected capabilities can be quite individualized, resulting in differential effects on well-being depending on the individual's values, beliefs and background. This thesis aims to explore how newcomers take action by setting goals to address capability gaps during life transitions, particularly through an open-ended task of action planning.

2.2.2 Applying Capability-Based Approaches to Goal Setting

Grounded in the Capability Approach, setting goals during life transitions requires identifying not just immediate needs but broader aspirations, focusing on expanding individuals' real freedoms to achieve the lives they value. According to Latham and Locke [62], goal-setting is a form of self-regulation, where "conscious human behaviour is purposeful [and] regulated by the individual's goals". One theory suggests that newcomers try to achieve three basic goals—maintenance of heritage culture, participation in the host society, and maintenance of psychological and physical health [99]. Several motivational strategies have been developed to help individuals in setting achievable goals and working toward them. One such strategy is Mental Contrasting (MC), which links people's desires to the barriers that hinder their realization [85]. Through MC, individuals identify a wish and explore it by vividly imagining the best possible outcomes of achieving it. Similar to this approach,

we use a capability-based reflective journaling approach to set goals that promote a list of capabilities essential for human well-being. This approach can assist individuals to not only think about abstract goals but also to set capability-centred goals by identifying their priority capabilities and actively addressing them through processes of reflection and commitment to actions.

2.2.3 Using Reflective Journaling toward Positive Action

Digital journaling is a key component of reflective journaling, where users can document their experiences, taking concrete actions to address capabilities. During life transitions, people's sense of well-being often declines, and research has found that journaling can be an effective tool to promote positive thinking and improve mental well-being [55, 33, 93, 52]. In addition, reflecting and journaling stressful negative events can increase greater awareness of their positive benefits (i.e., the "silver lining") [121]. Compared to analogue journals, digital journaling tools incorporate the use of technology and can help users manage their well-being by programmatically encouraging positive thinking and self-reflection [51, 74, 9]. Prior work in HCI has explored a variety of methods to enhance analogue journaling practices through the use of technology. For example, data-enabled journaling tools that prompt users to annotate visualizations of collected physiological data have been shown to significantly increase user engagement with self-reflection tasks [102, 94]. Bentley et al. [11] found that reminders can influence logging frequency and increased logging can lead to enhanced reflection. Sayis and Gunes [101] showed that the use of embodied agents (social robots and voice assistants) can be a viable method for eliciting rich journal writing. Other research investigates the use of text-based conversational agents such as Wysa [46] and Woebot [29] to guide users through mental health problems. Finally, health informatics research has shown that machine learning techniques can be applied to analogue journal entries to extract insights about mental well-being and resilience [84]. Together, these studies illustrate how journaling practices mediated by technology can be impactful in facilitating reflection, improving data comprehension, and supporting mental health. Building on these insights, we designed a tool called Life Transition Journal (LTJ) (details in Chapter 4) to incorporate key features of digital journaling, such as visualizations that highlight the capabilities addressed most frequently vs unaddressed ones and reminders to help users track their progress.

Building on this body of work that emphasizes the role of capabilities in guiding intentional goal-setting during life transitions, we now explore how Capability Sensitive Design (CSD) has been applied in the design and evaluation of technologies to support individual well-being and social justice.

2.3 Capability Sensitive Design and Applications

Recent work across multiple domains demonstrates the evolving use of Capability Sensitive Design (CSD) and the Capability Approach (CA) to inform technology and intervention development that centers marginalized groups. This section synthesizes how researchers have operationalized CSD principles to uncover needs, align interventions with users' valued goals, and anticipate ethical challenges.

2.3.1 Designing Technologies for Newcomers: Research in HCI

There has been a growing body of research in HCI on technological solutions for newcomer immigrants and refugees, related to transition [15], settlement [64, 90, 54, 110], safety [112, 100], and well-being [5, 27, 98].

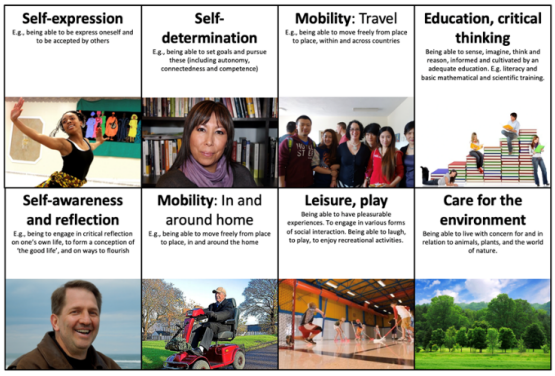
Prior research in HCI related to immigrants' capability to receive support shows key misalignment where immigrants view their journey as iterative with overlapping goals, whereas service advisors consider this a structured sequence of prerequisite steps [119]. AI-generated visual narratives could help structure and adapt information-sharing to align with both perspectives [119]. Similarly, Seguin et al. [103] examine how digital platforms can support scaling up services for immigrants by improving access to organizational knowledge and volunteer coordination. This points to the need for digital tools that not only facilitate personal guidance but also strengthen collective support networks. Similar challenges extend to having a healthy lifestyle, where economically disadvantaged immigrants face financial difficulties when seeking medical assistance [120]. Unfamiliarity with healthcare systems, language barriers, and cultural differences often prevent them from accessing necessary healthcare services.

In studying challenges to have social connections, Almohamed et al. shared the importance of social media to facilitate connections between newcomers and nonprofit organizations [7, 8]. On the other hand, platform affordances like metavoicing (prompting to leave positive messages about one another) and social connecting foster trust in local communities and enhance the advantages of community commerce, such as meeting local people, learning social norms, and facilitating transitions to a host society [43]. Research studies from Liaqat and Nunez et al. [59, 60, 61, 75] illustrated how incorporating cultural elements into technology design can improve social connectedness through shared connections with immigrants of different generations or separated from their loved ones.

To improve newcomers' capability to express themselves, Brown and Grinter [17] implemented a phone-based, human-in-the-loop translation platform to foster communication

between Caribbean refugees and African American mentors in the United States; their findings show the importance of human translators in building refugees' trust in mentors. In addition, there is a strong need for flexible, convenient, and readily accessible support tools for newcomers. Saksono et al. [100] shows how the StoryMap app helped immigrant and low-income families build healthy habits by supporting reflection on physical activity and learning from similar others. It also created a safe and supportive space for parents and children to talk about exercise together, reducing stress and building confidence around staying healthy. On the other hand, English Language Learners (ELL) can be considered to create socialization opportunities, which can act as an avenue for informal language learning [1]. Finally, research also shows that newcomers need time to develop trust as they adapt to a new country [32, 31] and that the uncertainty as well as real and perceived risks of online activities can hinder newcomers' use of online platforms to access local resources [40, 44, 42].

2.3.2 Capability-Based Tools in Participatory Design



(a) Example of some prototype capability cards developed by Steen [113].



(b) Example of some capability cards developed by Jansen et al. [50]

Figure 2.2: Practical tools to use CSD in designing projects.

Several studies have demonstrated how CSD can serve as an ethical lens during the early stages of technology development. While tools such as Envisioning Cards [36] in VSD help facilitate ethical reflection during design, there remains a lack of practical tools within CSD to support structured discussion and informed selection of which specific capabilities

a solution should prioritize. Steen [113] proposed 24 Capability Cards (see Figure 2.2a) using the Capability Approach to design for well-being. These cards were intended to support discussions about human capabilities in the context of project management—to articulate shared goals in preparation for the project work in aligning different project partners' ambitions, or to evaluate progress in project meetings. On the other hand, Jansen et al. [50] proposed 20 capability cards (see Figure 2.2b) to initiate conversation. To operationalize CSD, Van de Poel et al. [124] applied capability cards in participatory workshops with small-scale farmers across Spain, Colombia, and Namibia, aiming to support fairer and more socially just bio-based value chains. The cards helped participants articulate capabilities they valued, such as economic stability, environmental stewardship, and social inclusion, thus grounding technical decisions in local aspirations. Similarly, Gebarski [39] used customized capability cards with street-connected children to explore how they perceive and prioritize their own capabilities. These studies illustrate that capability-based tools can successfully bridge the gap between normative theory and participatory practice, and capability cards need to be contextualized. Rather than focusing on individual aspects in isolation, this thesis analyzes how these capabilities interact, particularly through the lens of corrosive and fertile capabilities—where limitations in one area may negatively impact others, or where strengthening a capability can create positive ripple effects. By adopting this broader perspective, we share a deeper understanding of how technology can holistically support newcomers, considering the interconnected nature of their well-being and settlement experiences.

2.3.3 Lessons and Challenges from Applying CSD in Diverse Contexts

While the application of CSD offers significant benefits, researchers have identified key challenges in real-world contexts. Gebarski [39] noted that the abstract nature of capability cards can present difficulties for certain groups, such as children, unless adapted through long-term engagement. Van de Poel et al.[124] faced barriers related to language, trust-building, and resource limitations in Namibia, which impacted the ability of local farmers to fully participate. In clinical environments, Timmermann et al.[116] acknowledged that practical constraints, such as limited consultation time, may restrict the depth of ethical dialogue needed to fully align rehabilitation technologies with patient goals. Nevertheless, these experiences demonstrate that with thoughtful adaptation, CSD can offer a flexible, context-sensitive approach for promoting social justice, user empowerment, and ethical integrity in technology design.

Our work builds on prior research by operationalizing CSD across the entire technology design process which we discuss in the next chapters—from eliciting newcomer needs and mapping valued capabilities, to designing and evaluating a capability-based application—thus moving beyond conceptual discussions to demonstrate how CSD can guide practical, end-to-end technological interventions that support newcomer well-being and integration.

Chapter 3

Mapping Newcomer Needs and Capabilities

Through the lens of Capability Sensitive Design (CSD), I first conducted an interview study to understand newcomers' most valued capabilities, as well as the conversion factors, corrosive disadvantages and fertile functionings that are most relevant to the newcomers' health and social service navigation problem. These were semi-structured in-person interviews with both newcomers (Study 1a) and representatives from health and social service providers (Study 1b) to answer the following research questions -

- **RQ1.** What are the most important and affected capabilities of newcomers, and what coping strategies do newcomers currently use to maintain these capabilities?
- **RQ2.** What are the capabilities that lead to corrosive disadvantages vs fertile functionings in this context?
- **RQ3.** What capability gaps did organizations identify? What are their successes/challenges in addressing these gaps?
- **RQ4.** What roles can technology play in supporting capabilities, especially those that lead to fertile functionings?

This research project received approval from a coordinated ethics review board, consisting of our university and several local public hospitals.

3.1 Participants

Study 1a We recruited newcomers who are 18+, immigrated to Canada in the last 5 years, and living in a particular region of Canada that our non-profit partner organization serves. We distributed flyers where newcomers generally visit or seek support, such as settlement agencies, community centers, medical clinics, places of worship, public libraries, food banks, and ethnic restaurants. The flyers and screening surveys were translated into the seven of the most common languages spoken by newcomers in the recruitment region. We attended various in-person events, such as Newcomer Family Days, Multicultural Festivals, Information Nights, and English Conversation Circles, to recruit newcomers for the study. Individuals who answered the screening survey were contacted by phone call and/or email, and scheduled to attend an interview session at a convenient location with access to quiet rooms, such as public libraries, community centers, etc. To converse with participants who speak little to no English, we used an on-demand interpretation service called VOYCE [127] during the recruitment process and hired interpreters to attend the interviews.

In total, we interviewed 50 newcomers (male = 17, female = 32, 1 prefer not to say) from 18 countries and 9 immigration pathways (see Table. 3.1). Our participants included protected persons, permanent residents, temporary resident workers and students. Of the 50 participants, 41 had at least a Bachelor's degree or higher qualifications and among whom 17 were unemployed and seeking employment during the time of the interview sessions. We conducted the majority of our sessions in small groups (18 sessions, 2-3 participants, 2 hours in duration), while the remaining were conducted one-on-one (13 sessions, 1 hour duration). For the group interviews, we grouped participants of similar ethnicity and language to leverage common cultural ground and build trust during these sessions. We covered nine languages, including English, for the interview sessions based on our participants' preference supported by professional interpreters.

Study 1b We recruited members of settlement agencies and health / social service organizations that primarily support newcomers in the same region as mentioned in Study 1a. For organizations, the flyers and the screening survey were distributed in English, which is the primary language for running their day-to-day operations. Individuals who shared interest by answering the screening survey were further screened, contacted via email, and scheduled for an interview session at their respective organizations. We interviewed 16 members of 13 organizations who primarily support newcomers (see Table. 3.2). All of the interviews were in English where we conducted the majority (14) of them in a one-on-one

PID	Age	Gender	Immigration Pathway	Immigrated from
N1	30-39	Woman	Refugee Settlement Program	Colombia
N2	40-49	Woman	Study Permit	Nigeria
N3	40-49	Prefer not to say	Work Permit	Hong Kong
N4	30-39	Woman	Work Permit	Hong Kong
N5	40-49	Woman	Family Reunification Program	Pakistan
N6	30-39	Man	Work Permit	India
N7	30-39	Woman	Spousal Open Work Permit	India
N8	30-39	Woman	Express Entry	Nigeria
N9	30-39	Man	Express Entry	Nigeria
N10	18-29	Woman	Study Permit	Nigeria
N11	40-49	Woman	Foreign Worker Stream	China
N12	50-59	Woman	Refugee Settlement Program	Pakistan
N13	40-49	Woman	Express Entry	India
N14	30-39	Man	Provincial Nominee Program	Russia
N15	30-39	Woman	Provincial Nominee Program	Russia
N16	30-39	Man	Express Entry	Nigeria
N17	40-49	Man	Refugee Settlement Program	Turkey
N18	30-39	Woman	Spousal Open Work Permit	India
N19	30-39	Man	Work Permit	India
N20	18-29	Woman	Study Permit	India
N21	18-29	Man	Study Permit	India
N22	50-59	Man	Provincial Nominee Program	South Korea
N23	30-39	Woman	Express Entry	Nigeria
N24	60-69	Man	Refugee Settlement Program	Pakistan
N25	40-49	Man	Work Permit	India
N26	40-49	Woman	Refugee Settlement Program	Palestine
N27	30-39	Woman	Work Permit	Russia
N28	30-39	Woman	Refugee Settlement Program	Afghanistan
N29	18-29	Woman	CUAET (Ukraine Emergency)	Ukraine
N30	18-29	Man	CUAET (Ukraine Emergency)	Ukraine
N31	18-29	Woman	Refugee Settlement Program	Iraq
N32	40-49	Woman	Refugee Settlement Program	Sudan
N33	30-39	Woman	Refugee Settlement Program	Sudan
N34	18-29	Man	CUAET (Ukraine Emergency)	Ukraine
N35	40-49	Woman	CUAET (Ukraine Emergency)	Ukraine
N36	30-39	Man	Express Entry	Nigeria
N37	18-29	Man	CUAET (Ukraine Emergency)	Ukraine
N38	30-39	Man	Refugee Settlement Program	Colombia
N39	40-49	Woman	Express Entry	Malaysia
N40	40-49	Woman	Refugee Settlement Program	Colombia
N41	40-49	Woman	Refugee Settlement Program	Colombia
N42	18-29	Woman	Study Permit	Mexico
N43	18-29	Woman	Study Permit	Nepal
N44	18-29	Woman	Work Permit	Nepal
N45	18-29	Man	Study Permit	India
N46	40-49	Woman	CUAET (Ukraine Emergency)	Ukraine
N47	40-49	Woman	Family Reunification Program	Vietnam
N48	18-29	Woman	Study Permit	China
N49	30-39	Woman	Study Permit	India
N50	30-39	Man	Work Permit	South Korea

Table 3.1: Demographic profile of our 50 newcomers participants

PID	Type of organization	Services	Role
O1	Education	Employ community and social worker	Multilingual Language Learner Consultant
O2	Social	Culturally sensitive counseling	Administrator
O3	Social	Volunteer support and information service	Community Engagement
O4	Social	Newcomer settlement and navigation	Case Manager
O5	Social	Shelter, career, childcare for women	Interim Social Enterprise Coordinator
O6	Social	Assist and advocate for refugee claimants	Caseworker
O7	Social	Shelter, career, childcare for women	Entrepreneurship and Employment Coordinator
O8	Health	Navigation, referrals and advocacy	Case Manager/Health Care Coordinator
O9	Health	Mental health and developmental support	Self Help Group Facilitator & Peer Support
O10	Social	Employment, language, recreation	Settlement Worker
O11	Health	Newcomer mental health, nutrition, senior programs	Newcomer Mental Health System Navigator
O12	Health	Refugee healthcare, counseling and navigation	Manager of Primary Care
O13	Social	Multicultural centre: translation, interpretation	Language Interpreter
O14	Social	Find housing, financial management	Director
O15	Health	Refugee patient healthcare	Director
O16	Social	Volunteer support and information service	Engagement Coordinator

Table 3.2: Our 16 organization participants who provide health and social support to newcomers

format (1 hour in duration) and 1 session had 2 participants (2 hours in duration).

In each of these data-collection methods or studies, participants were given a gift card valued at $25 per hour spent in an interview. Newcomers were provided an additional $5 cash for transportation (bus fare, parking, etc.) to the interview location.

3.2 Study Design

Prior to the interview, each participant was asked to read and sign a consent form and answer a short demographic survey. All interview sessions were audio-recorded. All related materials, e.g. consent forms, demographic survey, CSD cards, etc., were translated by professional translators prior to each interview session with newcomers (Study 1a) in their preferred language.

We began the interviews by asking participants to describe their background and general experiences as newcomers or organization members serving newcomers. For Study 1a, newcomers were asked about their family situation and reasons for moving to Canada. For Study 1b, organization members were asked to comment on their organization's mission or vision, and how they define the term “newcomers" with respect to their offerings and services. We asked these questions in order to familiarize the participants to the context of the study and to help them anticipate the upcoming interview questions.

A core component for both interviews (Study 1a and 1b) was a Capability Sensitive Design brainstorming exercise that involves a set of CSD cards that I created to guide the conversations. These cards were designed based on similar cards proposed by Steen [113], who used them to facilitate the communication of shared goals in project meetings, and Jansen et al. [50], who used them in a variety of problem settings, including to address personal development, social activation, and explorations of living environments.

For Study 1a, these CSD cards include (a) ten capability cards (see Fig. 3.1a), representing the ten basic capabilities, (b) navigation cards, representing newcomer participants' activities (e.g., participated in a program, workshop, course, or some other organized event) or where they sought help to support a capability, and (c) experience cards, representing whether their experience in addressing the capability was positive (✓ cards) or negative (✗ cards). We used ten cards, unlike Steen and Jansen, to keep the number small and convenient for participants to comprehend the meaning and converse. During the brainstorming activity, each newcomer first ranked five capability cards that were most important to them and placed them on the 'capability board' (see Fig. 3.1b). They then used experience cards to describe how each capability was affected in either a positive or negative way after immigration. After that, they used navigation cards to write down services, programs, and activities that they tapped into (if any) to address each capability and placed them on the board. Finally, they used experience cards to write about the successes and challenges in finding and/or using services to address each capability. Newcomers also verbally shared their personal stories relevant to each of the points written on the cards. We finished each session with a small discussion of potential technological solutions to the discussed problems.

For Study 1b with organization members, we used a similar set of CSD cards, including (a) the same ten capability cards used in Study 1a, (b) service cards instead of navigation cards, representing the services the organization provides, and (c) experience cards, representing successes (✓ cards) or challenges (✗ cards) of delivering services to support newcomers. During the brainstorming activity, each representative first ranked five capability cards that their organization promotes for newcomers and placed them on the 'capability board' (see Fig. 3.1c). They then used service cards to write down all services they provide to address each capability and placed them on the board. Finally, they used experience cards to describe their positive or negative experience in providing these services to newcomers. Our participants also shared stories of successes and/or failures relevant to each of the points written on the cards. Similar to Study 1a, we finished each session with a small discussion of potential technology solutions that would aid organizations in providing services to newcomers.



(a) Ten capability cards (b) Newcomers capability board (c) Organizations capability board

Figure 3.1: An example of our setup with CSD cards and capability boards used during the interview sessions: (a) our ten capability cards, (b) a capability board of a newcomer participant in Study 1a and (c) a capability board of an organization participant in Study1b

3.3 Analysis Methods

We transcribed approximately 100 hours of interview data and analyzed them using a mixed coding method, e.g., deductive and inductive coding, using NVivo [83]. Firstly, we developed a codebook with (1) an initial set of codes corresponding to the ten capabilities (our ten capability cards), (2) three conversion factors from Capability Theory: personal, social, and environmental (addressing RQ1 and RQ3), (3) capability valence - negative (where the lack of a capability negatively impact other capabilities) or positive (where the possession of one capability improves other capabilities) (addressing RQ2), and (4) the technology used and technology proposed for addressing newcomer challenges (addressing RQ4). In addition, we analyzed the content of all the capability boards created by our newcomer and organization participants.

3.3.1 RQ1 and RQ3 Analysis

For RQ1, we tried to understand the capabilities that newcomers prioritized and the challenges they faced in trying to maintain these capabilities during their settlement in Canada. The inter-rater reliability between myself and a member of the Augmented Intelligence Lab (25% data coded independently by second individual) shows a moderate agreement [69], $\kappa = 0.779$, $p < .001$. Similarly, for RQ3, we tried to understand which capabilities organizations prioritized when they structure their newcomer programs and services, and the successes and challenges they encountered in the delivery. The same two members independently coded the data (25%) which shows a moderate agreement [69], $\kappa = 0.72$, $p < .001$. Using the data from the capability boards, we performed a weighted rank aggregation [4] using the PyFLAGR [3] library to understand in aggregate how newcomers and organization participants rank capabilities. We then categorized and counted all the experience cards to see which capabilities have improved (✓ cards) or declined (✗ cards) for newcomers after their move to Canada. For organization participants, we counted the experience cards to understand the frequency of their successes and failures in providing newcomer-specific support. The navigation cards were coded for each capability and analyzed to generate themes of coping strategies that newcomers adopted during their settlement period.

3.3.2 RQ2 Analysis

For RQ2, our goal was to understand how capabilities affect one another. To analyze this, myself and the second individual first independently identified all participant quotes that mention two or more capabilities, and coded which capabilities are mentioned and what effects (negative or positive), if any, one capability has on the other capabilities mentioned. We ran Cohen's κ to determine the inter-rater reliability between the two members (as shared earlier) and found a weak agreement [69], $\kappa = 0.461$, $p < .001$. The two individuals met multiple times to iterate and finalize the mapped capabilities. In case of any disagreements, both individuals resolved through discussions based on the definition of each capability. We then re-coded the data, with a final κ score of 0.737, $p < .001$ (moderate agreement). Based on this coding, we ranked each capability based on the number of mentions of it positively (or negatively) impacts other capabilities; from this, we derived the key capabilities that behave as corrosive disadvantages or fertile capabilities in the settlement context.

3.3.3 RQ4 Analysis

For RQ4, we identified all the quotes related to technology, and coded them to differentiate between "technology used", e.g., how newcomers currently use technology to address their settlement challenges, and "technology proposed", what newcomers envision to be useful technological solutions for addressing settlement challenges. Two of the members separately coded and we found a strong agreement [69], $\kappa = 0.872$, $p < .001$. In addition, based on the data analysis for RQ1 and RQ3, we identified the main problem areas to address and how fertile capabilities can be supported through the use of technology.

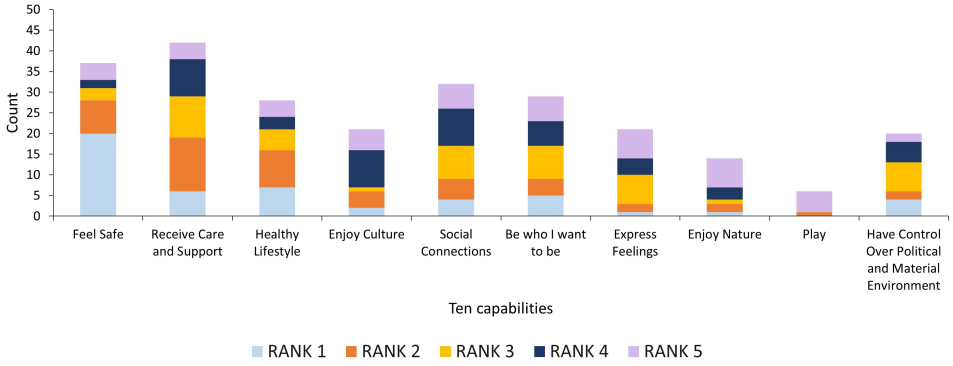
3.4 Findings

3.4.1 Key Capabilities and Coping Strategies of Newcomers

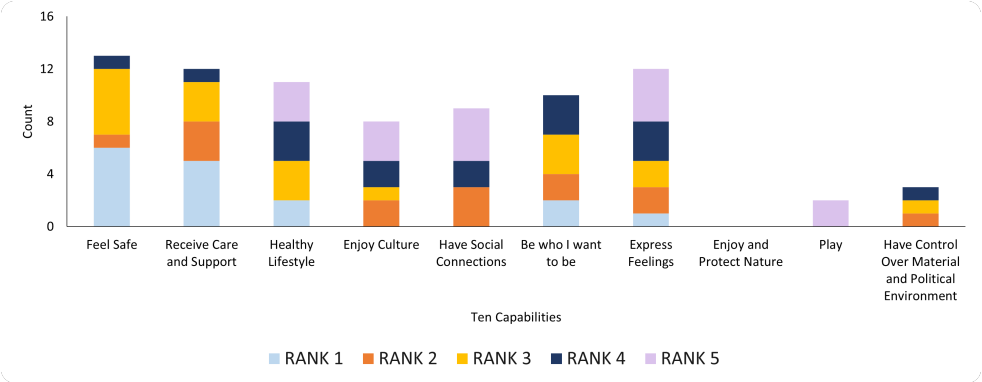
Most Important and Affected Capabilities.

Our findings show that the capabilities newcomers value are highly individualized. All ten capabilities were mentioned to some extent by our newcomer participants (see Fig. 3.2a). A majority of our newcomer participants (40%) emphasized *Feel Safe* as the most important capability, which includes the need of an abuse-free environment (e.g., physical safety) and a psychological sense of security. Another group of participants (14%) saw *Have a Healthy Lifestyle* as the most important capability, in terms of being in a state of physical and mental well-being as well as having the ability to achieve personal goals and freely explore their environments. Some participants (12%) expressed *Receive Care and Support* was crucial to strive especially being in a new country while another group (10%) valued the capability *Be who I want to be* without concerns about freedom of speech or discrimination based on gender, skin color or spoken accent.

We found an alignment between newcomer and organization priorities. Similar to newcomer participants, organization participants prioritize *Feel Safe*, *Receive Care and Support* and *Have a Healthy Lifestyle* as the top three capabilities that their organizations promote or support (see Fig. 3.2b). Table. 3.3 shows that, indeed, the aggregated ranking of the capabilities are similar between our newcomer and organization participants.



(a) Importance of Capabilities from the Perspectives of Newcomers



(b) Importance of Capabilities from the Perspectives of Organizations

Figure 3.2: Distribution of the ten capabilities ranked from 1 to 5 by 50 newcomers and 16 organization members in Study 1a and Study 1b

Voter (Capability)	Newcomer Rank	Score	Organization Rank	Score
Receive Care and Support	1	38.80	2	12.00
Feel Safe	2	34.95	1	13.83
Have a Healthy Lifestyle	3	25.10	3	10.5
Have Social Connections	4	24.95	5	8.39
Be Who I Want to be	5	21.50	6	8.33
Enjoy Culture	6	20.30	4	8.67
Have Control Over Political and Material Environment	7	17.85	8	5.28
Express Feelings	8	17.35	7	7.89
Enjoy and Protect Natue	9	16.50	10	0.00
Play	10	13.70	9	5.11

Table 3.3: Rank aggregation of the ten capabilities by 50 newcomer participants and 16 organization participants [4]

Evolution of Capabilities and Conversion Factors.

Our findings, thus far, show that all capabilities are important to some extent to different newcomers, and that newcomers and organizations have similar notions about the most relevant/important capabilities related to the settlement experience. Our findings further reveal how capabilities evolve, for the better or for worse, during settlement. Figure 3.3 shows, for each capability, the number of times newcomer participants mentioned that capability improving or deteriorating as a result of transitioning to the new country. Most of our participants felt that capabilities such as *Feel Safe*, *Have a Healthy Lifestyle*, *Enjoy Culture* and *Enjoy and Protect Nature* improved, whereas capabilities such as *Receive Care and Support* (highest ranked capability in terms of importance), *Have Social Connections* and *Express Feelings* deteriorated. Our interview data provides rich stories that shed light on the causes of these capability improvements and deterioration, especially with respect to Canada and its unique physical and socio-political environment. We summarize these qualitative findings below, organized by capability and identify the conversion factors (personal, social, and environmental).

Receive Care and Support. This capability refers to have the ability to access medical care, good food, and receive care from others in the community. Participants shared mixed feelings about receiving support in Canada. Of the 42 participants who chose *Receive Care and Support* as one of the top five capabilities, 22 felt their ability to receive support increased while the remaining shared that it decreased compared to their prior circumstances (see Fig. 3.3). Despite appreciation for free healthcare (N28), many newcomer participants think that the Canadian health care system falls short of fulfilling the basic human needs of receiving care (environmental), due to the shortage of primary care / family doctors

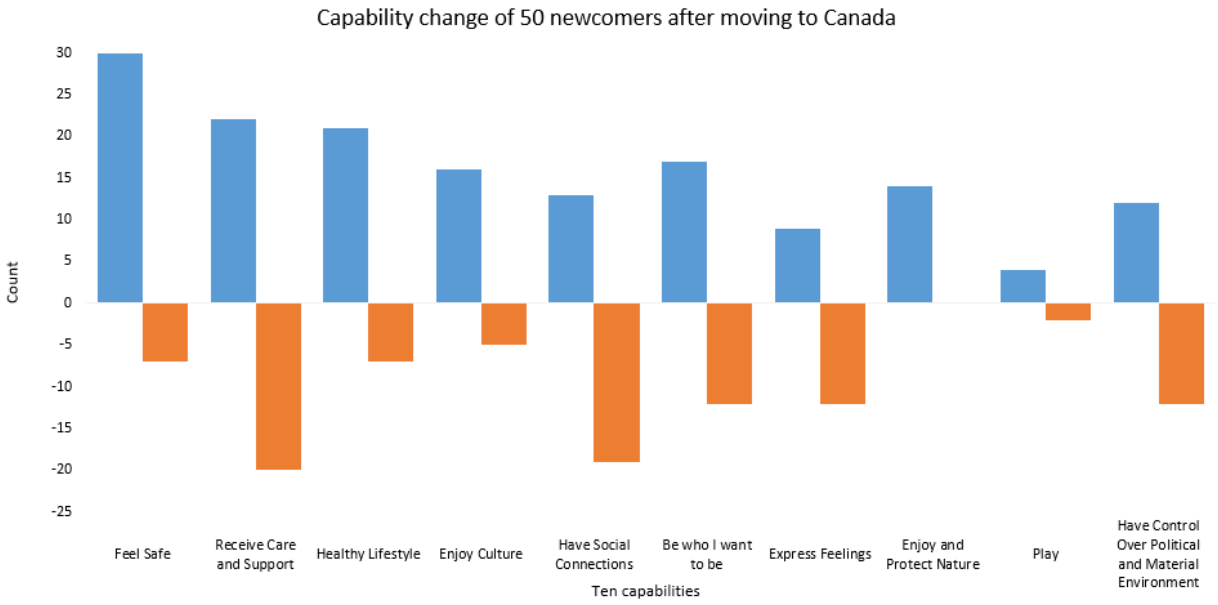


Figure 3.3: Distribution of how the ten capabilities positively or negatively changed for 50 newcomers in Study 1a

(N47, N25), long wait times for appointments (N47, N19) and specialists (N50) and at the emergency room (N47, N6), rushed appointments (N26), and lack of choices (N27). As N50 aptly summarizes, the challenge is getting "the proper treatment within the proper time." Some newcomers (e.g., N45) resorted to ignoring the illness in response to long wait time: "Most of the time it's just... procrastinating—maybe you'll get better in a week or two weeks, just leaving it like that." Some participants, e.g., N27, consider flying back to their home country for medical issues (e.g., surgeries), and have to make the tough decision weighing safety (of flying back to a potentially unsafe environment) and meeting health needs. For many (N5, N16, N17, N19, N38), it is the lack of care for their children (e.g., long wait time for specialists, lack of insurance that covers vaccination and pediatric check-ups) that bother them the most, showing that newcomers' circle of concern consistently goes beyond themselves to include their extended family.

Language barrier is a strong culprit of the decline of newcomers' ability to receive care and support (N1, N11, N28, N27, N41, N33, N50). N1 and N50 feel that the lack of interpreters prevented them from describing their symptoms accurately. N11 felt that she was being made to feel responsible for not getting proper care: "we find that it's *our job*, in order to make good use of the medical care, to learn the language to be able to communicate well with the doctors." Language barriers, compounded by short appointment

time, makes it difficult for N27 to feel that they “have enough choices", can stay “in charge of treatments" or continue to be “informed". Having language support through their ethnic community or interpreters (social) was key to receiving care and support. N33, who had interpreter help during a hospital visit, felt like there was “No discrimination", perceiving the healthcare system to be “really good”.

Transitions between immigration statuses bring uncertainty. N6 mentioned that the ambiguity regarding when individuals are expected to no longer identify themselves as newcomers leads him to feel uncertainty in various social interactions or in receiving specific services. For N28, the refugee clinic not only provides translators, but assisted newcomers by helping them book appointment and sending them reminders. Newcomers often lose access to these benefits when they transition out of the refugee status. N24, an older refugee with mobility issues, said that immigration status affects the extent to which newcomers can receive one-stop-shop care. He said, “new refugees is lucky because IRCC (immigration) is supporting everything ... a place to live, the SIN (Social Insurance Number) card, health card, bank card, mobility card ... they send agents ... they will send us car and take us to center and help us ... after one year, we are on our own, we have to do ourselves." N21 who transitioned from holding a student visa to a work permit characterized that period as being “very risky" and “costly". Several newcomers (N38, N41, N49) remarked that their immigration status prevented them from accessing certain needed services (social - e.g., food bank), sometimes in a way that felt discriminatory (N38). N1 became ineligible for legal aid after getting a full-time job as a refugee, having less than a month to raise money to pay for the lawyer that cost thousands. Having greater awareness of the potential losses of privileges as immigration status changes would create a less fragmented and more continuous feeling of care among newcomers.

Feel Safe. This capability refers to the ability to feel safe and secure, and to be in charge of one’s body. Of the 37 participants who chose feel safe as one of the top five capabilities, 30 participants felt their safety improved, while 7 shared their safety negatively impacted after moving to Canada (see Fig. 3.3). Many factors contribute to the sense of control. For N20, safe transportation (environmental) allows her to feel comfortable traveling “a lot at midnight while coming back from work".

Likewise, multiple participants (N42, N43, N35, N45) mentioned that access to safe, efficient, low cost transportation (social) would improve their mobility, allowing them stay out late and get to essential locations (e.g., university, grocery stores, etc.) quickly. Simple services like a central police number, as N47 mentioned, which some countries lack, provide a sense of safety. Social media, e.g., Twitter (X) run by police services, lets N48 “receive the latest updates of recent incidents" , giving him the ability to assess the safety of unfamiliar

areas.

One factor that severely and negatively impacts newcomers' sense of control and safety is the shortage of affordable housing (environmental). Newcomers do not always have the freedom to choose a place to live based on safety criteria. N27 did not have a car and was therefore restricted to living somewhere central, and had to stick with "the only [residence] that [he] could get". N45, likewise, mentioned that it is important to live where one does not have to "look [over] your shoulder". Newcomers express the desire to be familiar with the safety profiles of different neighborhoods. For N27, feeling safe "depends on the city", explaining: "because I'm not native to that city and I don't understand the dynamics, not always. In [my home city], I knew where I could go, where I shouldn't go".

For some newcomers, the feelings of safety or a lack of safety are determined by whether they see themselves as outsiders versus having an "in" with the local community. As N39 explains, "Being an immigrant, you have this kind of a feeling that you are not the main people ... you're basically an outsider. Does that make me feel unsafe? A little bit. Probably people [are] profiling you because you are an immigrant." In contrast, N21 described how feeling accepted by his community, and feeling confident that his community was "ready to guide" him, "share their experiences", and "show [him] how things are done here" helped him to feel safe. Likewise, for N50, the feeling of safety comes from encounters with organizations and people who are "kind" and who "try to wait to listen until [he finishes his] words."

Newcomers in our research frequently expressed that it was critical to them that they feel protected by local authorities and can trust the system. N25 recalls encountering a scary situation, but refrained from contacting local authorities: "we don't see much effectiveness to report that to police. The area where I'm living, there are mostly immigrants and they are mostly on rented homes...So, they feel like 'why bother?'" When her child is bullied, N15 found relief in the ability to change schools (social). Finally, newcomers feel a sense of safety in having the ability to express themselves through language. As N26 explains: "the best thing to protect yourself is to learn the language. This way you can defend yourself and understand what people are talking [about] nearby."

Be who I want to be. This capability refers to the ability for a human being to express their identity, live free from discrimination and according to one's conscience and moral values, and participate in activities that affirm one's identity (e.g., practice one's faith). Our participants (n = 29) shared negative (n = 12) and positive (n = 17) feelings toward conditions where this capability is improved or reduced (see Fig. 3.3). A major contributor to identity change is employment. Newcomers often have difficulty finding work that is

commensurate with their qualification and experience. Employment outcomes significantly affect newcomers' identity as active contributors to society. As N5 said,

> "I don't think I can ever be who I want to be in other someone's country. For now, I cannot... There are so many reasons for that. When the message will be spread out to the world—that we are also contributing to this country; we are not using the tax money; we are actually giving tax; we're working as much as they (local people) are working. When I will be given respect as much as the Canadian person is getting... I think it will take years to understand or adjust, to be owned and welcomed."

Experiences of discrimination, however subtle, can be perceived as threatening to newcomers' sense of self-determinism and the expression of their ethnocultural identity. Several newcomers mentioned experiencing discrimination in everyday life (N2, N14, N26) and also in the workplace (N18, N19). N2 said, "every time I take the bus, when I sit down, there is a person trying to move away from me." N18 recounts a work situation where someone approached a white colleague instead of them at the front desk for help, even though they held knowledge that their colleague didn't have. N26 experienced a situation where she was publicly ridiculed for not knowing certain rules (e.g., how to operate a parking meter). Perceiving being othered for his speech, N14 feels that "people will be making fun of you most of the time .... because of the accent."

Some positive changes were also noted. Some participants, like N20 and N21, expressed appreciation for a new-found freedom to "say what [she] feels like and also do things that [she] was afraid to do before, or couldn't do", or "wear whatever you want to, ... walk how you want to." Some participants felt that their gender and religious identities are more protected in Canada than in their home country. For example, N50 praised Canada as having "a very good culture that respect each religion and nationality", though finding a "suitable" religious community (e.g., one that is mono-ethnic, or as vibrant as the ones they found in their home country), and one that is easily accessible by public transportation, is not easy (N16, N47). N48 appreciated that in Canada, gender identities are relatively protected in the job application process, e.g., "you don't need to mention your gender ... [or] attach your photo in your resume". Finally, changes in self-identity can be positive. N1, for example, had a new-found sense of identity through "embracing Canadian culture" by participating in new activities (e.g., skating, watching baseball games). She said, "it's like finding [out] who you actually are, because it's not the same 'me' that was living in Colombia. It's a new 'me' for sure."

In terms of conversion factors, some newcomers adapted by developing resilience by adopting a "don't care" attitude. As N2 said "All these ... initially I used to get affected by this but as time went on, I just told myself, well, if you like to have to survive you should not care."

Enjoy and Protect Nature. One capability in Nussbaum's Capability Theory is the ability to "express concern for the environment and other species". This capability encapsulates the idea that our ability to influence environmental sustainability is not only a responsibility, but a basic human right, one that is intricately tied to our well-being, at the present and in the future. In our interpretation, this capability refers to the ability for a human being to not only care for the environment, but also enjoy nature and appreciate its beauty. All 14 newcomers who chose this capability shared that this has improved positively compared to their condition prior to migrating (see Fig. 3.3). Several newcomers (e.g., N11, N27, N43) commented on the abundance of greenery, fresh air and wild animals, helping them become more in touch with nature. N20, N21 and N43 all alluded to the fact that the environment in Canada is "very protected", with clean and well-structured roads and availability to garbage bins to discourage littering. Newcomers adopted a shift in habits and mindset by modeling after others. N20 started "planting [a] few trees", "making sure the waste items are properly separated" [for recycling], and "picking up waste" when she sees it.

In terms of conversion factors, N31 mentioned having to learn the know-how about environmental protection—her family and friends "taught [her] how to do recycling and how to do abide by the rules."

Enjoy Culture. This capability refers to the ability to use all of one's senses, be able to freely imagine, have access to all cultural experience (whether it be one's home culture or a new culture) and gain access to the conditions that enable self-development e.g., learning. Of the 21 participants who chose this capability in the top five, the majority (n = 16) felt their ability to enjoy culture has improved (see Fig. 3.3). A major theme is the desire of newcomers to both learn about Canadian culture *and* retain connections to their cultural roots (social). Several participants (N17, N22, N25, N36) appreciate the emphasis on multiculturalism in Canada and the ability to simultaneously "taste all cultures", "share your culture with others" (N17), and "continue one's own culture" (N22). Newcomers described the importance of opportunities to 'learn about other cultures "through their senses" such as through food (N36, N35) and holidays (N11). For some newcomers, it is difficult to stay connected to their cultural roots due to the lack of a large ethnic community from their home country (N37), difficult to find people to celebrate their ethnic holidays with as a

way to “express our feelings of that culture" (N44), and difficult to commute to cultural activities (N45).

Express Feelings. This capability refers to the ability to be accepted—feeling a sense of belonging, having the ability to care for others in the community and to be heard regarding one's needs (having equal rights and opportunities as locals). A total of 21 participants chose this capability as one of the top five capabilities. Nine of them shared that this ability has improved the since migrating whereas the remaining described how this has declined after moving to Canada (see Fig. 3.3).

N20 and N42 built a sense of belonging by contributing from their means. N20 “started donating clothes [rather than] just throwing them away." N42, who volunteers with a refugee organization, said that it was difficult at first to feel that she belongs by “going to school" and wanted to find a way to “meaningfully contribute to society" (social). N2 recalls the strong urge to “give people back and help where I can", even when lack of system recognition of her credentials are undermining her capacity to give at the level with which she is capable. She recounts seeing an unwell child and saying to the child's mother, “Unfortunately, I can't prescribe anything to you because I'm not licensed to practice in Canada. But all I can tell you is to re-hydrate the boy." N16, who volunteered with various organizations, says that it “gives [him] this [sense] of belonging [and] community ownership" and an opportunity to learn about people and society. N7 describes the philosophy of reciprocation that motivates her participation as a community helper: “Being in a community, we have to give to the community, so that we can also receive from the community." Having received help from volunteers, N42 wants to reciprocate and help others.

For other newcomers, contributing to the community is not always straightforward and may not provide the same level of reward. N19 had to learn the social norm around help-giving, and came to perceive that local people value privacy, independence, individualism, and “self-oriented" care. He said, “I've seen many times ... people are just about to fall and and I'm giving hand to her and they said ‘I'm fine'. They are not trusting anybody; I don't know why. The person [that] I am ... I'm ready to help if you're falling... That's the thing I struggle [with] here—loving and caring for others and maintaining friendship." For some, it was difficult to build a sense of belonging. N45 said, “Whatever I do, even if I stay over here for 10 years, raise my family over here, I would still be identified as Indian. I would always be an outsider here ... I wouldn't have that home ground advantage." N45 added that the intensity of studies and the lack of time makes it only possible to “care for yourself, just taking care of minding your own business" and harder to care for others.

Have a Healthy Lifestyle. This capability refers to the ability to be physically active and mobile, free from imposed constraints and abuse. Although 21 out of the 28 participants shared that the capability to *Have a Healthy Lifestyle* improved positively as one of the top five, the remaining participants shared some negative views towards it (see Fig. 3.3). While ample recreational opportunities exist that promote physical health, newcomers may not take advantage of them for various reasons. The cold weather in Canada is a big limitation for a healthy lifestyle for some immigrants, like N18, who ended up doing most physical activities indoors except for three months of the year when "you can go outside playing at the beach". For another participant, N1, cost and work constraints makes it difficult to prioritize self-care. As she said, "in Canada, I don't know why but time is not enough. As a newcomer, you have to work very hard at the beginning, so there is not much time to exercise or to do any kind of physical activity... Whatever you make (income) as a newcomer, I would say it won't be enough to join... a gym or something like that." Likewise, N5 said, "the timings doesn't suit us. For the working parents, there are always less spots for kids." Language barriers is a factor for N11, who found that without the ability to communicate, "it is quite difficult to get involved in certain physical activities, especially group activities, or try to sign up for anything."

Various conversion factors exist that help promote physical activities, such as having access to beautiful nature (N43, N46) and being in a social environment where others are active. As N20 said, "I've seen a lot of people walking and moving around and that really motivates [me]." For N39 and N50, having access to free membership (e.g., offered by newcomer-serving organizations such as the YMCA) helped get her family into physical activities. Once gaining access to their favorite activity (e.g., badminton), N39 was able to discover other activities that are available.

Have Control over Material and Political Environment. This capability refers to the ability to own property and goods, to seek and accept work, and to participate in community building. Our participants (n = 24) shared mixed feelings toward this capability being reduced (n = 12) or improved (n = 12) as the result of moving to Canada (see Fig. 3.3). One of the biggest struggle is for newcomers to find meaningful work, achieve promotion or have career mobility. Some attribute this struggle to language barrier (N40) and the reluctance of organizations to recognize prior job experiences (N19, N27, N50, N49, N46), integrate newcomers into their profession (N16) and discrimination (N18). As N27 explains, "my ability to work went down because I'm not able to find employment in the field that I had studied for and that I like." Our newcomer participants mentioned having to take jobs irrelevant to their expertise (N44, N5) and spend a significant amount of their savings on re-educating (N16). Upskilling is not always easy because newcomers need to

balance education, work and family (N23, N28), and the *process* of upskilling—e.g., completing licensing requirements, completing programs expected by regulators, and achieving the immigration status required before one can obtain a certain license—is not always transparent (N16, N27, N34, N43, N44). Several newcomers mentioned the importance of connections (N28, N32, N35) for obtaining their first employment in Canada.

Newcomers' negative sense of control over their material environment is compounded by their struggles meeting the rising costs of childcare (N7), food (N15) and housing (N16, N49). Newcomers are faced with double standards when it comes to housing (N4, N38). N4 notes that she lacks "stable jobs" and "credit history" that others have in order to be accepted for rental properties, and she is often required to "prepay for the whole year of the rent" and provide banking statement to show "how much you have in your banking account". N27 explains that there is ample of housing information online, but that the market is very competitive and effective strategies (e.g., directly emailing condos to inquire about vacancy) is sometimes a form of local knowledge that is hidden until you manage to find it. Finally, people from certain countries tend to have larger families (e.g., N28), and finding "a house where the landlord accepts so many people" is a challenge.

Have Social Connections. A majority of our participants who chose this capability as the top five shared this has decreased negatively (n = 19) while others shared positive improvement (n = 13) (see Fig. 3.3). Social connections is extremely important to many of our participants, sometimes beyond material needs (N42). As N26 explains:

> [When] newcomers travel or see their family, they come back different; it's like they don't have any concerns. I met a lady at the airport... she was on a wheelchair because they (doctors) couldn't figure out what's wrong with her– she couldn't move. She had lots of pain and it was like all over her. She told me the moment she was on the street, close to her parents' house, she started running. She told me, 'I didn't have any pain!'... So I think that [it's psychological]. People here [locals] won't understand how much that kind of connection means to people.

Some see benefits in using social media and chat platforms (e.g., WhatsApp) to "spend the hours" with friends and family, while others (e.g., N48) find online technologies as "inconvenient" and inadequate for addressing loneliness or disconnection from previous social circles. Many newcomer participants mentioned finding it difficult to establish deep friendships where you can "speak freely" and "for hours", going beyond the "meet-and-greet" kind of relation (N5, N8, N30, N45). N5 attributed this paucity of connection to a

mutual lack of familiarity between locals and immigrants, preventing the two groups from openly communicating with one another. Other hindrances to social connection include language barriers (N28, N48), "harsh winter" (N25), being too busy (N45), [in]ability to initiate friendship (N9, N42, N45, N49), [not] understanding social norms, e.g., when it is appropriate to call or show up at people's houses (N1).

Newcomers have attempted to find new connections through hobby groups (e.g., a private gardening group (N9)), church (N41), or through impromptu local connections (e.g., "meeting people [while] waiting for the elevator (N27)). More importantly, newcomers seek connections within their own ethnic group to gain that sense of belonging. N20 said, "I joined few Indian communities so I don't feel that I'm separated from my country." Likewise, N8 said "Coming here, having to now find your own people has made me realize [that sense of belonging that I had back home] is something that I can't trade." Connections to one's own ethnic community also helps to break knowledge barriers. N50 said, "I wasn't confident that I could digest all the necessary information, so that's the main reason I tried to find ... that lawyer or this mortgage broker who could speak Korean, so that they could understand [us] and could explain [things in a way that is] equivalent to my own country". And as N34 explains, its like when "Ukrainians [try] to find help from [other] Ukrainian, because they speak the same language." N22 mentioned receiving "a lot of help from Korean society community" and that "many Koreans get together in Korean market ... and they exchange the information with each other".

Ethnic online communities provide newcomers with a powerful source of information (N47, N8, N38) and a source of empowerment. As N38 said, "we take the solution into our own hands and try to create WhatsApp groups to connect people, ... because we don't see this support from the government". N1 also remarks that "locals don't have knowledge of those tools that newcomers can have" (e.g., which organization provides interpretation services), resulting in "miscommunication". For N8, online groups (e.g.,"Nigerian moms", "local food" WhatsApp groups) help to not only provide information "about things that you don't even know are happening around you", but also help alleviate boredom, loneliness and sadness.

Play. This capability refers to the ability to participate in activities that one enjoys e.g., recreational activities, hobbies etc. Only six participants picked this capability on their top five and four of them shared this has improved after their move to Canada (see Fig. 3.3), pointing to the implications that the capability to play is only an afterthought second to the capabilities more central to survival. For N42, play is important for relieving stress, and for N10, it was a learning opportunity "figuring out what they (local Canadians) do for fun". The ability to play, as N21, N44 and N48, N25 all alluded to, depend on many things,

including cost (N25), weather (N44), what is accessible in the vicinity or for a particular age group (e.g., adults (N44)), and the ease of finding recreational activities online or via newsletters (N48).

We categorize the conversion factors from the above findings, which are shown in Table 3.4.

Conversion Factor	**Type**	**Capabilities Affected**
Language proficiency	Personal	Express Feelings, Receive Care and Support, Have Control Over Material and Political Environment
Immigration status	Social	Receive Care and Support, Feel Safe
Access to public transportation	Environmental	Have Control Over Material and Political Environment
Community support networks	Social	Have Social Connections, Express Feelings, Have a Healthy Lifestyle
Cultural familiarity of services	Environmental	Feel Safe, Enjoy Culture, Have Social Connections
Availability of childcare	Environmental	Have Control Over Material and Political Environment
Access to healthcare professionals	Environmental	Have a Healthy Lifestyle, Receive Care and Support
Discrimination experiences	Social	Be Who I Want to Be, Have Social Connections, Feel Safe
Ability to set goals	Personal	Be Who I Want to Be, Play

Table 3.4: Mapping Conversion Factors to Capabilities

3.4.2 Corrosive Disadvantages or Fertile Capabilities of Newcomers

In Nussbaum's Capability Theory, capabilities do not exist in isolation; instead they can influence one another. In particular, *corrosive disadvantages* are capabilities that, if lacking, will negatively affect many other capabilities, and *fertile functionings* are capabilities that,

if well supported, will boost many other capabilities in a positive way. In other words, identifying the key corrosive disadvantages and fertile functionings and addressing those capabilities directly in technology design is often the most impactful. From the interview data, we overview a few key corrosive disadvantages and fertile functionings that newcomers experienced when transitioning to Canada.

Corrosive Disadvantages

Our newcomer participants have discussed a variety of capabilities, that when lacking, act as corrosive disadvantages that negatively impact other capabilities. Figure 3.4 shows these relationships: namely, the head capability of an arc was mentioned by participants to be negatively affecting the tail capabilities, and the weight of the arc denotes the number of such mentions. We identified three main corrosive disadvantages, which include *Ability to Have Control over Political and Material Environment*, *Having Social Connections*, and *Ability to Express Feelings*.



Figure 3.4: Graph showing the relationships between capabilities which are corrosive disadvantaged and what other capabilities they disadvantage

Lack of Control over Political and Material Environment. Not having control

over one's material environment, such as jobs and housing, can have detrimental effects on other capabilities. Not having foreign credentials recognized a by place of employment means that newcomers have to take jobs that are irrelevant to their expertise, affecting their self identity, or the ability to *Be Who I want to be*. Lack of choices / control over work locations and hours also affects the ability to *Play* (N21, N40, N42).

Low income, compounded by high cost of living, affects newcomers' ability to *Have a Healthy Lifestyle*. As N42 said, " in my budget, I can pick, home or eat." Uncertain work conditions, e.g., not knowing "what will be tomorrow" (N15) also has a negative impact newcomers' emotional well-being. Some newcomers mentioned feeling discriminated due to their status (N18, N42), or language and ethnicity (N17, N18, N40) and seeing discrimination as being inescapable because it is happening at their place of employment, on which they depend. N40 recalls repeatedly facing a hostile environment, despite her attempt to change her shifts: "I have to suck it out, just clean my tears and just keep working. But I don't think there's anything that I can do regarding that". Lack of control over one's material environment can lead to anxiety and the feeling of being trapped.

Lack of Having Social Connections. Not having access to social connections, whether professional, personal, or familial, can put newcomers at a disadvantage in their ability to *Receive Care and Support*. Many newcomers (N16, N17, N25) discussed how not having family or friends in Canada made it harder for them to get access to government-supported care. Not having social connections additionally makes it harder to get access to peer support for newcomers such as N8, who described the differences between the lack of social connection in Canada compared to their experiences in their home country: "We didn't know one person that would even say, 'how are you doing?', 'are you guys good?' There was nothing ... like someone is not going to check on you, ... even if you were dying".

Additionally, a lack of personal social connections negatively impacts their ability to *Have Control over their Political and Material Environment*. Some newcomers (N27, N44) faced issues in finding help at community centres or settlement agencies to assist their transition where N44, in looking for housing, "ended up just finding something [themselves], [by] just sending lots and lots of emails". In the other direction, not having a work environment can make it more difficult to foster these personal connections in the first place, where N27 mentions, "If you work from home. If you don't have colleagues, then there are not a lot of ways to meet people". N2 adds, "I notice that coming to Canada, people here have their own sets of friends and they tend to like keep away ... if you don't have a job", creating a negative feedback loop between the two capabilities (as seen in Figure 3.4).

Lack of Express Feelings. Inability to express oneself through language might make newcomers feel like they do not belong, are not heard (affecting *Feel Safe* (N13)), and cannot meaningfully contribute to society (affecting *Social Connections* (N42, N45)). Despite the availability of mental health services, some newcomers did not feel that they have an adequate outlet to express and address their stress, depression and anxiety (N1, N5) (affecting *Receive Care and Support*). Many newcomers do not have the same privileges (e.g., affordable tuition) as those with permanent residency or citizenship status, and newcomers do not always feel that they have platform to voice their concerns about such inequalities (N19). Some newcomers (N1, N42) discussed how they lack certain opportunities to study, work, or obtain legal aid (aspects of *Have Control over Political and Material Environment*) due to a barrier caused by immigration status or language. The extra time and money spent by newcomers to achieve what Canadians have is detrimental to life itself. As N42 puts it, "it's time; it's money. Time is very valuable".

Other Interesting Relationships between Capabilities. Being disadvantaged and discriminated (N8, N26, N38, N39) can leave newcomers with an unsafe feeling (affecting *Feel Safe*) about their environment (N6, N25, N42) which can negatively impact more than one capability at once. Not feeling safe can be a product of the physical environment (physical appearance), and have negative impacts on the ability to *Express Feelings* and *Receive Care and Support* (N6,N25). As N42 puts it, "feeling safe, I really consider that to be very important because it allows the other categories to kind of develop more effectively in one person. If you feel constrained or kind of...unsafe, so it can really hinder your growing in any of those categories now".

Not having the ability to enjoy one's own culture or the local culture (e.g., *Enjoy Culture*) affect newcomers' ability to adapt to their new lives in Canada. For N42, enjoying culture is tied to the ability to play (e.g., *Play*), and not having the joint ability to enjoy culture and play can lead to negative mental health. As he eloquently explains, "if this person only works and and doesn't have time to themselves, even though they objectively have what they need, they would still feel a lack or unhappiness, which is why I think [enjoying culture is] very important".

Fertile Functionings

In addition to the corrosive disadvantages, newcomers had discussed a variety of fertile functioning capabilities, as shown in Figure 3.5. Like Figure 3.4, Figure 3.5 shows the relationships between capabilities, where the head capability of an arc is mentioned by

participants to be positively affecting the tail capabilities, and the weight of the arc denotes the number of such mentions. As depicted in Figure 3.5, the capability of *Having Social Connections* is the most fertile capability when newcomers are able to realize it as a functioning.

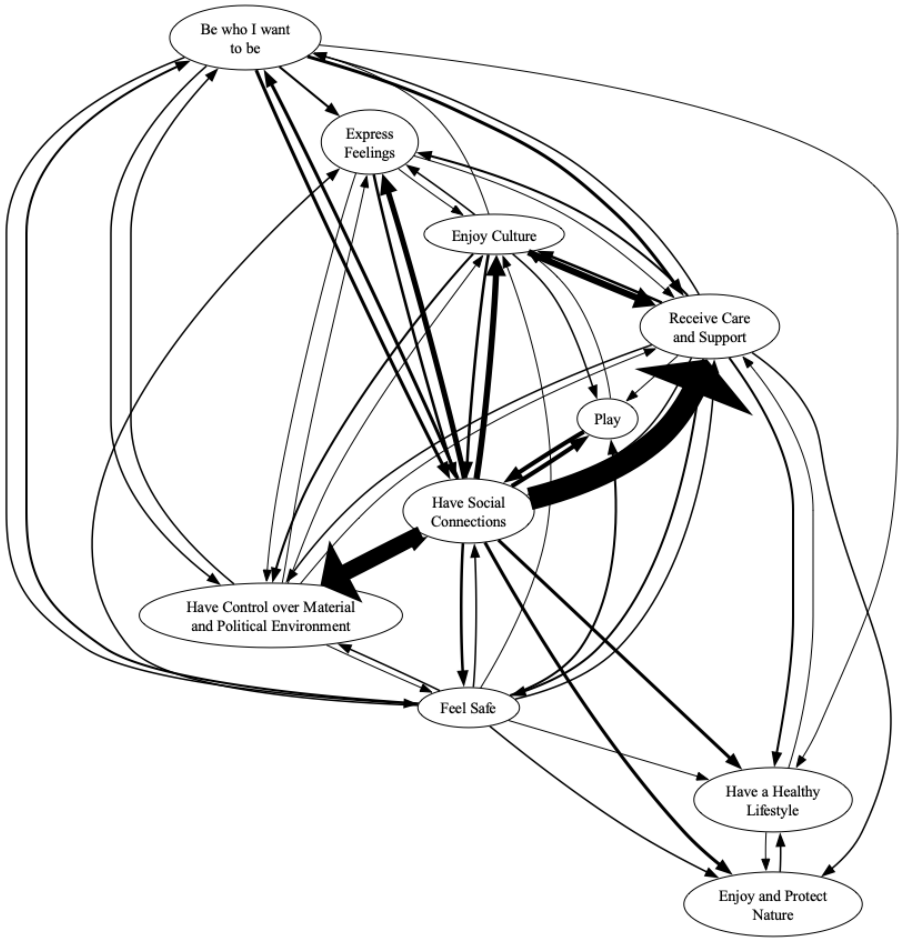


Figure 3.5: Graph showing the relationships between fertile functionings and other capabilities they aid in turning to functionings

Having Social Connections. The ability to form or continue social connections helped newcomers realize other capabilities. Connections with friends helped both N8 and N19 to

settle in Canada, and helped N19 practice her faith. In creating and forming professional connections, newcomers were able to feel less discriminated against and learn more about equity and diversity (N41, N48). All of these are key aspects of the capability of *Be Who I Want to Be*. Having various kinds of social connections helped newcomers *Express Feelings* more often and more openly. Having the ability to speak with family (N43), friends (N5), or neighbors (N7) helps newcomers to have an outlet for expression and sense of belonging, "like there are people to help you out. (N45)" Newcomers were able to use various kinds of social connections to help them *Feel Safe* in their new environments. N5 relied on her spouse, who had lived in Canada for 10 years, to find a safe neighbourhood for them to live. Other newcomers (N37, N48) used various contacts from their post-secondary institutions to navigate potentially unsafe situations (e.g., St. Patrick Day's street parties) about which they have little knowledge.

Our newcomers shared that *Having Social Connections* enabled them to *Enjoy Culture*, whether it be one's own culture, other cultures, or the local culture. When family cannot be around, newcomers such as N39 and N46 were able to find cultural groups through virtual connections to meet similar people and experience their own culture while in Canada. Helped by the wide variety of cultural groups that exist in their community, many newcomers (N4, N17, N25, N36) were able to learn about a variety of different cultures through social connections. N25 describes the importance of this learning: "I think that way we can learn [from] each other's culture and respect each other's background, we will learn so many good thing about that. Until we mingle with the people, we don't know their culture, their belief and unknowingly, we would hurt them." The learning extends beyond social learning as well. Through social connections, newcomers are able to gain formal or academic training (N5, N17), sometimes through volunteer tutoring (N15).

Newcomers that had existing connections in Canada (N1, N34, N44) tended to connect with them for help improve their ability to *Have Control Over Material and Political Environment*. N44 connected with family, who lives outside of the local region, for employment advice, prompting her to "do [that] core certification course ...to get the jobs in the bank.". Many newcomers were able to leverage connections with neighbors or landlords (N44) to find jobs. N6 learned about the NPower Program for newcomers from friends, a program that "they were not made aware of anywhere else". N46 was able to live at a volunteer's house upon arriving, which was "very big help". Other newcomers (N5, N27) got help in adapting to the new environment through the family they arrived in Canada with. Cultural connections also proved to be useful for newcomers' ability to integrate into Canada's material environment. Through different cultural online groups (N39, N47, N49, N50), or meeting friends of the same culture in-person (N17), newcomers are able to get help in finding housing from someone with a similar cultural background. For some,

getting culturally specific information helps them to prepare for the transition even before they move to Canada. N50, for example, learned from someone that it might be useful to bring their driver's license from South Korea. After experiencing the benefits of social connections, some newcomers have either started volunteering (N5), or would like to volunteer their time as a mentor (N14) to help other immigrants have better control over their material environment, such as finding employment. Finally, newcomers also relied heavily on online social connections, using platforms such as Facebook (N3, N20) and YouTube (N4) in order to find housing, professional networking websites (N5, N7) to search for jobs, and online cultural groups (N39, N40, N48) to find advice.

Having social connections can positively impact newcomers' ability to *Have a Healthy Lifestyle*. N49 leveraged connections with family and friends as incentives to cook good food and go for walks. Having new connections through exercise clubs enabled newcomers (N4, N11) to learn the "correct way of exercising or running", "build [their] physical" health, "move around or go places". N50 used community connections, e.g., representatives from YMCA, to learn about physical health benefits to which he would be eligible. Having social connections also has a significant positive impact on the ability to *Receive Care and Support* in various ways. Many newcomers had existing connections to family, friends, or other connections in Canada, and were able to gain help with access to the medical system (N1, N5, N9, N26, N32) or basic needs e.g., food (N39). N1 discussed how navigating systems was made easier through having someone they know acting as a guide:

> "In my case, my brother would drive me everywhere I needed and he tried his best to guide me ... I never, in the whole process, knew that at one place I could be able to get different kind of services. So, if I need translations, just go to this place. If I need this, ask him."

Meeting neighbors (N7, N37, N44), new friends (N15, N48, N49), community members (N1, N2, N7, N10, N45, N46, N48), or tutors (N14, N15) helps with health navigation. The ESL teacher of N15, for example, suggested to him "how to find the family doctor, how to go to the community center"; he adds, "It's really simple step, but you don't know what you should do in some situations". Newcomers such as N37, N38, and N41 all found cultural connections through a church to get care both physically and mentally, where in N41's case, "The church was a great help for us. They contacted us, connected us with the community center, and at the community center, we get connected with the social worker", creating a chain of connections to find care.

Having and creating various social connections aided newcomers in various aspects to *Enjoy and Protect Nature*, along with the ability to *Play*. Some newcomers (N15, N43) had

learned from new connections, formed through their landlords or others, about the rules and regulations related to garbage and recycling. Various hobbies such as gardening (N9), camping (N14), ice skating (N48), and arts and crafts (N45) were all facilitated through the social connections newcomers were able to make.

Other Interesting Relationships between Capabilities. *Have a Healthy Lifestyle* acts as a fertile functioning when realized. On this capability, N44 points out, "Health is wealth. If we have good health, then we can achieve everything; if we don't have good health, then we can't.". Furthermore, *Have a Healthy Lifestyle* and *Receive Care and Support* are both fertile functionings that are intricately related. For example, as N45 pointed out, having a healthy lifestyle can prevent the need to go to a hospital unless it's an emergency.

To *Have Control Over Political and Material Environment* positively impacted other capabilities, such as *Have Social Connections* and *Receive Care and Support*. Through the workplace (N17, N44) or volunteer positions (N27), newcomers gain financial means to obtain primary care (N35), social support (N18) and the opportunity to find new social connections in a variety of communities (N21). Having a decent income also enables newcomers to *Enjoy Culture*, for example, N3 said in having a job, "I feel like I am more being accepted by other people, despite [having] different cultures".

Having the ability to *Enjoy Culture* in Canada helped various newcomers in a myriad of ways, such as feeling more comfortable to *Receive Care and Support*. Examples of this comfort include receiving medical care with a doctor of their own background (N5), going to neighbouring cities to experience traditional dance classes (N43) (*Play*), and finding connections through online cultural groups (N27) (*Have Social Connections*). Having the capability to experience other cultures, including Canadian culture has also been a boon for newcomers. Newcomers are able to experience culture through festivals (N25), different foods (N8, N48), sports (N1), and many other ways. Embedded in the promises of multiculturalism and when those promises are realized in concrete ways, newcomers also feel less discriminated against (N38) and more comfortable practicing their own religion (N22, N42), affirming their self-identity (*Be Who You Want to Be*).

3.4.3 Capability Gaps, Successes, and Challenges of Organizations

In addition to understanding the current challenges of newcomers in the community, understanding their surrounding support structure is also crucial. Our discussions with various organizations revealed critical capability gaps in the support structure for newcomers, particularly concerning their safety, support, and social integration. Organization members

also shared their successes and challenges in supporting newcomers, which we summarize below.

Safety, Support and Social Integration. Participants O1, O5, and O6 emphasized significant gaps for newcomers related to safety and support. They expressed concerns about the absence of school-based programs designed for newcomers that promote awareness on how to deal with bullying, trauma, and sexual trafficking (O1). Additionally, there is a recognized need for safe spaces where newcomers can express themselves without judgment and share concerns about discrimination based on skin color, religion, and gender (O5). In terms of providing support to newcomers, our organization participants identified areas lacking resources to support newcomer needs. O6 highlighted the importance of providing one-on-one assistance in navigating primary care systems and counseling support for mental health and well-being. Participants O4, O8, and O12 identified critical gaps in accessibility and inclusion, due to the shortage of interpretation services. There is not sufficient integration support for job search readiness and for decision making about healthcare and primary care systems (O9, O10). Participants O3, O9, and O10 highlighted gaps in social integration, including the lack of networking opportunities for newcomers and challenges in connecting them with organizations and communities, specifically religious and cultural communities (O3). There is a pressing need for cultural representation and competency training for staff to ensure that services are accessible and welcoming for all newcomers (O8, O12).

Successes and Challenges in Supporting Newcomers. Organizations do not work in isolation. For example, O1 and O3 have reported positive impacts from collaborating with public health authorities, equity team initiatives and local grassroots organizations. These efforts have facilitated improved essential services delivery, including counseling services and group therapy sessions (O2), and programs (e.g., supporting food businesses for women (O5)) that help newcomers engage in their community. O4 and O8 discussed their roles in raising newcomers' sense of belonging and providing access to instant language interpretation; and O6, O9, and O10 have found success in fostering safe communication with the help of local cultural groups, and in guiding newcomers' educational and employment endeavors. Despite these collective achievements, many organization participants recognized that what newcomers face are systemic issues, such as unrecognized international work experience as well poor access to medical care, unstable housing, unavailable or unaffordable childcare that are sometimes beyond organizational control to mitigate (O4, O5, O8, O9, O10, O11) . Financial sustainability (O15) and inefficiencies in cross-institutional resource sharing are pervasive challenges (O3). As O3 said, "everything that we learn is so

important to share (with other organizations)."

The murky definition of the term 'newcomer' creates challenges for organizations to determine eligibility when applying for newcomer-specific financial assistance programs (O4, O5). As O3 said, "Is it one year? Is it two years? ... when you're a newcomer, you're a newcomer for a long time, because the process to feel like you belong takes more than one to two years. (O3)" In the same session, O16 elaborates on the subjective nature of newcomer identity, noting that even individuals born in Canada to newcomer parents may still struggle with feelings of alienation.

To serve more diverse population, O3 and O16 mentioned the pressure on organizations to 'constantly innovate' to secure funding from numerous resources e.g., government, donors, etc. Limited capacity and funding constraints have hindered the efforts of organizations to provide comprehensive health and mental health support for marginalized groups such as LGBTQ+ individuals (O1 and O3) and single parents (O8-O11), ESL support and employment opportunities (O2 and O3), and language support for accessing medical services (O6). These challenges show the complex socioeconomic and structural barriers that organizations encountered in their efforts to assist newcomers and address their diverse needs.

3.4.4 Technology in Enhancing Newcomer Capabilities

We answer RQ4—the role of technology in supporting capabilities—based on both the strategies employed and technological solutions envisioned by the newcomer participants. We also discuss the capabilities that were or would be affected as a result of such technology use.

Current Strategies

Several newcomer participants feel the need to connect to someone they can relate to, often using social media platforms like Facebook (N14, N27), WhatsApp (N7, N8, N16, N17), Instagram (N42) in order to form/maintain social connection, enjoy culture, develop control over one's material environment (e.g., employment, transportation (N20)) and play. Social Media facilitates newcomers' abilities to receive care and support. Unable to find a time-sensitive appointment, N7 used WhatsApp to ask her network for suggestions on labs that provided fast access, and due to that technology, was able to secure an appointment

the next day. In envisioning a mobile app for resource navigation, newcomer participants suggested features that will allow people to find events and activities (N25), connect newcomers to community members based on similar skills, hobbies and interests (N45) or a similar work background (N16), and filter resources by cost and proximity, etc (N40). In other words, social media was a often-used strategy for maintaining various capabilities, including *Have Social Connections*, *Enjoy Culture*, *Have a Healthy Lifestyle*, *Play*, *Receive Care and Support* and *Have Control Over Material and Political Environment.*

Envisioned Technology

When asked to envision a mobile app solution for capability-based resource navigation, our participants mentioned different types of information they wish to access online and suggested features for navigating such information. Having access to the right information helps newcomers develop a sense of control and belonging. As N8 said,

> "... for Canada, they (service providers) assume the information is out there. I do not see, but it's like they expect you to know. I would want to find a store as simple as a meat shop - where you can buy halal meat ... because for some people, it helps their sense of belonging to where they are like they can readily get their own food. Like the anti-hate crime thing, if you experience maybe hate crime or something, just click on this button and you can report the event or something. Or you need support, your child is experiencing bullying in school, you can reach out to this."

To *Receive Care and Support*, newcomers such as N4, N9 and N16 also want more transparency, such as the ability to choose a family doctor based on the doctor's educational background, language spoken, estimated wait times, patient ratings, etc. Other participants such as N20, N24, N29, N36, and N43 expressed the need for online information related to child medication, healthy diet, affordable access to food, and public transportation. To *Enjoy and Protect Nature*, N6, N11, and N14 mentioned wanting more information about access and procedures, including details on conservation areas, parks, sites and trails, and whether these spaces are family-friendly, as well as visual explanations of recycling and how it works (N41). In terms of *Play*, newcomers expressed a desire for a comprehensive app that integrates information about community centers and local activities, including festivals and concerts (N21, N25, N40). They highlighted the importance of real-time updates and a user-friendly interface, suggesting features like maps, listing of

upcoming events, explanations of associated costs, and safety ratings for family-friendly events.

Many newcomer participants (N3, N4, N6, N11, N15) highlighted the need for simplified explanations of procedural information (e.g., how to seek medical support or prepare for a Canadian winter), step-by-step guides and checklist systems (N26) or a 'one-stop-shop platform for newcomer information (N17, N38, N42, and N43); these can be seen as addressing the need to *Have Control Over Material and Political Environment*. Newcomers encounter different stages during the settlement process (N48), and so stage-sensitive resource navigation can be a useful feature. For example, when first arriving in Canada, information about basic survival needs, such as shelter ("... don't even have where to stay when they (newcomers) arrive" - N1), and provisions for sleep ("... we need mattress like basic things" - N43) are crucial and should be accessible in a step-by-step region-based settlement package (N1, N37, N43, N47) or filter-based search (N21). After initial settlement, it may be relevant to then access newcomer-specific benefits based on immigration status (N15), apply for legal procedures (N27, N37) such as social insurance number, bank account, health card, cellular service etc., and acquire information on how to prepare for resumes/certifications (N43, N44) to find employment opportunities (N20, N21, N29, N37). At a later time, resources such as renewing immigration documents (N50), financial goals (N16) e.g., savings toward purchasing car, home etc. become more relevant. Frequency of app use is also anticipated to change over time (N21) as newcomers enter different stages of their settlement journey. It is, there, important to have a customizable app that can evolve over time with the users' changing needs.

Participants also highlighted cultural sensitivity (social) and transparency as two important values that a resource navigation app should embody. Organizations often focus on specific immigration statuses, potentially overlooking the diverse needs of those arriving on different pathways. N27 emphasized the need for guidance in such situations when not all newcomers fit the standard support models. Participant such as N43, who is a student shared the importance of the app to display realistic goals to help students navigate through daily challenges. On the other hand prior to arrival, N45 and N47 compared the way the Canadian government paints "a perfect picture" of life in Canada to potential immigrants that is not aligned with the real, nuanced reality and struggles of newcomers.

Overall, our participants highlighted the significance of cultural sensitivity, tailored support, and realistic expectations in facilitating the integration of newcomers into Canadian society.

Language Support. In terms of useful app features, several of our participants (N1, N3,

N4, N11, N12, N22, N28, N32, N33, N37, N38, N40, N42, N46) mentioned their struggle with the English language and their desire to have translated content in the language of their choice. In addition, both N32 and N33 had difficulties reading the translated documents in their preferred language and relied solely on communication with the interpreter during the focus group. N3 values online systems to access various services due to language barriers: “Online booking is the best place, because as new immigrants we don’t prefer to speak over the phone. If we can book it through an online system in our language, then it will help us." Several newcomers emphasized the importance of self-expression (*Express Feelings*) via a conversation feature (e.g., translation of spoken speech) in their preferred language. N38, N39, in particular, would envision using such a feature to connect to their faith-based organization (e.g., Christian Church, Islamic Mosque). Consequently, by enabling newcomers to express themselves, such translation support would bolster capabilities such as *Be who I want to be*, *Enjoy Culture*, *Social Connection* and *Receive Care and Support*.

3.5 Conclusion

In this work, we used a Capability Sensitive Design approach to understand newcomers’ priorities, strategies and challenges during their settlement journey in Canada, and identify capabilities and conversion factors that cause corrosive disadvantages and fertile functionings. In the next chapter, we present a digital planning tool to enhance these capabilities that can help newcomers support their well-being during transition.

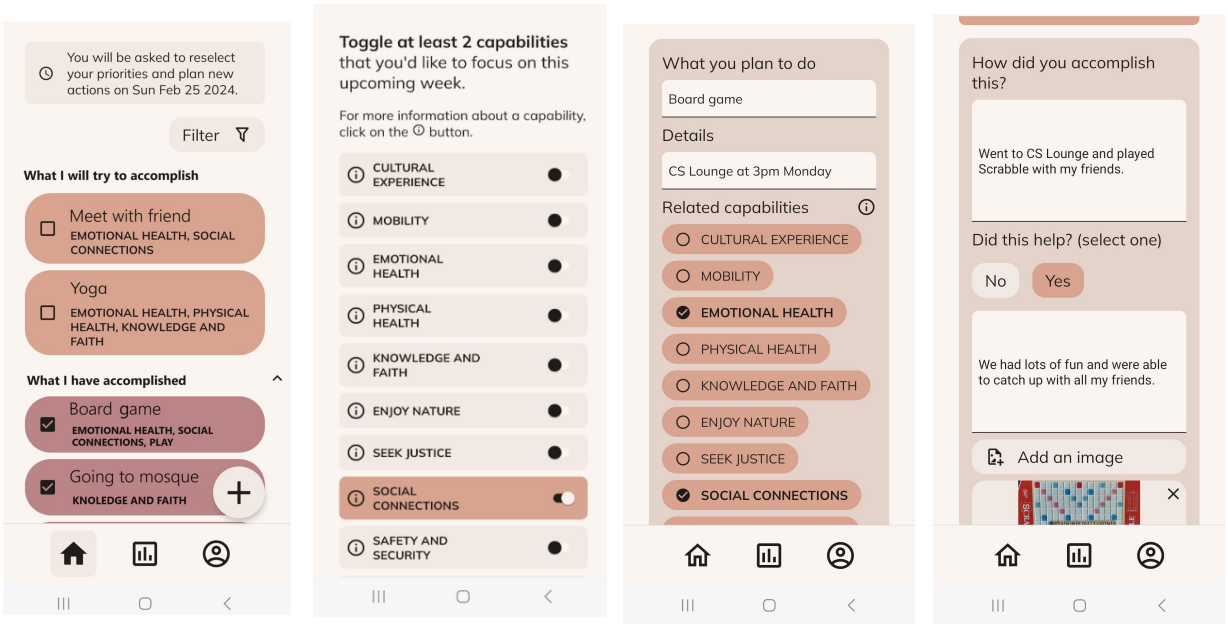
Chapter 4

Mapping Newcomer Capabilities to Actions

To understand the usefulness of creating plans by prioritizing a list of basic capabilities, I conducted a study to explore how capability-based journaling can help people manage their transition to a new country. Specifically, we tried to answer the central question, how does the use of capability-based journaling affect the behaviour **(RQ1)** and well-being **(RQ2)** of newcomers going through a life transition? To facilitate the study, we created a simple digital journaling tool called Life Transition Journal (LTJ), which allows users to select a capability to focus on, plan an action to address that capability, and describe how the planned action went. Our goal is to explore the idea of capability-based journaling for life transitions with a particular user population: international students experiencing winter for the first time in Canada, a daunting experience with significant implications for emotional and physical health [24]. This protocol was approved by our university's Research Ethics Board and the study was carried out during the winter term of 2024 between January and March. Below, we describe the study apparatus (i.e., LTJ), study design, and analysis methods.

4.1 Apparatus

Life Transition Journal (LTJ) (see Figure 4.1), a mobile application for both Android and iOS, serves as the apparatus for this study. LTJ was programmed by a student in the Augmented Intelligence Lab, where I contributed to the system design workflow. The



(a) Home (b) Priorities (c) Planning (d) Logging

Figure 4.1: Life Transition Journal (LTJ) app is used for creating plans and record experience based on capabilities that consists of: (a) a home screen that shows plans to accomplish and already accomplished actions, (b) a priority screen that allows users to select at least two capabilities to work on each week, (c) planning workflow shows how to add details about a plan and choose related capability(ies) for that plan, (d) logging workflow shows how to record experience after accomplishing a planned action

app features (i.e., overview, prioritization, planning, and capability visualization) and the associated interfaces are described below.

4.1.1 System Design

LTJ is designed as a planning-based journaling tool inspired by the CSD framework to promote the well-being of newcomers. We characterize 14 capabilities relevant to newcomers and use them to encourage capability-targeting actions. These capabilities were adapted from the capability cards developed by Steen [113] and Javornik et al. [50]. The app was built using JavaScript and React with Expo [34]. The basic features of LTJ are described, as follows.

Overview. The home screen (see Fig. 4.1a) shows a list of planned actions to accomplish (in orange) and a list of actions already accomplished (in pink). For each action, along with the action name, it also shows the related capabilities identified by the user. On the home screen, there is a '+' button to create a new action plan. At the top of the home screen, a message is always displayed to show the upcoming deadline for re-prioritizing capabilities.

Prioritization. The prioritization feature allows users to select at least two capabilities to prioritize each week, by toggling capabilities on or off. When it is time for users to reset their priorities, the app opens by default to the prioritization screen (see Fig. 4.1b).

Planning and Logging. The planning feature enables users to plan actions for the prioritized capabilities (see Fig. 4.1c). Once a plan is accomplished, the logging screen (see Fig. 4.1d) is presented to the users, allowing them to add new journal entries to document their experiences completing that action.



Figure 4.2: Capability visualization shows all 14 capabilities and sorted by the most addressed capability (top of the list) to the least addressed one (bottom of the least).

Capability Visualization. The capability visualization feature (see Fig. 4.2) shows a list of capabilities, in descending order by the number of planned actions accomplished to address them, providing an overview to the users about the relative attention they have paid to each capability.

4.1.2 User Workflow

To further clarify how LTJ works, we describe here the user workflow of LTJ. When a user opens LTJ for the first time, they start on the priority screen (see Fig. 4.1b), where they must choose at least two capabilities (priority capabilities) to focus on for the week. Users cannot proceed past this screen until they have prioritized at least two capabilities. After saving the priority capabilities, they move to the planning screen (see Fig. 4.1c). Here, the user can create a planned action by adding a short title of the plan, an optional description to describe how the plan will be accomplished and the related capabilities addressed for accomplishing the plan. Once the user has created at least one planned action that can address the priority capabilities, the home screen (see Fig. 4.1a) is shown with the list of plan(s) to accomplish. For the next seven days, each time the user opens LTJ, it first shows the home screen. During this period, when a planned action is accomplished, the user can select that action to record their experience using the logging screen (see Fig. 4.1d). The recording includes writing a description of what was actually done to accomplish the planned action, whether it helped to address the relevant capabilities, a description of how it helped or did not help, and an optional picture to upload that represents the planned action. Now, they can press the 'Record experience' button at the bottom, which saves their overall experience and, on the Home screen, moves the planned action from the 'to accomplish' section (What I will try to accomplish) to 'already accomplished' section (What I have accomplished) (see Fig. 4.1a).

4.2 Participants

We recruited 20 first-year international students (12F, 8M; P1-P20; M_{age} = 24, SD = 2.9) from 7 countries (Bangladesh, China, India, Iran, Pakistan, Palestine, South Korea) and across 5 departments at our university who moved to Canada in the last 4 months and faced their first winter in Canada. We distributed recruitment posters in multiple departments throughout the university to engage a broader student population, with the requirement that they own a smartphone and feel comfortable using it regularly. Participants were remunerated with a gift card valued at a pro-rate of $20 per hour. The pro-rating was

based on the logged data: a week was counted as active if users chose priority capabilities and accomplished at least one action.

4.3 Study Design

The study consists of three parts: a) pre-study, b) in-study, and c) post-study.

4.3.1 Pre-study

The pre-study session lasted approximately 30 minutes where participants filled out an online well-being survey, attended a brief interview, and installed LTJ onto their smartphone. We used the Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS) [115, 114, 73] as part of the online well-being survey (see Appendix B.2). This mental well-being scale consists of seven items relating to different aspects of positive mental health, and has been validated for internal consistency and reliability across different populations and is suitable for adults [41, 97, 30]. During the interview, the researchers familiarized participants with the features/functionality of LTJ and explained the 14 capabilities. Afterwards, we asked them to choose at least two or more capabilities that they would like to work on for the next seven days. In addition, once the capabilities were identified, each participant was instructed to add one or more planned actions that could address the capabilities they chose.

4.3.2 In-Study

For the in-study phase, participants were asked to use LTJ for 8 weeks, for around 15 minutes per week. Each week, LTJ prompted participants to prioritize at least two or more capabilities, plan at least one action for each of the prioritized capabilities, and record experiences at their own pace. In addition to the daily notification reminder sent from LTJ, a check-in email was sent to all participants after the first 4 weeks to see if they were experiencing any challenges using LTJ.

4.3.3 Post-study

The post-study session took place at the end of 8 weeks and lasted approximately 30 minutes, during which participants first completed the same online well-being survey as in

the pre-study session and then attended a brief interview to share their experience using LTJ and discuss how their well-being evolved during the in-study phase (see Appendix. B.3 for the questionnaire used during the post-study.)

4.4 Analysis Method

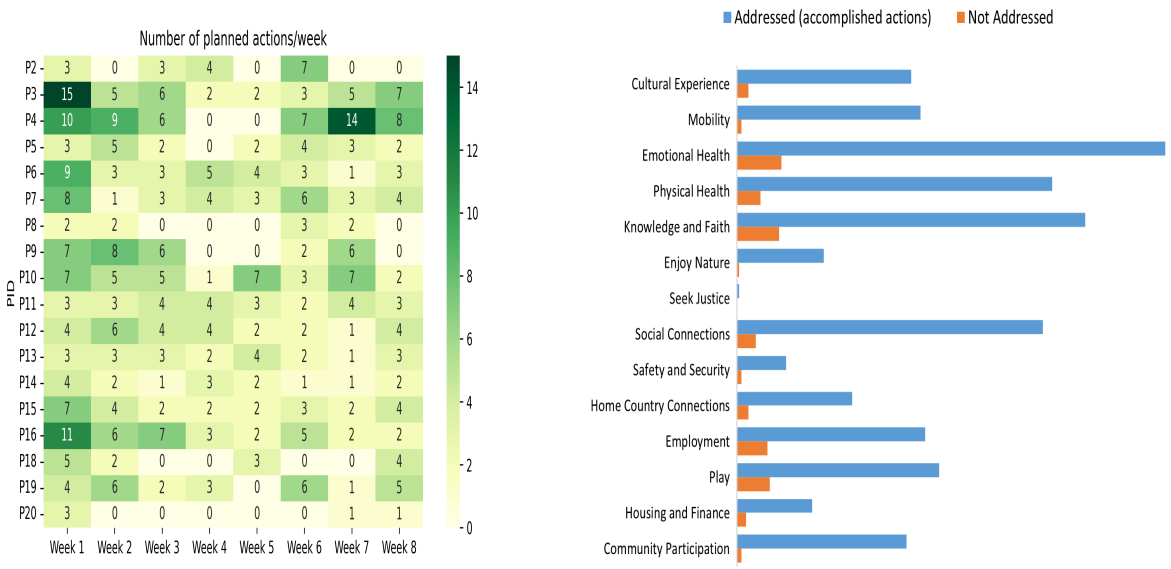
Two participants, P1 and P17, dropped out of the study after the pre-study session, so the analysis was done on the remaining 18 participants. Of the 18 participants, only P14 had used a digital journal before and P18 used pen and paper to add weekly goals. The remaining participants tried active planning and journaling for the first time during this study. Additionally, participants noted that weeks 4 and 5 coincided with their reading week and midterm exams, which may have influenced their logging frequency during that period. We transcribed approximately 15 hours of interview data and analyzed it using Thematic Analysis [13]. We generated a set of deductive codes for analysis: actions (the type of activities planned), success (planned actions that were accomplished and logged), failure (planned actions that could not be accomplished), and wellness (positive or negative impact on well-being). For evaluating inter-rater reliability, the second author coded 25% of the data. The Cohen's κ score shows a strong agreement between coders [69], $\kappa = 0.839$, $p < .001$.

4.5 Results

In this section, we present our qualitative and quantitative findings about the capability-based journaling process and how it affects behaviour and well-being within the context of this study.

4.5.1 Effects on Behaviour (RQ1)

All of our participants shared that using LTJ helped them improve their lifestyle and daily routines. In terms of completed actions, P4 created the most journal entries (n = 54), while P20 created the least (n = 5) over 8 weeks.



(a) Distribution of Planned Actions

(b) Distribution of the 14 Capabilities for Planned Actions

Figure 4.3: Distribution of actionable plans created across 8 weeks with associated capabilities across 18 participants: (a) number of planned actions by week, and (b) number of times each capability was addressed by accomplishing actions vs unaddressed planned actions

Exploration

Our participants used LTJ to explore the different capabilities and created a wide variety of action plans (see Fig. 4.3a) and learned over time how to map events to the relevant capabilities. The top four capabilities addressed were *Emotional Health*, *Knowledge and Faith*, *Physical Health*, and *Social Connections* (see Fig. 4.3b).

Many participants remarked that they went beyond their regular routines and planned activities they had not experienced before. More than half of the participants (n=11) shared that during the initial phase (weeks 1-2), they explored new activities beyond their regular classwork and that recording these experiences in LTJ positively impacted their physical and emotional health. P4, P6, P7, P8, and P15 found themselves journaling 'special' events that were significantly different from their daily routines. P4 said, "I would say, for me, journaling is not ... like recording everyday tasks. It's more like if anything special happens ... that's different from what happens regularly, that's a special memory, [then] that's the thing worth [noting down]." A majority of our participants (n=13) explored winter activities for the first time in their life while using LTJ. These include outdoor activities such as skating (P2, P5, P6, P7), skiing (P15) and building a snowman (P6, P7), as well as indoor activities such as kickboxing (P8), meditation (P10), yoga (P11), crochet (P11), exercising in a gym (P2, P5, P12, P14, P15, P18, P19), squash (P12), badminton (P5, P13), and hip-hop dancing (P20). Several participants shared that these new activities brought them happiness during the transition.

On the other hand, participants such as P2, P6, P7, and P13 used LTJ to create plans to participate in events that were taking place in their vicinity.

> "... coming to Canada, there is not a lot of ties to my own country. So, whenever there is a festival, I feel like I should attend ... whenever I'm planning to attend the festival, I just put it in the app (add a new plan in LTJ) like I am connecting to my home ... and it feels good." - P2

Organization

LTJ proved to be a valuable tool for participants in helping them organize their thoughts, maintain discipline, and create realistic, actionable plans to support better decision-making and daily routines. P5 said, "Using the journal (LTJ) ... I was able to accordingly arrange and make sure [that] when it comes to eating, I cook at regular intervals to make sure that I almost never run out of home-cooked food." P6, P7, and P16 used LTJ to plan

and create achievable actions. Notably, these participants created a large number of plans during their first week using LTJ but ended up reducing the number and adding more realistic plans in the later weeks. P14 renewed the focus on non-academic goals, such as long-term financial planning, which was previously neglected. P15 shared that LTJ acts as a system that motivated him to stay organized and accomplish planned actions.

> "... when I started recording them (in LTJ) ... it was kind of a reward system. So, once I got that done (completed a goal), that could be removed (accomplished) ... in a way, it helped me to handle my schedules better." - P15

Self-Understanding

The design of LTJ, i.e., the specific emphasis on capabilities, helped participants recognize and reflect on the capabilities they previously thought were irrelevant to their life transition. P10 mentioned being unaware of the importance of mental health—"I wasn't aware of how much I depended on emotional health before using the app (LTJ). So, like the leaderboard (capability visualization referenced in Fig. 4.2) [there was a] big difference between everything else (other capabilities) [compared] to emotional health (top capability). That really made me understand [how emotional health is important]." P18 mentioned how he gained a more comprehensive perspective on personal growth. Reflecting on the list of capabilities helped him to consider important aspects of life that might otherwise be overlooked. For P20, reflecting on daily activities and related capabilities offered insights into areas that were previously neglected, such as cultural experience and maintaining social connections. P11, P18 and P19 found thinking about the capabilities fostered more intentional goal-setting beyond mere task completion.

> "I think it did work for me (capability-based planning). It made me think of what I wanted to do, what I want to focus on and then, the more I thought about the topic (capability) in general, the more I could come up with tasks under it that I need to do. If I just went by tasks, I think there would be like less of [such] abstract thinking." - P11

Initiatives and Efforts

Several participants shared that LTJ influenced them to take initiatives to organize their own event and to see the event through. Other participants mentioned challenging themselves with unfamiliar experiences or actions they previously avoided. Focusing on social

connections, P3, who identified as an introvert and was accustomed to attending events organized by his peers, shared that using LTJ helped him recognize the importance of his wellness. Rather than passively waiting for his friends to organize a gathering, he took the initiative to plan a get-together himself, acknowledging its positive impact. Likewise, P14 said "I was just using the app (LTJ) to focus on things which I usually did not do that often ... like, keeping in touch with people from my previous school, messaging them once in a while, calling them." P5 and P7 noted that using LTJ made them feel motivated to try new sports like badminton (P5) and winter activities like skating (P5, P7), which they arranged themselves and invited their friends to join, often having to battle winter conditions to accomplish these actions. Both P13 and P14 shared that they were unable to connect with fellow classmates because they were unsure how to approach them. So when their school shared an event, they created a WhatsApp group and invited others to sign up for events like the escape room. Similarly, P19 made the decision to leave her comfort zone by going to her friend's house and both went to exercise at a gym. As a result of the positive experience using LTJ, one participant (P11) actually took the initiative to keep a journal after the study had ended:

> "Actually using this app (LTJ), I feel like I want to try like properly journaling now. And I bought a journal yesterday. So, I'm going to give that a shot." - P11

These stories highlight how adopting a proactive mindset, stepping outside one's comfort zone, and engaging in deliberate planning and coordination enabled participants to take greater control of their actions. Overall, our participants appreciated how the structured approach of LTJ helped them reflect on their capabilities for self-development.

4.5.2 Effects on Well-being (RQ2)

To evaluate if using LTJ helped support overall well-being, we compared the pre- and post-study well-being scores calculated using SWEMWBS [114]. We see an overall increase in mental well-being among 15 participants after using LTJ for 8 weeks (see Fig. 4.4). For the online well-being survey, a higher SWEMWBS score indicates a higher level of mental well-being. We also analyzed the pre and post-study SWEMWBS scores using a paired sample t-test (2-tailed) where $t = 3.70$, $p = 0.00176 < 0.05$, which is statistically significant.

Participants shared instances of improvements in various aspects of their lives as a result of planned capability-based actions. P10 shared how his visualization screen in LTJ

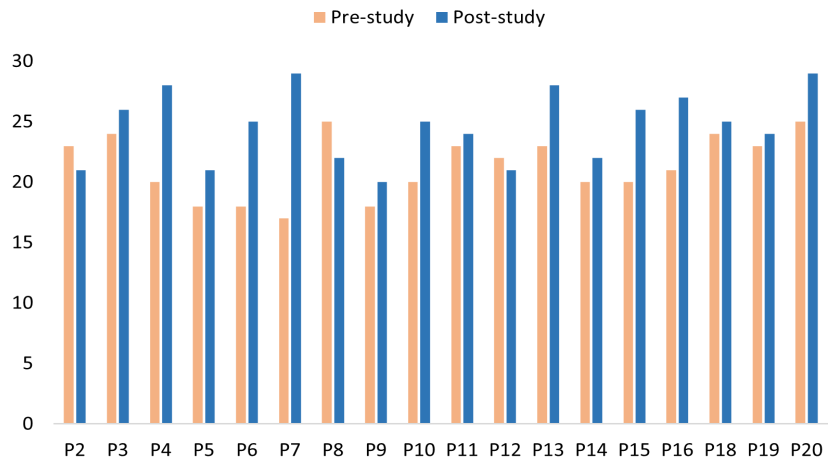


Figure 4.4: Distribution of mental well-being calculated using [114] for 18 participants before (pre-study) and after (post-study) using the LTJ app.

focuses on mental well-being, where “the app (LTJ) made me realize that most of my activities were just [attached to] emotional health." Other participants, such as P14 and P19, focused on physical health by consistently attending gym sessions, which improved their fitness, sleep, and concentration. LTJ supported social connection in the case of P19. She “motivated two other friends to join" her gym sessions, which became a regular and enjoyable part of her routine. P3, P5, and P18 improved their personal and daily task management with the help of reminders and notifications that helped them improve their mindset. P5 explained that the key factors that helped him maintain well-being were “the organization ... the actual reminders ... and the weekly requirement to update". He found joy in actions that involved sharing gifts with friends and stated that “helpfulness is a core value for me, [to] at least to contribute to the well-being of others and seeing people smile." This experience was also shared by P14, “I would only write down things which made me happy". Figure 4.5 presents three examples of actions participants planned and how those planned actions affected well-being. Below we elaborate on the three actions with the associated stories of how the planning evolved.

P6’s Breakfast Event. P6 received an email invitation to attend a ‘make your own pancake breakfast’ event at her campus residence. As this was the first time P6 was about to make pancakes by herself, she thought about how to use LTJ to break down this abstract plan into actionable steps. The steps involved first learning which ingredients are needed to

make pancakes, then gathering the necessary ingredients and finally following the relevant steps to make pancakes during the event. Through this process, P6 engaged capabilities related to “social connections", “community participation", “mobility" and “cultural experience". The act of both cooking and sharing a local food with her roommates allowed her to build friendships and enjoy a new culture.

P10’s Snow Photography. P10’s experience of capturing a snowy landscape on his walk home highlights the importance of connecting with nature and preserving moments of beauty for mental well-being. By identifying the capabilities of “emotional health,” “enjoy nature,” and “play,” P10 was able to intentionally focus on the positive aspects of his environment. His decision to take a photograph and share it with friends demonstrates how LTJ prompted to create an experience worth sharing with others.

P12’s Sabzeh Growing. P12 who moved to Canada from Iran, had a family tradition during Iranian new year celebration. During this time, they grew Sabzeh, which is a traditional Iranian plant from lentils. Being apart of his family, P12 planned to grow Sabzeh in his new apartment in Canada. He made video calls with his parents and was able to decorate for Iranian New Year, which illustrates how cultural practices can support mental health by fostering a sense of identity and connection to one’s heritage. Through LTJ, P12 shared the capabilities he valued such as “home country connections” and “cultural experience,” showing that connecting to cultural traditions can play a significant role in preserving cultural identity, especially for individuals living far from their home country.

4.5.3 Overall User Experience

All of our participants enjoyed using LTJ to add plans and the notifications were helpful for logging experiences. P7 said, “... the feeling of completing a task felt really good. I’ve completed it even if I feel I haven’t done much over the week, I can always look back at it and feel a sense of achievement." The structured approach of requiring users to think about prioritizing at least two capabilities each week works well in general, but is overly restrictive for some participants (e.g., P11, P14), who preferred more free-form way to add quick journal entries. Instead of following the prescribed planning and recording procedures, some participants opted for more spontaneity. For instance, P4 leveraged experience logging in LTJ to reflect on and write about happy moments. P3, P5, and P16 maintained a flexible planning strategy, where they only recorded spontaneous social events



Capabilities: Social Connections, Community Participation, Mobility, Cultural Experience.
What you want to accomplish: Get together with roommate and make pancakes.
How you completed this: Brought the ingredients and made pancakes in the campus housing event.
Did this help? Yes.
How? It helped me track my plans and we enjoyed pancakes together.

Accomplished on Jan 26, 2024



Capabilities: Emotional Health, Enjoy Nature, Play.
What you want to accomplish: Take pictures of nature.
How you completed this: When walking home I captured snow fall.
Did this help? Yes.
How? The landscape is really pretty and I can't wait to send it to my friends.

Accomplished on Jan 18, 2024



Capabilities: Home Country Connections, Cultural Experience
What you want to accomplish: Grow Sabzeh, video calling my family
How you completed this: Using lentils to grow a plant named Sabzeh, for Iranian new year. Spoke with my family.
Did this help? Yes.
How? Connect with my parents during Iranian new year celebration

Accomplished on Mar 14, 2024

Figure 4.5: A few actionable plans and recorded experiences by participants where the left column shows a picture taken related to the action by P6, P10, and P12 (top to bottom) and the corresponding right column shows the related steps taken to accomplish these goals: addressed capabilities, plan to accomplish, how the plan was accomplished, the reasoning if this was helpful and the accomplished date at the bottom.

when friends called or when they decided to call others. During the study, our participants also logged and reflected on experiences where their actions did not go as planned. P11, P16, and P18 had setbacks due to a lack of planning and preparation. P16 said, “I didn’t have a monitor, so I added a plan [in LTJ] to buy one ... I looked at the price and thought I can’t buy it. I need to save." P16 and P18 misjudged the start times of the events they planned to attend and missed them. P19 lost her phone during week 5 and did not have one for a week. Afterwards, she logged the experience of losing her phone to remind herself of the incident and to avoid the same thing from happening in the future.

For some participants like P3 and P13, receiving the daily notifications at a fixed time led to several missed recordings because they were in the middle of a meeting when the notifications arrived. They suggested that it would be useful for users to have the ability to customize when notifications are delivered, as individual needs/preferences can be quite unique. For example, P3 would prefer the notifications to come at night before he sleeps or in the morning, so he can plan for the next day. He explains, “my notifications are coming at 5 PM, and by that time, more than half of my day is already gone."

4.5.4 Conclusion

Our findings demonstrate that capability-based journaling can potentially be an approach to support individuals, especially newcomers in transition, in identifying key goals by creating plans and navigating systemic barriers to enhance their capabilities. Our analysis of participant experiences and journaling entries shows that LTJ helped newcomers articulate and prioritize what they valued, track their progress toward personally meaningful goals, and reflect on small but significant actions to support their broader well-being. In the next chapter, we present the end-to-end design flow of a full-fledged resource navigation digital application for newcomers using the Capability Sensitive Design (CSD) approach.

Chapter 5

CSD as a Methodology for End-to-End Technology Design

This research presents a new methodological contribution by demonstrating how Capability Sensitive Design (CSD) can be operationalized across the end-to-end technology design process. While CSD has been discussed as a theoretical framework, there remains a gap in practical guidance for how to apply it at different stages of design. Our work addresses this by creating and testing concrete techniques for applying CSD in the design process: interviews, co-design sessions for feature ideation, prototype evaluation, and field study. To guide each stage, we created specific questions and prompts rooted in the ten central human capabilities [47], with attention to identifying both fertile functionings and corrosive disadvantages. For interviews and co-design, this meant not only gathering needs or desires, but actively eliciting participants' valued capabilities, aspirations, and lived constraints. Afterwards, we evaluated the concept of "capability-based goal-setting" as a framing tool to enhance real freedoms in design, not just offer tools or access.

5.1 Operationalizing CSD in Interview Design

To understand how newcomers prioritize different aspects of well-being and navigate barriers in a new country, we grounded our interview study in the principles of Capability Sensitive Design (CSD). As shared in Chapter 3, we identified two primary stakeholders, newcomers and members of organizations and asked participants to reflect on what they value being or doing in their lives, what barriers prevent them from achieving those aspirations, and what support—technological or otherwise—could help them get closer to those

goals. These interviews were shaped by the CSD framework and focused on understanding not only the needs and barriers faced by newcomers, but also the capabilities they prioritized in their everyday lives. A key methodological tool introduced during the interviews was the capability board—a physical board (see Figure 5.1) featuring simplified prompts to understand the evolvement of a newcomer's five most important basic capabilities (e.g., "Have good physical health," "Have social connections," "Express feelings" etc.) and five important capabilities each organization supports. This board served two main purposes: (1) it grounded abstract questions about well-being in tangible and relatable life experiences in settling into a new country, and (2) it empowered participants to self-identify which capabilities mattered most to them and reflect on both the strengths and gaps in these areas during their settlement journey.

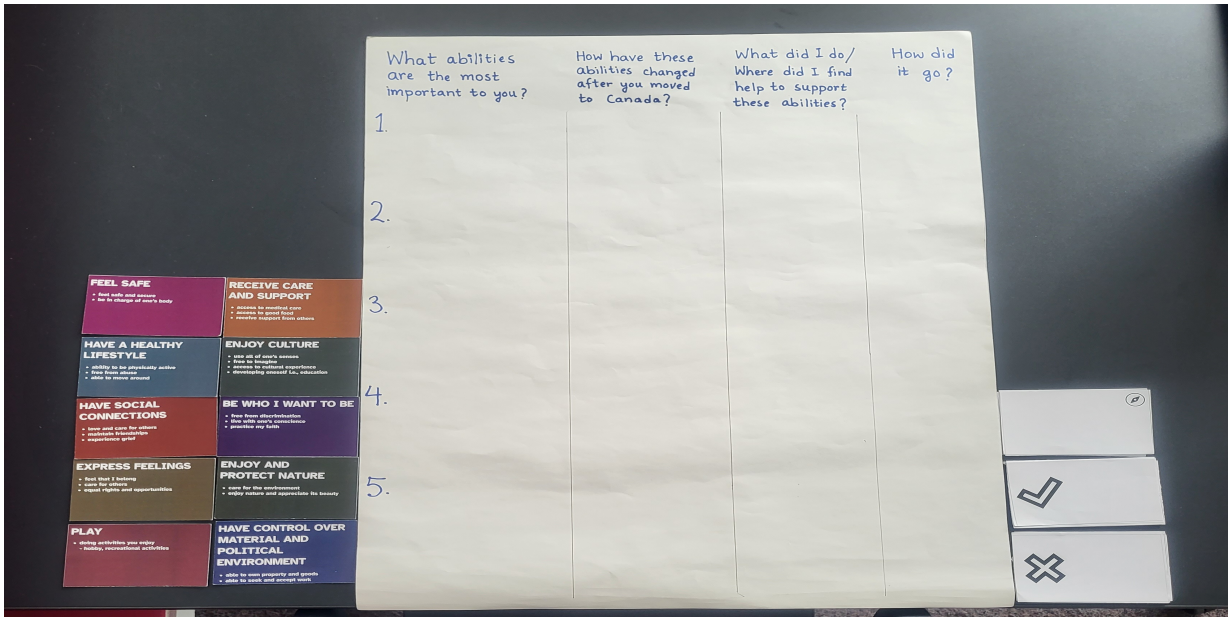
Our newcomer participants found the capability board helpful to expand the conversation beyond immediate needs (like housing or jobs) and invited them to think about deeper values—such as creative expression, caregiving, and feeling a sense of belonging. For many, this shift in conversation allowed them to reframe their goals not just in terms of survival, but in terms of thriving in a new environment. From an organizational perspective, organization participants shared that using the board helped them better understand the non-linear, multi-dimensional nature of newcomer settlement. It also revealed gaps between what services were offered and what newcomers truly valued. For instance, while job search services were widely available, participants often expressed a desire for stronger emotional support, creative engagement, or the ability to play and explore—capabilities not conventionally prioritized during settlement.

Although initially we created and used the ten capability cards mapped to Nussbaum's ten basic capabilities, some of the capabilities were still very abstract, which led us to a modified set of 14 capability cards (see Figure 5.2).

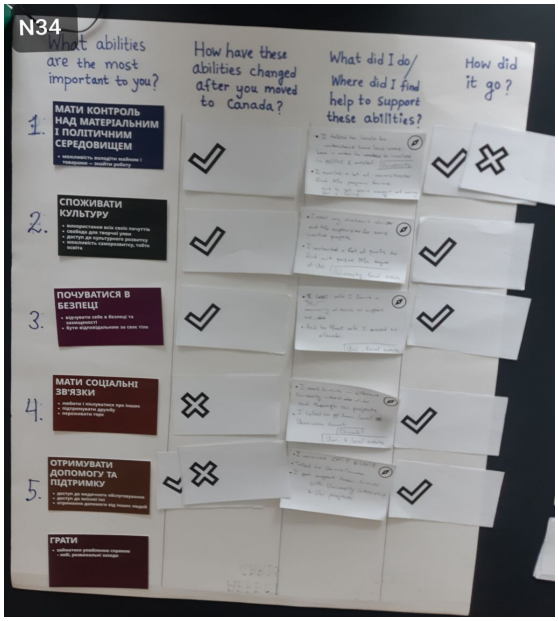
5.2 Translating Capabilities into Feature Ideation

Building on the insights from the interviews, we extended by making the ideas concrete through a structured co-design session. During the interviews, our participants shared their settlement challenges and prioritized capabilities. From interview to moving into feature ideation, we interpreted these values into design goals using a structured mapping between capabilities and user goals.

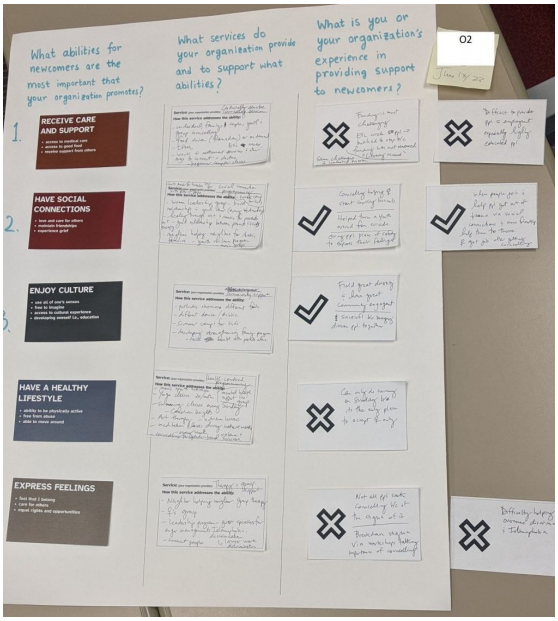
The primary objective of this session was twofold: first, to write concrete needs of newcomers; and second, to map the written needs to identify specific technological oppor-



(a) Initial Setup of a newcomer capability board



(b) A newcomer's capability board



(c) Organizations capability board

Figure 5.1: Capability board setup used during the interview sessions: (a) Initial setup before each interview, (b) a capability board of a newcomer participant who arrived from Ukraine, where the capability cards are translated in Ukrainian and (c) a capability board of an organization participant



Figure 5.2: The 14 Capability Cards used during the co-design session.

tunities. We also asked our participants whether the capability framing using cards was meaningful and easy to understand. This helped us to identify design directions.

5.2.1 Co-design Session

To translate insights from the interview study into concrete design concepts, we conducted a structured co-design session, keeping the modified 14 capability cards as part of coordinating the design iteration. The co-design process was organized into two parts, lasting approximately 2.5 hours. A total of 29 participants took part, comprising 22 newcomers and 7 representatives from newcomer-serving organizations. Participants were formed into groups of 4 to 6 from different backgrounds for collaborative ideation and dialogue, and seated at a table. To make the session inclusive for everyone, we supported three different languages including English, and we had professional interpreters to help participants understand and communicate during the whole session.

In session 1, we used affinity mapping [63], a design and management tool used to generate innovative insights and problem-solving ideas. This session lasted 60 minutes where newcomers and organization members thought of and wrote down on sticky notes a list of challenges in any events, programs, courses, activities, etc. that they had personally

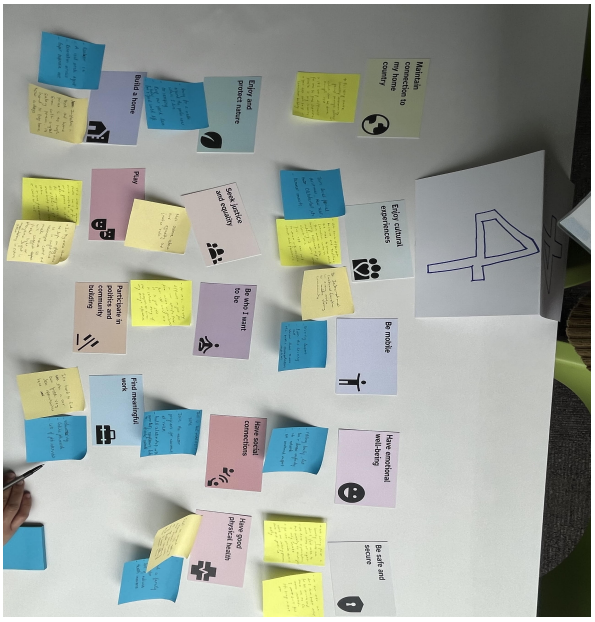
experienced or something that had helped them in their journey as a newcomer or in supporting newcomers (see Figure 5.3(a)). This was followed by sorting, grouping, and naming similar notes under each of the 14 capability cards. Finally, participants were asked to write down the ways in each sticky note to find and filter the various services, discuss potential features, and make any changes to the mapped notes in front of them (see Figure 5.3(b)).

In session 2, we involved only newcomers or organization members at each table, which consisted of enactment (role-playing) [20] and discussion of technology desired features for newcomers and organizations that support newcomers. This session lasted 90 minutes where both newcomers and organization members were prompted to imagine possible solutions to overcome newcomer settlement challenges with the use of technology. To do so, we shared a rectangular-shaped cardboard that looked like a tablet/computer with each group of newcomers or organization members. This was represented as a tool that could solve any challenges the participants shared during session 1. The participants held it in turn, thought aloud, and listed possible solutions on sticky notes and paper to address each challenge(see Figure 5.3(c) and (d)). Finally, this was followed by sorting and grouping these sticky notes as potential solutions to the relevant challenges under each capability card.

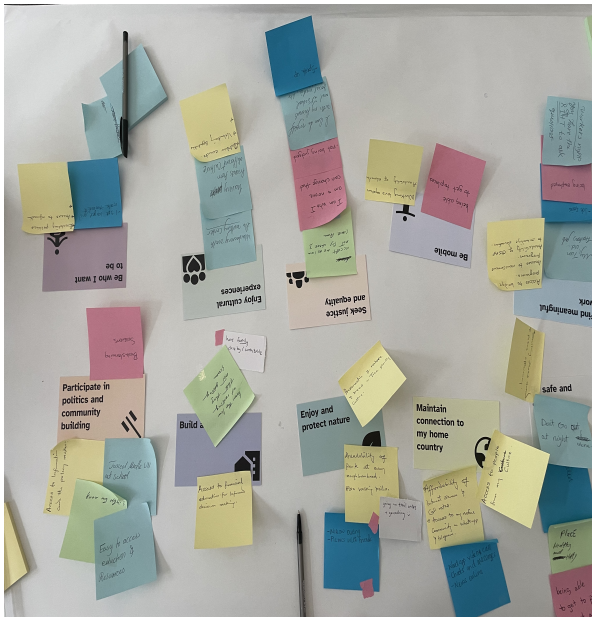
Based on the co-design session and our analysis from the interview study, we see the capability hierarchy proposed by Jacobs (see Figure 2.1) does not consider inter-connection among capabilities. As capabilities do not remain isolated, and technology identified through design requirements can address one or more capabilities. Hence, we extend the capability hierarchy to be more suited for practical use. Figure 5.4 shows how capabilities need to be understood for the specific context and mapped to extract a common norm/problem to identify one solution for the common norm. This process needs to be reiterated to ask questions such as: can the solution be translated into a design? can the solution bridge the gap of the identified problem?

5.3 Feature Ideation to Design Iteration

Based on our findings from the interviews and co-design session, we identified the key problem areas of newcomers: knowledge, connection, communication (self-expression), and managing the big picture. For these key problem areas, we categorized design features from the co-design session and created an initial design to prototype with newcomers. Below, we describe our design iteration procedure to form the final prototype that we have named the Newcomer App.



(a) Session 1 - Table 4: Newcomer challenges listed by each capability



(b) Session 1 - Table 2: Newcomer challenges grouped and categorized by each capability



(c) Session 2 - Table 3: Proposed technological solutions categorized by each capability



(d) Session 2 - Table 7: Technological solutions categorized. The rectangular cardboard is on the left.

Figure 5.3: Some examples from our participant tables during the co-design session

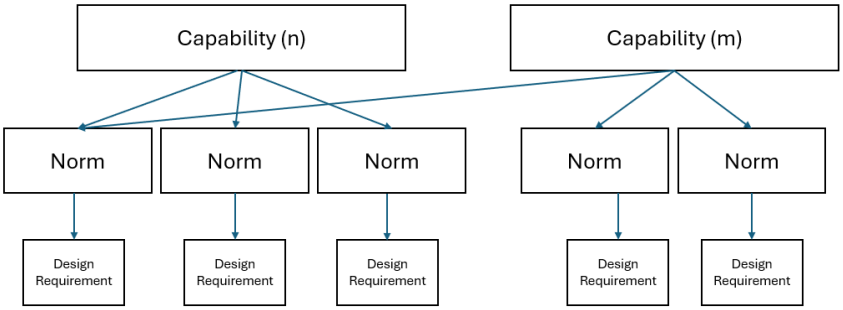
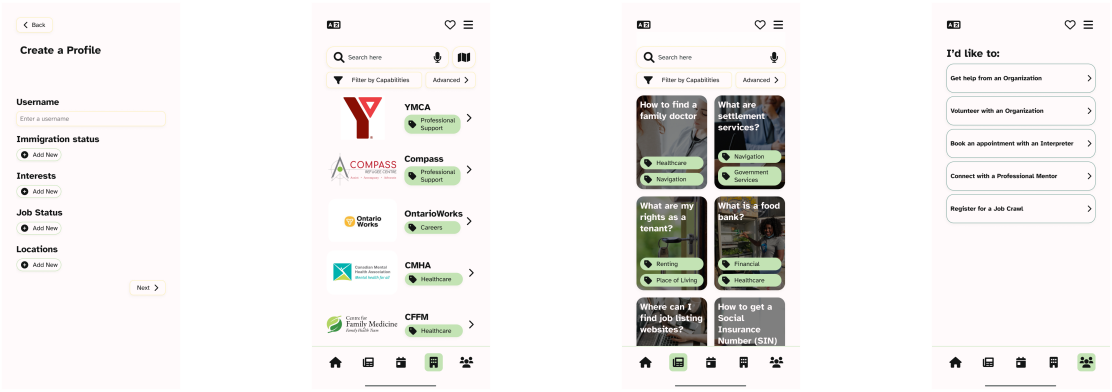


Figure 5.4: The Capability Hierarchy (extended) — at the top level are the core capabilities (where n,m $\in$ [1,|C|] where C is the total number of capabilities (contextualized) identified in any problem context). Two or more capabilities can be grouped based on the common societal norms, which shape expectations, access, and constraints. Design requirements can emerge from an individual or common norm to generate novel design interventions that support and enhance one or more capabilities (fertile capabilities)

5.3.1 Initial Prototype Design

We developed an initial mockup prototype using Figma. Then we recruited 10 newcomers to conduct a prototype evaluation. We asked two participants to participate and complete a list of tasks to evaluate whether the tasks can be easily accomplished with the mockup. For tasks, we first asked participants to complete a series of structured tasks that reflected common usage scenarios.

Participants began by signing up for an account, providing basic information such as email, username, interests, immigration status, and job status (see Figure 5.5(a)). They were then asked to locate and edit their profile, add a new interest ("Physical Activities"), and update their privacy settings to allow sharing with organizations. Next, participants navigated to the Organizations section (see Figure 5.5(b)), found a local organization ("KD-CHC"), and signed up for an upcoming event. After that, they were asked to find a specific article on building a resume using the "Filter by Capabilities" feature (see Figure 5.5(c)) and to share the article with a friend. Additionally, they completed a task to request an interpreter for a specific event by selecting a language and filling out a form. Finally, participants used the app's "Translate" feature (see Figure 5.5(d)) to convert a health-related phrase ("I have back pain") from French to English. These tasks allowed us to observe how participants interacted with different features and assess whether the app's layout, labeling, and workflows supported their goals effectively. We improved our design and workflow and afterwards invited two participants after two weeks. This helped us to keep evolving



(a) Create Profile (b) Search Organizations (c) Filter (d) Translation help

Figure 5.5: The initial prototype wireframe design of our mockup: (a) create a profile for each user, (b) search to find a list of organizations, (c) filter articles by capabilities (d) ability to request for interpreter, connect to programs etc.

the design based on existing feedback from participants.

5.3.2 Evaluating Capabilty-based Planning as a Feature

In the previous chapter (Chapter 4), we described how individuals, particularly newcomers, could identify, prioritize, and act on what they value most in their lives through structured reflection and goal setting. We created a Life Transition Journal (LTJ) which integrated the ten central human capabilities into the journaling process. Our findings show that we were able to observe how participants mapped their “wants" onto real, achievable actions, and how they reflected on barriers that either supported or hindered their progress. The LTJ study showed that structured, capability-oriented planning helps newcomers not only clarify their intentions but also break them down into manageable, motivating actions. This supports one of the core ideas of CSD—that design must enhance real freedoms, not just provide access to resources.

By evaluating how participants used journaling to reflect on well-being, take initiative, and consider systemic constraints (e.g., language barriers, limited time, lack of familiarity), we further developed design criteria for digital planning tools that support fertile function-

ing. We use these criteria in developing the features: the ability to customize plans based on what users personally value; clear prompts as suggestions that help users define and track their actions; and reflecting on the progress of accomplished plans over time. Thus, the LTJ study served as a crucial step in transitioning from conceptual insights about well-being to concrete, actionable technology design. These insights directly informed the design of the "Plan" feature in the Newcomer App which we describe in the next section. This enables users to choose a capability, set related goals, and identify small steps to reach those goals.

5.3.3 The Design of the Newcomer App

For design evaluation, we returned to these mapped capabilities to ask whether our prototypes meaningfully enhanced participants' agency in areas they prioritized. We created a mobile app called the Newcomer App that was designed keeping the capabilities at the core inspired by the findings from our interviews (Chapter 3), capability-based planning (Chapter 4), co-design session, and prototype evaluation. During our final iteration, we rephrased and modified a final list of 12 capabilities contextualized to the newcomer problem -

- Be who I want to be
- Care for others
- Communicate thoughts and ideas
- Enjoy and protect nature
- Feel safe and express concerns
- Find meaningful work
- Have good physical health
- Have social connections
- Improve emotional well-being
- Maintain home country connection
- Manage basic needs (food, shelter)

Categories	Capabilities
Community	Care for others, Communicate thoughts and ideas, Play and explore
Cultural	Maintain home country connection, Play and explore
Education	Be who I want to be
Emergency	Feel safe and express concerns
Employment	Find meaningful work
Faith	Be who I want to be
Family	Care for others, Have social connections, Maintain home country connection
Financial	Manage basic needs (food, shelter)
Food	Manage basic needs (food, shelter)
Government	Communicate thoughts and ideas
Health	Have good physical health, Improve emotional well-being
Housing	Manage basic needs (food, shelter)
Legal Help	Feel safe and express concerns, Communicate thoughts and ideas
Nature	Enjoy and protect nature
Recreation	Play and explore
Retail	Manage basic needs (food, shelter)
Settlement	Manage basic needs (food, shelter), Have social connections
Transport	Manage basic needs (food, shelter)

Table 5.1: Our final 18 categories mapped to the 12 capabilities that we have used for knowledge acquisition built into the Newcomer App.

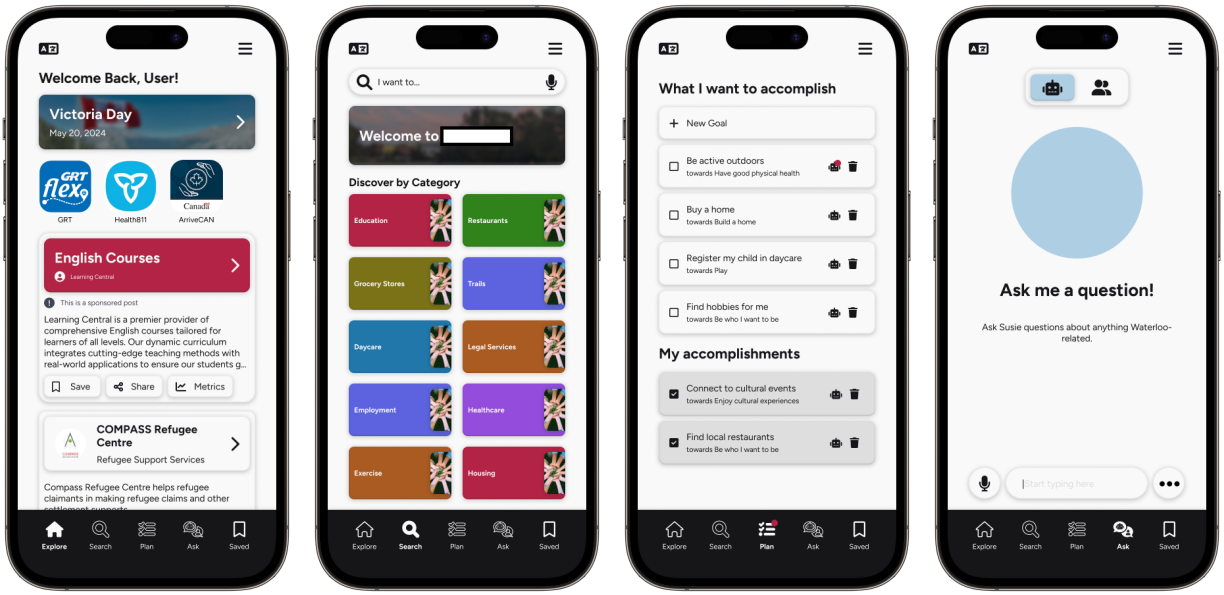
- Play and explore

Afterwards, to make the app more useful for newcomers, we added 18 categories that were linked to the 12 core capabilities (see Table 5.1). This is to ensure that newcomers are able to search for relevant information, where the capabilities can be built into the planning and are being addressed through the categories.

Here, we describe the main app features as part of the system design of the Newcomer App, namely overview (home screen), search (by category), plan (capability-oriented goals and actions), ask, and saved (contents).

System Design

The Newcomer App is designed as a resource navigation and planning tool, keeping the 12 capabilities contextualized for newcomers and their corresponding categories at the core of the design. These capabilities were adapted from the capability cards developed by Steen [113] and Jansen et al. [50]. The app was programmed by a team of students in the Augmented Intelligence Lab using React and Django, which supports 14 languages



(a) Home (b) Search (c) Plan (d) Ask

Figure 5.6: The Newcomer App is used for finding resources and creating action-based plans based on capabilities that consists of: (a) a home screen that shows newcomer-specific articles, events, and organizations, (b) a search screen that allows users to search and find events, articles, and organizations, (c) planning workflow shows a list of plans to accomplish and a list of accomplished actions, (d) ask workflow allows user to ask or type a question and have a conversation with a chatbot or another person in their preferred languages.

through the integration of Meta's Seamless language model [71]. I contributed to designing the system workflow of the Newcomer App, which is described as follows.

Overview. There are five tabs in the Newcomer App. The first tab shows an overall overview which is the home screen where users see a welcome message on the top section and below that is a space to share a list of local or international days of significance (Figure 5.6a). Below this section, users can scroll through posts regarding tips, events, and organizations that can benefit newcomers.

Search. The second tab is the search screen where users can interact in two ways (Figure 5.6b). In the first method, users can discover all services, events, and activities by

clicking through the 18 (wellness) categories that are mapped to the 12 capabilities. On the other way, users can interact on the app by typing in a search bar in their own language to see available services in their local area. After completing a search, the user will see a list of related tips, events, and organizations that offer the requested services. Users can further filter from these three criteria and consequently save all related information they are interested in and would like to avail the services.

Plan. The third tab is the plan screen, where users can create customized plans to act on their needs. Planning can be done both without or with assistance from chatbot (Figure 5.6c). Using this screen users can first create a new goal that they want to accomplish and then choose one of the 12 capabilities (wellness category) they would like to work on. Based on the chosen capability, the app will suggest a list of activities that may help address the goal. Once a suggestion is picked the app will show a list of related organization names and recommended events. Once a user selects an event or organization, the description will be automatically filled up which can later be edited and saved.

Ask. In the fourth tab, users can opt in to ask for help from a chatbot regarding one of their planned actions (Figure 5.6d). When a user may not find the information they are looking for or need additional information to fill out the plan, they can type or ask a set of questions in the messaging screen where a chatbot will guide the user to create the plan as the user intend to do. There is another option in the ask feature where users are able to chat in real-time with another person in their respective preferred language.

Saved. The final tab is the saved screen, where on the top screen it shows a summary of all the addressed capabilities and below that a list of all saved contents categorized by chats, articles, events, and organizations (see Figure 5.7).

User Workflow

The Newcomer App provides a secure login platform where after signing in, the user can set their preferred language out of the top 14 languages spoken primarily in the study region, including English, which is set as the default language. In addition, users can optionally save their cultural and educational background to see filtered content based on their needs.

On the top of the home screen (see Figure 5.6a), the user can see an upcoming day of significance, local or cultural, and can click to see details. Below is a list of horizontally

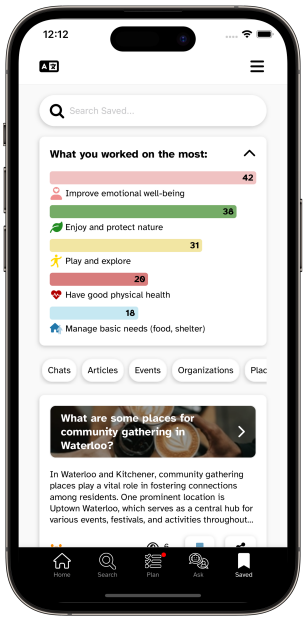
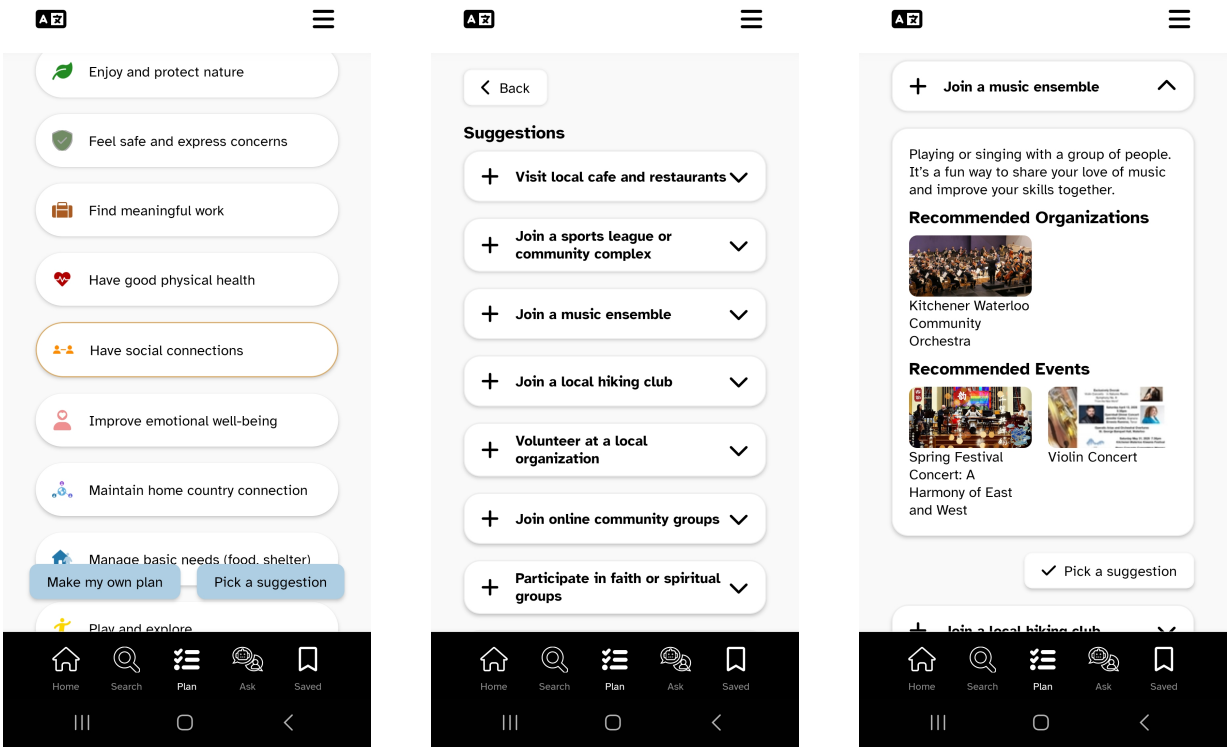


Figure 5.7: This is the saved screen which enables users to see a summary on the top section of which capabilities they have been addressing more and below that shows a list of saved articles, events, and organizations that the user found helpful and saved for reference

scrollable emergency service contacts. The remaining part of the home screen consists of a vertical scrollable section where a list of newcomer-specific articles, upcoming events, and service organizations can be viewed. This list can be repopulated using a vertical swipe on the top screen.

Users can use the search screen (see Figure 5.6b) to type about a need in their selected language or can click through a wellness category to see a list of relevant articles, events and organizations based on the typed keyword(s).

The planning screen (see Figure 5.6c) can be used to create new plans based on a capability. To begin, a user first clicks on '+ New Goal', then they can choose a specific capability to work on. Once a capability is selected, the app will prompt the user to either make their own plan or choose a suggestion (Figure 5.8a). When users choose to 'Pick a suggestion', the app will suggest a list of actions (Figure 5.8b) and from a suggestion a list of relevant resources in the form of organizations, events, or articles (Figure 5.8c) that could help address the selected capability. The app will also show specific steps i.e., where



(a) Capability List (b) Suggestions (c) Recommended Actions

Figure 5.8: In the Newcomer App, creating a Plan requires users to first choose: (a) the related capability from the list of 12 capabilities, i.e., *Have social connections*, then either make their own plan or pick a suggestion. Once user clicks to pick a suggestion, (b) the user can see a list of suggestions to act on. After they pick a suggestion i.e., Join a music ensemble, and finally (c) the user sees a list of recommended nearby organizations, events and related articles to create the plan with a related action from the list.

to start and what to do next to fulfill the created plan. Once a suggestion is selected, the user can save it and that plan will get added to a list of plans that the user wants to accomplish. After following through all the steps, once a plan is accomplished, the user can mark the plan as completed, and the plan will move from the 'What I want to accomplish' list to the list of 'My accomplishments'. In case the user would like to make their own plan, they can also write the steps they would want to take to fulfill the plan. Similarly to before, the plan moves to 'My accomplishments' when tagged as completed. This ends

the planning flow in the app.

The ask screen (see Figure 5.6d) allows the user to type or use the phone's microphone to ask a question in any of the ten languages. A chatbot will respond to the user as the chat progresses. At the end of the chat, the user can save the chat by giving a name for future reference. Users can also toggle the mode on the top screen to start a one-on-one conversation with another person in the comfort of their own language. For example, if a user who speaks Spanish chooses to speak to another person who speaks English, both can continue the conversation and listen to the other person's conversation in their language (see Figure 5.9).



Figure 5.9: This is the "Ask" screen for a one-on-one conversation between a newcomer who speaks in Spanish and another individual who can speak in English. The newcomer types or speaks a question in Spanish. The other person sees and hears the question in English. When the English speaker replies, the newcomer can read or hear the response in Spanish.

In the saved screen (see Figure 5.7), users can see a list of the top five capabilities they have addressed, where the most addressed capability is listed at the top. Users can also reflect on their saved content (chats, articles, events, and organizations) based on their needs and what they have previously accessed or were interested in.

5.4 Limitations in Designing with Capabilities

One of the key challenges we faced in operationalizing Capability Sensitive Design (CSD) during end-to-end technology design was finalizing the set of capability cards. While the theoretical framework provided by Nussbaum's ten central capabilities offered a strong foundation, we found that transforming these abstract concepts into tangible, understandable capabilities and categories for participants was not straightforward. Throughout the process, the capability cards continued to evolve. Nussbaum's original list of capabilities, for example, has a very general and abstract capability called "Life" (i.e., "being able to live to the end of a human life of normal length; not dying prematurely, or before one's life is so reduced as to be not worth living" [81]), which is too abstract for our purpose and hence discarded. The capability "Control Over One's Environment" was made more concrete by referring to specific areas of controls, such as employment and housing.

In practice, striking the right level of concreteness or specificity is very difficult to achieve. Capability card names that are too abstract might evade understanding. If these are made concrete and specific, users will be incentivized to think about their challenges in terms of tasks instead of broad aspects of well-being or rights and entitlements. Researchers who plan to use CSD during their design iteration may find it effective to treat the capability cards as starting points for discussion and interpretation, rather than fixed categories. Creating layers from concrete resources to broader capability goals can also support better alignment between user-facing features and underlying design values.

5.5 Conclusion

Using Capability Sensitive Design (CSD) in different phases of application design provides a comprehensive, user-centered approach. The design process starts with an in-depth understanding of users' needs via information gathering from all stakeholders, which we discussed in Chapter 3. Then we discuss how to translate capabilities into features through co-design (Section 5.2.1), which is followed by designing a mockup prototype and feedback to continue design iteration (Section 5.3.1). In the next phase, (Chapter 4) highlights a novel way of incorporating capability-based planning for users to set goals based on their valued capabilities, so that they can transform their needs into practical actions. Through this method, we move beyond general value-sensitive principles and offer a replicable pathway for applying CSD in real-world design efforts, particularly those involving marginalized or structurally disadvantaged populations such as newcomers. Finally, we describe the design

details of the Newcomer App (Section 5.3.3) by incorporating the findings from information gathering through feature ideation and design via design iterations.

In the next chapter, we present a field study to find the user experience of using the Newcomer App, a capability-based goal-oriented resource navigation application for newcomers.

Chapter 6

Evaluating the Newcomer App

In the previous chapter, we presented Capability Sensitive Design (CSD) as a methodology for end-to-end technology design. We demonstrated how CSD can be operationalized through concrete techniques—interviews, co-design sessions, prototype design, and finally the application design and evaluation—each guided by structured prompts rooted in the ten central human capabilities. Our approach emphasized not only understanding needs, but identifying valued capabilities and the real-world constraints that enable or hinder them. By framing design through the lens of capability-based goal-setting, we aimed to ensure that design interventions would support meaningful expansions of agency and well-being.

Building on these foundations, this chapter shifts focus to the implementation of a field study using the Newcomer App—a mobile platform introduced in the previous chapter (Chapter 5). The goal of the Newcomer App is to improve the settlement experience of newcomers and to explore the usefulness of a capability-based tool to navigate their transition in a new country. This protocol was approved by our university's Research Ethics Board and the study was carried out between January and March 2025. Below, we detail the design of the field study, including participant recruitment, training, data collection procedures and our overall findings.

6.1 Apparatus

The Newcomer App, a multilingual app for both Android and iOS, serves as the apparatus for the field study. The app was designed as a resource navigation planner using the CSD framework to focus on capabilities and enable users to create actionable plans.

6.2 Participants

We recruited 42 newcomers (28F, 14M) from 12 countries who are 18+, immigrated to Canada in the last 5 years, and living in the region where the study was conducted. Individuals who answered the screening survey were contacted by phone and/or email and scheduled to attend a training session at a public library.

6.3 Study Design

The field study consists of three parts: a) pre-study, b) in-study, and c) post-study.

6.3.1 Pre-study

During the pre-study, we conducted a group training session where each participant was guided through several tasks, from the installation of the app to exploring all the features. Each participant scanned one of the two QR codes to download and install the Newcomer App on their iOS or Android smartphones. At the end of the training session, each participant was suggested to use the app for 8 weeks in their own time. In addition, we gave them a paper notebook to keep track of their capability changes at the end of each week (see Figure D.1 in Appendix D).

6.3.2 In-study

For the in-study phase, participants were asked to use the Newcomer App for 8 weeks, planning at least one action per week to address a capability they care the most. In parallel with using the app, participants were also given a physical tracking notebook to monitor changes in their lived experience. Each week, they identified up to three capabilities that had either improved or deteriorated, along with a brief reflection explaining what influenced those changes (Appendix D.1). We provided two additional app features - 'Report a bug' - to share about any technical issues, or 'Suggest a feature' - to propose new feature ideas or existing feature improvement. A check-in email was sent to all participants after the first 4 weeks to see if they were experiencing any challenges using the Newcomer App. Although we encourage it, there was no requirement for participants to follow through with their created plans to complete the action. Finally, all participant interactions with the app (e.g., mouse clicks, text input) were logged during app use.

6.3.3 Post-study

At the end of 8 weeks, all participants were invited to answer a post-study survey to share their general experience of using the Newcomer App. In addition, participants took part in a follow-up interview session (see Appendix D.2), which aimed to elicit deeper insights into how they engaged with the app to pursue their most valued capabilities, the plans they formulated, and the actions they successfully carried out. These interviews lasted approximately 30 to 45 minutes.

6.4 Analysis Method

Of the original 42 participants, 32 completed both the post-study survey and interview. Hence, our analysis is based on data collected from these 32 participants. We transcribed approximately 10 hours of interview data and analyzed it using Thematic Analysis [13]. Furthermore, to examine whether browsing a category increases the likelihood of creating a capability-aligned plan, we employed a logistic regression model defined as follows:

$$\text{logit}(P(Y_i = 1)) = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \cdots + \beta_n X_{in}$$

Where:

- Y_i is the binary outcome variable for participant i:
  - $Y_i = 1$ if the participant created a plan under a specific capability.
  - $Y_i = 0$ otherwise.
- $\text{logit}(P(Y_i = 1))$ is the log-odds of the outcome occurring.
- β_0 is the intercept term.
- β_j are the regression coefficients that estimate the effect of each independent variable X_{ij} on the log-odds of the outcome.
- X_{ij} is a binary variable indicating whether participant i browsed category j:
  - $X_{ij} = 1$ if the category j was browsed.
  - $X_{ij} = 0$ otherwise.

The odds ratio (OR) for a predictor X_j is computed as:

$$\text{OR}_j = e^{\beta_j}$$

Where: $\text{OR}_j > 1$ indicates a positive association between browsing and plan creation, and $\text{OR}_j < 1$ indicates a negative association.

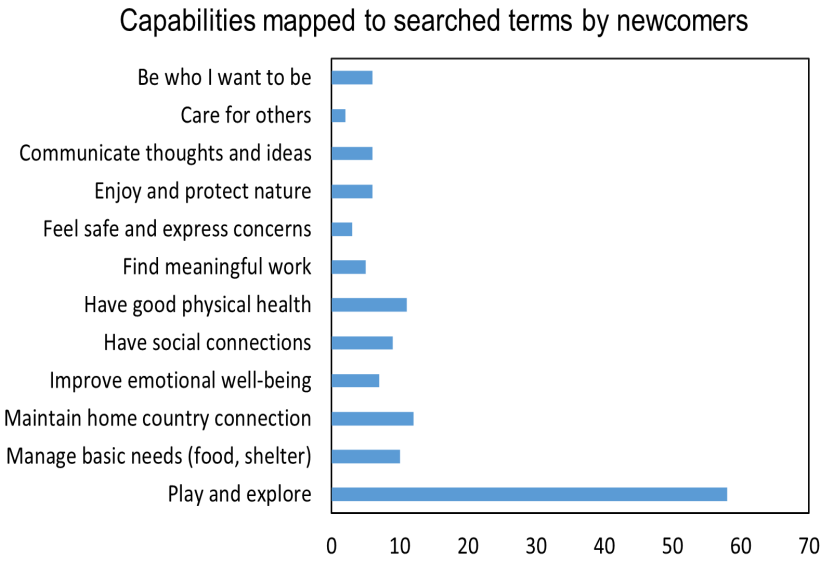
6.5 Results

In this section, we present our qualitative and quantitative findings about the personal insights and a deeper understanding of newcomer goals, interests, and values through the Newcomer App.

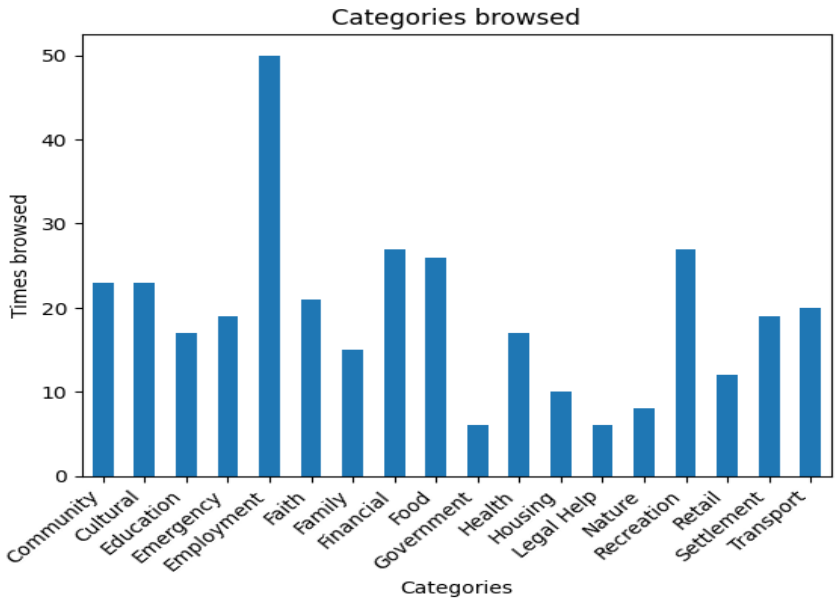
6.5.1 Enhancing Self-Discovery and Agency

Discovering Values Through Exploration and Engagement. All of our participants shared that interacting with the Newcomer app helped them uncover new aspects of themselves and their preferences. It allowed users to surface latent aspects of their identity through patterns of exploration and engagement. Figure 6.1a shows the distribution of keywords searched in the Newcomer App by participants to explore their needs, which is categorized by individual capability. *Play and Explore* is by far the most searched by participants as N27 shared, "I found myself looking out more for social activities... I think I'm more of a social person than I thought". Similarly, N5 shared how the app facilitated meaningful actions aligned with personal values: "I'm trying to give back a little. It helped me know that as much as the economy is giving to me, I'm giving back". Apart from searching, participants browsed the 18 categories (see Table 5.1 in Section 5.3.3) mapped with the 12 capabilities. Figure 6.1b shows that all the categories were browsed by our participants, where Employment was the most browsed one, whereas Recreation, Financial, Food, Community, Cultural, and Faith were prominent compared to the other categories. This allowed participants to discover articles, events, and organizations to enhance their relevant capabilities. These experiences point to the app's role in supporting users' agency by surfacing values and enabling intentional participation in community life.

Participants such as N35 and N40 also described how the Newcomer app encouraged the intentional pursuit of new habits. As N35 noted, "I didn't know about what is mindfulness (an in-app suggestion), so I started to look at it. I checked ... the information about



(a) Searched keywords categorized by capabilities



(b) Browsed categories by number

Figure 6.1: Visualization of user engagement with the Newcomer App through the lens of capabilities and categories: (a) keywords searched by capabilities, and (b) contents browsed by categories

it, and making some practice about it, so that one for me was helpful."

Observed Patterns in Capability-Driven Actions. Our findings show improved agency as all the participants engaged in a wide range of actions to pursue their goals to address a range of multiple capabilities essential for well-being. Several (11 out of 32) participants pursued physical activity goals by engaging in exercise-related actions such as joining a gym, attending aerobics or Zumba classes, or maintaining home-based workouts (N2, N4, N5, N6, N7, N25, N27, N34, N35, N39, N40). Others prioritized community engagement and volunteering, signing up to assist at local organizations or taking part in community initiatives (N5, N6, N25, N27, N34, N40). Social connection emerged as another prominent area, with participants actively attending local events, game nights, or visiting community centers to meet new people (N4, N5, N6, N13, N27, N34, N35, N39, N40). Many also focused on skill development and learning, including attending baking classes, language instruction, or informal education through online tutorials (N4, N5, N7, N25, N34, N40). In addressing basic needs and access to support services, several participants reached out to local employment agencies, healthcare providers, or food and housing assistance services (N4, N5, N6, N27, N34, N40). In terms of health and wellness, actions ranged from scheduling massages to health checkups, healthy eating, or practicing yoga and mindfulness (N5, N6, N7, N13, N35, N39, N40). A few participants also maintained or deepened their spiritual and religious engagement through mosque, church, or temple visits and participation in related community programs (N6, N25, N34, N39). Finally, participants expressed themselves through arts and hobbies, engaging in music, creative writing, dancing, and drawing to feel "happy" (N5, N25, N34, N35). These patterns of actions highlight the diverse strategies newcomers use to build meaningful lives, often drawing from multiple domains simultaneously.

Collectively, these narratives show that the Newcomer App reinforced personal agency and empowered users to explore a range of activities to support their well-being. The app's design features—ranging from capability-specific suggestions to actionable prompts contributed meaningfully to this process of self-discovery.

6.5.2 Bridging Awareness and Action Through Design Interventions

One of the central goals of the Newcomer App was to support individuals not only in becoming aware of relevant resources and opportunities but also in translating that aware-

Capability	**Category Browsed**	β	**OR**	p
Find Meaningful Work	Employment	2.20	9.03	0.001
Play and Explore	Recreation	2.05	7.77	0.004
Have Good Physical Health	Health	1.90	6.69	0.008
Be Who I Want to Be	Education	1.85	6.36	0.012
Improve Emotional Well-being	Health	1.75	5.75	0.015
Have Social Connections	Community	1.60	4.95	0.020
Feel Safe	Safety	1.50	4.48	0.030
Enjoy and Protect Nature	Nature	1.45	4.26	0.025
Maintain Home Country Connection	Cultural	1.30	3.67	0.038
Manage Basic Needs	Food	1.25	3.50	0.035
Care for Others	Family Support	1.10	3.00	0.045
Communicate Thoughts and Ideas	Government	-1.15	0.32	0.048

Table 6.1: Logistic regression results showing the highest β values sorted to lowest to represent the relationship between browsed categories and likelihood of plan creation across capabilities (Coefficient β, OR = Odds Ratio, p-value)

ness into intentional, goal-directed actions. This section examines how our participants interacted with browsing categories and in-app suggestions, formed actionable plans based on their personal values and priorities, and followed through on those plans.

Browsing Categories to Creating Plans. As described in the analysis method (Section 6.4), our logistic regression analysis examined whether browsing a specific category within the Newcomer App increased the likelihood of creating a corresponding plan, mapped to one of the capabilities. The results show that for all the capabilities except one, there is a statistically significant positive relationship between category browsing and subsequent plan creation.

Table 6.1 shows the 12 core capabilities and only the associated category of highest likelihood to create a plan. This demonstrates how browsing different categories in the app influenced users' likelihood of creating plans linked to specific capabilities. The capabilities are sorted based on the highest likelihood, where browsing the *Employment* category was significantly linked to creating a plan under the capability *Find Meaningful Work* ($\beta = 2.20$, OR = 9.03, $p = 0.03$). Similarly, browsing *Recreation* showed strong positive associations with the capability *Play and Explore* ($\beta = 2.05$, OR = 7.77, $p = 0.01$;). Conversely, we found a negative association between the category *Government* and plan creation under *Communicate Thoughts and Ideas* ($\beta = -1.15$, OR = 0.32, $p = 0.07$), which was not

statistically significant. Other capabilities such as *Have Good Physical Health*, *Be Who I Want to Be*, and *Have Social Connections* also showed significant positive relationships with their respective categories (*Health*, *Education*, and *Community*), indicating that users who explored these categories were more likely to act on their needs through capability-based planning.

Transforming Suggestions into Intentional Plans. Although some of our participants shared of planning goals by themselves, the majority (20 out of 32) shared that the suggested contents in the app had enabled them to create concrete plans for activities that aligned with their capability goals. The suggestions did not merely inform but also inspired users to take initiative in ways they might not have otherwise considered. N35, who migrated from Bolivia, found a restaurant as a suggestion she wanted to try out. "I didn't even know that we have a nice Korean restaurant ... I should go and try out". The Newcomer app shared suggestions during planning to guide participants in creating capability-driven goals. As N34 shared related to the capability *Have good physical health*, "... the app helped me to book [the workout class], to have it as my plan. That way I was more intentional, and I was able to go for those". N5 used the app to search and read an article about the importance of volunteering, and then continued to search for nearby organizations looking for volunteers. While many participants directly used the suggested plans, others, such as N35, used them more as inspiration. Instead of following the suggestions exactly, she reviewed them to better understand what type of actions could support a specific capability, and then created personalized plans accordingly.

> "It (app suggestion) gives you a better idea of how to make a ... plan by your own. That's why I used to pick first the suggestions plans, and then I can make my own plans according that. ' - N35"

Reinforcing Action from Meaningful Plans. Several participants shared that the app recommendations were helpful to transform a suggestion into a plan and then a deliberate action to completion. For instance, N4 remarked that seeing a suggestion in the Newcomer App to visit the Farmers Market led her to visit it for the first time. This experience was framed as both a discovery and a turning point: "This was not the first time that I was hearing about it, but after the app prompted me, I went ... Now we regularly go to the Farmers Market." N9 shared how the app supported her in accessing employment services through the planner. This shows the connection between information and intentional follow-through as N9 shared, "I found some employment services... I tried reaching out to them... that was one thing that the app helped me with the planner." All of our newcomer participants combined created and completed 443 plans, where they reported 311 plans

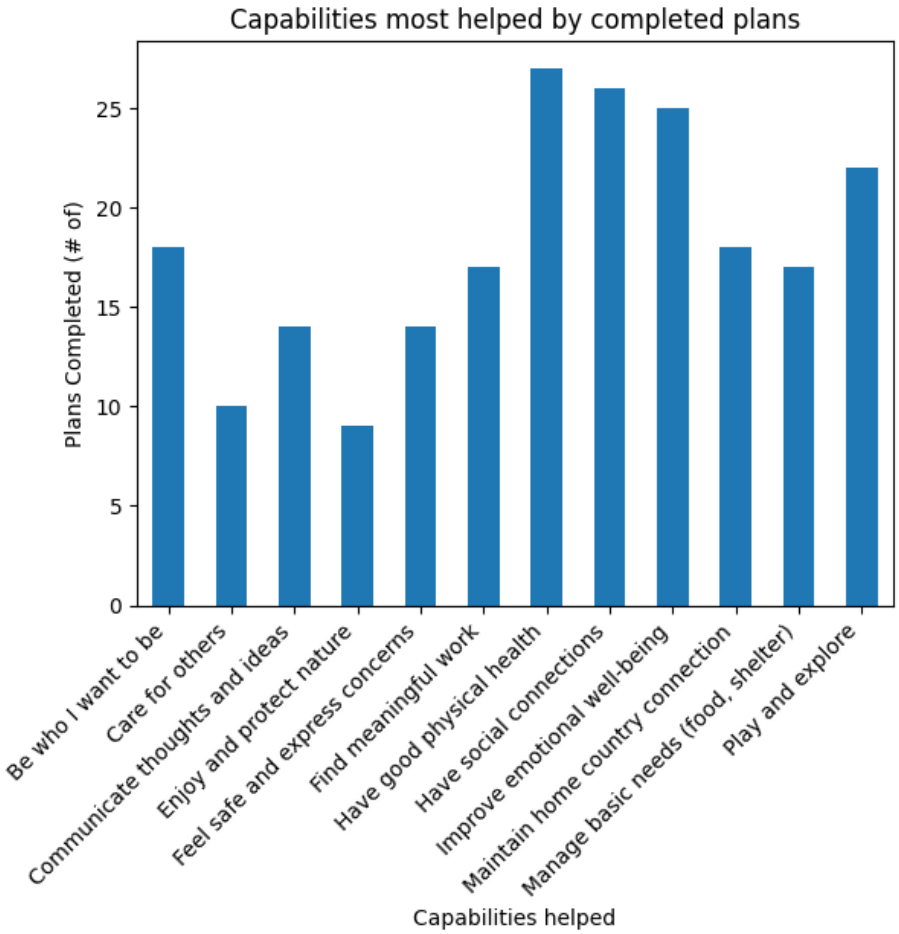


Figure 6.2: The capabilities that helped our newcomer participants through completing plans.

(70.2%) helped the corresponding capabilities they planned to address. Figure 6.2 shows the list of capabilities that helped our participants through plan completion, where *Have good physical health*, *Have social connections*, and *Improve emotional well-being* were more prominent. This illustrates how actionable content can lead to tangible engagement in addressing capabilities when paired with planning features.

Finally, both N13 and N25 reflected on the broader impact of accessing meaningful resources, not just for themselves but also for others. N25 shared, "I was able to refer to somebody go to the food bank. And presently the person is volunteering at the House of

Friendship. So, it empowers me."

Overall, the contents of actions and suggestions within the Newcomer App served multiple roles: supporting planning where users could reflect on their needs, expand perceived opportunities, and facilitating follow-through. By helping participants create and complete intentional actions that aligned with their personal values and aspirations, the app content directly supported capability development.

6.5.3 Addressing Structural and Design Barriers

Participants encountered a range of structural and design-related challenges while using the Newcomer App, which reveals areas for improvement in both content and functionality. Several users noted issues related to the availability and relevance of local resources. For instance, N6 pointed out resources from her own culture's business and organizations had "very limited options" in some categories. Similarly, N40 expressed the need for more tailored content, stating that while the app offered professional job listings, many newcomers initially look for part-time or entry-level jobs, such as "crew members or restaurant jobs," which were not well-represented.

Several participants expressed a desire for additional planning supports, including daily checklists and goal-tracking features, that could simulate a form of behavioral accountability. One of the five main features was 'Ask' which majority of our participants reflected as not helpful but shared potential ways the chatbot can offer support. N4 characterized the chatbot as a "last resort" when other options failed or language barriers arise: "If nothing is working... maybe I can [use the chatbot]." While not central to user experiences, chatbot support may act as an important role as a backup system for some users primarily in situations that require emotional or cognitive demands. N34 suggested integrating features that foster social accountability: "...if possible, having it like a challenge, like I can invite friends. And then my friend and I are competing to support each other's planned actions for the week". This framing indicates that social connectedness, when tied to goal-setting, can enhance user motivation and persistence in pursuing personally meaningful actions.

6.6 Conclusion

This chapter presented the findings from a field study exploring how newcomers engaged with the Newcomer App to reflect, plan and pursue their valued capabilities. Our findings revealed that the app served as a practical resource tool, helping users discover new aspects

of their identity and build a sense of agency in their settlement journey. Participants used the app in varied ways, including browsing capability-aligned categories, searching for specific goals, and adopting or adapting suggested actions to create personalized plans. These interactions led to tangible outcomes, such as finding volunteering opportunities, improving physical and emotional health, strengthening social ties, and navigating essential services. Importantly, the capability framing allowed us to identify key factors that shaped how newcomers moved from intention to action, including the usefulness of contextual suggestions in prompting goals to planning and follow-through.

Chapter 7

Discussion

In this dissertation, we begin with the problem that newcomers often experience a decline in their health and well-being during settlement. This deterioration is compounded by insufficient settlement assistance tools and is further exacerbated by language barriers, cultural differences, discrimination, and challenges in accessing healthcare and affordable housing. The following research questions guide the thesis:

RQ1: What are the most important conversion factors and fertile capabilities in the newcomer settlement context?

RQ2: What technology interventions can help newcomers develop agency towards addressing their own capabilities?

RQ3: How can CSD be adapted to guide the end-to-end design of a capability-centered resource navigation system for newcomers?

To answer these questions, I conducted three explorative studies using Capability Sensitive Design (CSD), a framework focused on designing well-being technologies. In the first study (Chapter 3), I analyzed the challenges and important capabilities of newcomers which led to identify fertile functioning and the relevant conversion factors (**RQ1**). The analysis helped to identify the key capabilities of newcomers and determine essential design features for supportive technologies. In the second study (Chapter 4), I evaluated whether capability-based goal-oriented plans and actions can be an effective design intervention and can address the relevant conversion factors to promote newcomer well-being (**RQ2**). This led us to the third study (Chapters 5 and 6) to conduct follow-up co-design sessions and prototype evaluation through multiple iterations to develop a resource-based navigation application (Newcomer App). To evaluate the Newcomer App, I conducted a field study

with newcomers to explore how a capability-based, goal-oriented application could support their settlement and to examine interactions with such a system in everyday life (**RQ3**).

The three studies enhance the understanding and potential of using CSD from identifying newcomer needs to designing and evaluating these features. Below, we discuss what we have learned in general and how to move forward -

7.1 The Need for a Socio-Technical Approach

Understanding the challenges faced by newcomers requires more than digital interventions; it demands socio-technical approaches that bridge technological design with the social systems that shape people's lived experiences. The Social Determinants of Health (SDoH) framework [65] and the Capability Approach [104] (which underpins CSD) both emphasize how personal, social, and environmental conditions influence well-being. However, CSD distinguishes itself by emphasizing two key ideas: freedom of choice—designing for the values individuals prioritize rather than prescribing outcomes and agency—recognizing users not as passive recipients of services but as active agents capable of shaping their futures when given the right supports, or conversion factors.

Despite CSD's strengths, much of the recent work applying the framework still embeds a silent assumption: that simply providing access to technology enables capability development. However, this overlooks the persistent realities of social barriers (e.g., cultural restrictions, gender norms) and environmental constraints (e.g., infrastructure constraints, fragmented systems) [23]. Such oversights risk narrowing users' real freedoms, leading to interventions that reflect designer assumptions more than user needs.

Our deployment of the Newcomer App sought to foreground these nuances by embedding capability-based planning into a real-world context. While the app allowed newcomers to set goals and explore resource pathways, its most transformative effect was in shifting users' awareness of their own potential. Participants like N35 and N40 described how the app's suggestions prompted a reevaluation of previously sidelined needs, such as emotional or physical health, resulting in renewed motivation to act. This process of guided discovery, goal-setting, and reflection provided a structured pathway for users to move from abstract values to concrete actions—what Sen calls real opportunities to do and to be [108].

However, in Section 6.5.2, we see the capability *Communicate Thoughts and Ideas* had a negative association with the category *Government* which denote the structural limitations and disconnect with organizational authorities to be able to be heard. The success of a socio-technical system hinges on integration with local infrastructures—community

organizations, peer networks, and institutional supports—that can fill gaps a digital tool alone cannot. A feature like 'Newcomer Ambassador' can act as a bridge where newcomers who have overcome the initial struggles can act as guides for others who may be in their initial settlement phase. These individuals can also work as a liason with organizations and engage in restructuring policies, services, and programs offered.

To summarize, this research introduces a structured method to recognize and respond to fertile functionings and corrosive disadvantages by surfacing conversion factors such as language barriers, infrastructure gaps, and systemic exclusions. This work further demonstrates how digital systems can be ethically accountable to users' lived realities by extending Nussbaum's vision of social justice by showing how personalized, goal-oriented digital interventions can actively support real freedoms. Advancing newcomer well-being is not a question of technology or community, but rather of how thoughtfully designed technologies can mediate and connect people to the social ecosystems that enable them to flourish.

7.2 Application of CSD: Opportunities and Limitations

One of the central contributions of our work lies in operationalizing *conversion factors*—the personal, social, and environmental conditions that shape whether newcomers can translate available resources into meaningful functionings. Prior work has established that the mere presence of resources does not guarantee improved outcomes; rather, structural barriers such as low education levels, poor infrastructure, or cultural misalignment often prevent vulnerable populations from benefiting [124]. Our findings reaffirm this, illustrating how even in resource-rich environments, newcomers struggle to navigate and act on these opportunities due to misaligned systems and unacknowledged social norms. The Newcomer App was intentionally designed to address this gap by embedding multilingual support, cultivating community knowledge through events, articles, organization to disseminate culturally resonant content, and finally, an intuitive planning feature. These elements transformed static information into *usable knowledge*, guiding users to take deliberate, capability-enhancing steps such as joining local community groups or seeking mental health practices, i.e., mindfulness etc. This shift—from merely presenting information to enabling action—demonstrates the potential of adaptive, context-aware design to improve fertile functioning.

Beyond identifying barriers, our approach positions digital tools as *capability catalysts*—technologies that not only support users in achieving immediate goals but also expand the horizon of what they believe is possible. By embedding goal-driven planning

features within everyday digital routines, the Newcomer App acted as a form of quiet scaffolding: not intrusive, but persistently present. Users were encouraged to self-reflect, prioritize, and take small yet meaningful steps, reinforcing their agency and personal growth. This resonates with the core concept of CSD, where the success of a design is judged not by its efficiency or novelty alone, but by its ability to enhance users' *real freedoms*. Our field study surfaced compelling examples of this empowerment. Participants like N40 used the planning feature to articulate and work toward long-held but dormant goals, such as rebuilding social networks or addressing emotional health needs often buried under the pressures of daily survival in a new country.

Yet, this capability-centered design approach also exposed key challenges and limitations. One of the most difficult aspects was translating abstract values—such as "emotional well-being" or "belonging"—into concrete, actionable technology features. Values are deeply personal and shaped by shifting life contexts; they resist simplification. To address this, we introduced co-design tools like the *capability board*, which helped participants surface what they truly valued. For example, newcomers such as N4 and N27 identified social connectedness as a priority, prompting to design of features that suggested relevant community activities and low-barrier events. However, a challenge lies in ensuring these designs remain personalized and contextually relevant over time. Capabilities are not static—they evolve with the user's experiences, environment, and growing sense of self. This requires continuous iteration and user involvement, suggesting that capability-sensitive systems must be designed not as fixed solutions but as *adaptive ecosystems* that evolve with users and the surrounding environment.

Moreover, evaluating whether capabilities have been enhanced introduces another layer of complexity. Unlike conventional success metrics (e.g., clicks, time-on-page), capability outcomes demand longitudinal insight into whether users experience real, valued changes in their lives. Our evaluation method allowed participants to reflect on what they planned, what they achieved, and how they felt about it. Participant N34, for instance, described how planning health goals led to consistent behavioral changes, such as attending fitness classes and joining community events. These may appear incremental, but in the context of capability theory, they represent significant shifts in agency, identity, and self-conception. Importantly, these outcomes were not driven by the app alone, but by its strategic role as a mediator—connecting individuals to both internal motivations and external support networks.

The application of CSD reveals a promising but complex terrain. While the framework offers a powerful lens for designing meaningful, value-aligned technologies, its implementation requires ongoing negotiation between user agency, systemic constraints, and evolving aspirations. The Newcomer App illustrates how digital interventions can not only sur-

face what matters to people but also support them in moving toward it—if designed with deep attention to context, conversion, and care. Still, realizing this potential at scale will demand more than isolated tools; it will require sustained partnerships across policy, community, and technology sectors to build infrastructure that is as responsive and diverse as the lives it seeks to support.

7.3 Leveraging CSD in HCI: Future Directions

As research in HCI continues to engage with questions surrounding ethics, inclusion, and justice, Capability Sensitive Design (CSD) acts as a compelling framework for aligning technology with what people have reason to value. To further advance CSD in HCI, future research should explore scalable tools, methods, and cross-sector collaborations that translate capabilities into actionable, context-sensitive design interventions.

Building upon the foundation of this thesis, future work could explore ways to support dynamic capability mapping. One promising direction is the integration of adaptive AI systems that co-evolve with users' self-identified goals and capabilities. An open question can be posed - "Can adaptive AI interfaces dynamically respond to evolving user-defined capabilities in ethical and equitable ways?". Instead of pre-defined feature sets, these systems would continuously learn from users' interactions and life contexts to offer more nuanced, relevant, and timely support. For example, newcomers navigating transitions could benefit from a system that learns to suggest evolving opportunities based on shifting priorities—such as health, employment, or social connection. This research would investigate how to balance automation with user agency, ensuring that adaptive technologies empower rather than override individual aspirations. It would also explore the boundaries of capability-aware personalization in design and develop methods to sustain value-sensitive feedback loops over time, offering meaningful contributions to both CSD and HCI.

A second open question could be - "How can CSD be used in multi-stakeholder environments (e.g., newcomers, service providers, policymakers) to facilitate equitable negotiation of priorities?". While CSD foregrounds ethical considerations and stakeholder participation, real-world design processes often involve tensions between competing values, limited resources, and structural constraints. This project would build a participatory platform that facilitates collective reflection among diverse actors—community members, government representatives, technologists, and advocacy groups—on how to prioritize capabilities in technology-enabled public services such as housing, employment support, or transportation. The platform would help surface which capabilities are at risk of being overlooked,

highlight potential areas of mutual reinforcement or exclusion, and offer structured guidance for balancing normative commitments. By embedding normative justification and procedural justice into the design process, this work could extend existing tools like capability hierarchies into usable formats for negotiation and decision-making.

Finally, a third open question could investigate - "How can we develop robust, longitudinal methods to evaluate whether digital technologies genuinely enhance users' real freedoms and capabilities over time?". This project would create participatory tools that allow users to document how their capabilities change over time, offering insight into the effectiveness of social interventions, services, and technological systems. By combining subjective user reflections with structural indicators—such as access to education, safety, or economic opportunity—the system could generate community-level data on capability expansion. These patterns could then be used to advocate for policy improvements or to hold institutions accountable for systemic inequities. This research would not only support individual well-being but also extend the role of HCI in contributing to public accountability and structural justice. Ultimately, such a system would make visible the often-invisible trajectories of marginalization or progress, offering an important tool for social empowerment grounded in the Capability Sensitive Design framework.

In our implementation, many of the capabilities were initially expressed through content, such as articles, events, and suggestions tagged to specific capabilities. However, to go beyond that, we designed functionalities like the goal planner, category-based search, and contextual prompts to scaffold user action toward improving those capabilities. For example, the "Plan" feature not only lists goals related to 'Have Good Physical Health' but also supports users in selecting relevant actions, scheduling them and tracking completion. However, we recognize that not all capabilities were equally integrated into the interactive functionalities of the application. This opens a space for further work to ensure that capability-based frameworks are not only represented in content curation but are also embodied in the core features and user pathways of the app.

Chapter 8

Conclusion

This work contributes to HCI by reframing technology use among newcomers not merely as a matter of access or efficiency, but as a process of capability cultivation to support their overall health and well-being. It shows how digital tools like the Newcomer App can scaffold identity, support agency, and nurture resilience. While our field study demonstrates short-term changes in participant behavior, motivation, and reflection, future researchers can investigate how digital interventions can support long-term capability development. This includes examining sustained patterns of goal-setting, habit formation, changes in well-being over extended periods, and analyzing how capability framing can inform AI-based recommendations. Much of the current work focuses on individual goal-setting and self-directed action. Future research could extend this to explore shared or collective capabilities, such as joint planning between family members, peer networks, or community-driven events. Social and collaborative planning tools could strengthen relational well-being and reflect newcomers' interdependence with their community or cultural groups for a better settlement experience.

These insights are especially relevant for researchers and practitioners seeking to build systems that are inclusive, empowering, and grounded in the lived complexities of migration and adaptation.

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APPENDICES

Appendix A

Materials for Interview Study

A.1 Ideation To Develop Our Capability Cards

Below we show the list of Nussbaum's ten basic capabilities, mapped with the capability cards of Steen and Jansen/Javornik and our capability cards texts.

Nussbaum's ten capabilities	**Steen [94]**	**Javornik [36]**	**Our capability cards**
1. being able to live a normal length of lifespan (Being able to live a complete and satisfying life into old age. Not having life cut short or being made such that it hardly seems worth living. Not everyone has a good life. People scrape by in humdrum and dismal situations. They may be regularly threatened and may have their life cut short unnecessarily.)	1.1 Everyday life (being able to provide basic needs in everyday) 1.2 Security (being able to be protected from violence) 1.3 Safety	1. Feeling Secure - Be in charge of my body - Feel safe - Go about as I please	**FEEL SAFE** - feel safe and secure - be in charge of one's body

Nussbaum's ten capabilities	Steen [94]	Javornik [36]	Our capability cards
2. having good health (Living with good health, and not in a state where ill health seriously affects the quality of life. Having access to medical help as needed. To have good food and be able to exercise in ways that sustain health.)	2.1 Bodily Health: Care (being able to visit a doctor and receive care) 2.2 Bodily Health: Food (being able to be adequately nourished)	2. Receiving the Care that I Need - receiving medical care - receiving support, receiving help from others - receiving support in household	**RECEIVE CARE AND SUPPORT** - access to medical care - access to good food - receive support from others
3. maintain bodily integrity (Being able to go where you want to go. Being free from attack and abuse of any kind. Being able to satisfy healthy bodily needs.)	3.1 Mental health: To relax and sleep (being able to relax and sleep well) 3.2 Mobility: In and around home (being able to move freely in and around the home) 3.3. Mobility: Travel (being able to move freely from place to place)	3. Healthy Living - Healthy eating - Enough exercise - Be good to yourself	**HAVE A HEALTHY LIFESTYLE** - ability to be physically active - free from abuse - able to move around

Nussbaum's ten capabilities	Steen [94]	Javornik [36]	Our capability cards
4. being able to use the senses, imagination, and think (Being able to use all of one's senses. Being free to imagine, think and reason. Having the education that enables this to be done in a civilized, human way. Having access to cultural experiences, literature, art and so on and being able to produce one's own expressive work. Having freedom of expression, including political and religious.)	4.1 Self-expression (being able to express oneself and to be accepted by others) 4.2 Self-determination (being able to set goals and pursue these) 4.3 Education, critical thinking (being able to sense, imagine, think and reason, informed and cultured but an adequate education) 4.4. Self-awareness and reflection (being to engage in critical reflection)	4.a Enjoying Culture - Enjoying art - Enjoying music - Enjoying books - Enjoying movies - Visit museums 4.b Developing Myself - Follow an education - participate in courses 4.c Making My Own Choices - Make and execute my own plan - Make decisions that are good for me 4.d Filling My Free Time - Practicing my hobby -Be creative - Use my imagination	ENJOY CULTURE - use all of one's senses - free to imagine - access to cultural experience - developing oneself e.g., education
5. having emotions and emotional attachments (Being able to become attached to other things and people outside of ourselves, loving and caring for them. Experiencing grief, longing, gratitude and justified anger. Not being subject to fear and anxiety or blighted by trauma or neglect.)	5.1 Relationships (to form and enjoy social relations, to share emotions and feelings) 5.2 Mental health: Emotions (being able to develop emotionally)	5. Having Contact With Other People - Engage in social relations - Maintain friendships	HAVE SOCIAL CONNECTIONS - love and care for others - maintain friendships - experience grief
6. possess practical reason to form a conception of the good (Being able to consider and develop understanding of good and evil, and to think critically about the world and one's own place in it. Being able to live with one's conscience.)	6. Dignity (having the social bases of self-respect and non-humiliation, being able to be treated as a dignified being)	6. Being Who I Want to Be - Practicing my religion - Expressing my sexual orientation - Be free from discrimination	BE WHO I WANT TO BE - free from discrimination - live with one's conscience - practice my faith

Nussbaum's ten capabilities	Steen [94]	Javornik [36]	Our capability cards
7. have social affiliations that are meaningful and respectful (Being able to associate with others, living with them and acting for them. Showing concern for people in general and interacting with others. Having sympathy and compassion, acting to help people. Seeking justice and making things right. Protecting others and the rights of people, including freedom of speech and freedom from fear.)	7.1 Care for others (being able to live with and towards others, to recognize and show concern for other human beings, to love those who love and care for us) 7.2 Social support (to be nurtured and cared for, to receive and give support to others, to share emotions and feelings) 7.3 Equal rights and opportunities (being free from discrimination on the basis of race, sex, sexual orientation, ethnicity, caste, religion or national origin)	7.a Being Meaningful to Someone Else -providing informal care -providing neighbor support -contribute to the community -doing volunteering work 7.b Expressing Feelings -say what I feel - share feelings with others - empathetic with others 7.c Belonging - stand up for myself - be part of a group	**EXPRESS FEELINGS** - feel that I belong - care for others - equal rights and opportunities
8. express concern for other species (Being able to live with the full range of creatures and plants that inhabit the world around us. To be able to enjoy nature and appreciate its beauty.)	8. Care for the environment (being able to live with concern for an in relation to animals, plants and the world of nature)	8.a Contributing to a Sustainable World -make choices that contribute to a sustainable world 8.b Enjoying Nature - enjoy the environment -have a pet animal	**ENJOY AND PROTECT NATURE** - care for the environment - enjoy nature and appreciate its beauty

Nussbaum's ten capabilities	Steen [94]	Javornik [36]	Our capability cards
9. able to play (Being able to laugh, play games and generally have fun. Not having one's enjoyment and recreation criticized or prevented.)	9. Leisure, play (being able to have pleasurable experiences. To engage in various forms of social interactions. Being able to laugh, play, to enjoy recreational activities)	9. Enjoying Life - relaxation - have fun - take part in valuable activities	**PLAY** - doing activities you enjoy - hobby, recreational activities
10. have control over one's material and political environment (Being able to participate in political activities, making free choice and joining with others to promote political views. Being able to own property and goods on the same basis that others do so. Being able to seek and accept work, and to be treated reasonably at work. Being free from unwarranted search and seizure.)	10.1 Participation (being able to participate in public, political, economic and legal arenas) 10.2 Political freedom (having the right of political participation free speech and association, and being able to participate effectively in political choices that govern one's life) 10.3 Meaningful work (being able to seek employment on an equal basis with others, to work as a human being, and to receive fair compensation) 10.4 Bodily health: Shelter (being able to have adequate shelter)	10.a Working - doing paid work - doing unpaid work - doing work that I find important 10.b Using Talents - show my talents - be valued for my talents 10.c Living the Way I Want - live in a house as I please - live in a place that suits me 10.d Getting by with Money - determine my own finances - have possessions 10.e Voicing My Opinion - express my opinion - vote in elections - being able to influence what I find important	**HAVE CONTROL OVER MATERIAL AND POLITICAL ENVIRONMENT** - participate in public - able to make free choice - able to own property and goods - able to seek and accept work

Figure A.1: The ideation to develop our capability cards for the interview study (Chapter 3)

A.2 Pre-Study Survey

What is your age?
- 18 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- 70+
- Prefer not to say

What is your gender identity? - Man
- Woman
- Genderqueer / Gender non-conforming / Gender non-binary / Gender Fluid
- I prefer to self-define:
- Prefer not to say

What is your current immigration status?
- Canadian citizen - by birth
- Canadian citizen - by naturalization
- Permanent Resident
- Temporary Resident (Work Permit)
- Temporary Resident (Study Permit)
- Just visiting (non-Canadian resident)
- Prefer not to say

Which race category best describes you? (Select all that apply)
- Black (African, Afro-Canadian, African-Canadian descent)
- East Asian (Chinese, Korean, Japanese, Taiwanese descent)
- Latino (Latin American, Hispanic descent)
- Middle Eastern (Arab, Persian, West Asian descent e.g. Afghan, Egyptian, Iranian, etc.)
- South Asian (Sount Asian descent e.g. East Indian, Pakistani, Srilankan, Indo-Caribbean, etc.)
- Southeast Asian (Fillipino, Vietnamese, Cambodian, - Thai, other Southeast Asian descent)
- White (European descent)

- Another race category

What is your highest level of education? - Less than a high school diploma
- High school degree or equivalent (e.g. GED)
- Some college, no degree
- Associate degree (e.g. AA, AS)
- Bachelor's degree (e.g. BA, BS)
- Master's degree (e.g. MA, MS, MEd)
- Doctorate (e.g. PhD, EdD)
- Prefer not to say

What is your marital status?
- Single (never married)
- Married, or in a domestic partnership
- Widowed
- Divorced
- Separated
- Prefer not to say

How many children do you have?
- None
- 1
- 2
- 3
- 4+
- Prefer not to say

What was your employment status (job title) before you moved to Canada?

What is your current employment status (job title) in Canada?

What is your annual household income?
- Less than $20,000
- $20,000 to $34,999
- $35,000 to $49,999
- $50,000 to $74,999

- $75,000 to $99,999
- Over $100,000
- Prefer not to say

Which country did you immigrate from?

Which postal code area are you currently living in? (First 3 letters of your postal code)
- N2G
- N2H
- N2M
- N2C
- Not listed above:

A.3 Interview Questionnaire

A.3.1 Newcomer Interview

- Can you tell a little bit about yourself and your family?
- Why did you decide to settle in Canada?
- Please pick 5 cards that represent the capabilities that are most important to you.
- Please go ahead, spend a few minutes to place the card on the board.
- Please put a X card next to the capabilities that are negatively affected by your move to Canada, and a checkmark card next to the capabilities that are positively affected by your move to Canada. Then, write down some reasons why these capabilities were affected.
- Using a "navigation card", please write down what did you do, some services that you looked for or used to achieve each of these capabilities that are important to you, and the method you used to find these services.
- Please put a "checkmark card" next to the services that you had a great experience finding or using, and write down why.
- Please put a "X card" next to the services that you had a bad experience finding or using, and write down why.
- Can you briefly share what's on your capability board?
- During your transition to Canada, how much have you relied on other [participant's cultural group, e.g., Syrian], e.g., friends, people from cultural organizations (e.g., Coalition of Muslim Women KW, Waterloo Region Chinese Canadian Association)?

- What would you imagine a new application to do that would be helpful for newcomers?
- How would you be most likely to hear of an app like this? - What are some ways in which this app can be advertised to reach the most newcomers?
- Can you envision you or your family using such a newcomers app? How?
- What challenges, if any, might prevent you from using such an app?

A.3.2 Organization Interview

- Can you describe your organization—what kinds of services it provides, and what mission drives the organization?
- Can you describe your role in the organization?
- How would you define the word "newcomers" from your organization's point of view?
- What methods do you typically use to reach out to newcomers?
- In your effort to reach out the newcomers, how much has your organization relied on cultural organizations (e.g., Coalition of Muslim Women KW, Waterloo Region Chinese Canadian Association)?
- Please pick 5 cards that represent the capabilities that your organization is trying to promote. Please go ahead, spend a few minutes to place the cards.
- Using a "service card", please write down some services that your organization provides to promote these capabilities.
- Please put an X card next to the capabilities that your organization encountered challenges promoting to newcomers, and a checkmark card next to the capabilities that your organization had great success in promoting to newcomers. Then, write down a brief description to describe these challenges and successes.
- Can you briefly share what's on your capability board?
- What would you imagine this application to do that would be helpful for newcomers and organizations that serve newcomers?
- How do you envision the people in your organization to use such a Newcomer app?
- What challenges, if any, might prevent the organizations from using such an app?
- How would you be most likely to hear of an app like this? What are some ways in which

this app can be advertised to reach the most newcomers and organizations?

Appendix B

Materials for Capability-based Actions Study

B.1 Pre-Study Survey

What is your age?
- 18 - 29
- 30 - 39
- 40 - 49
- 50 - 59
- 60 - 69
- 70+
- Prefer not to say

What is your gender identity? - Man
- Woman
- Genderqueer / Gender non-conforming / Gender non-binary / Gender Fluid
- I prefer to self-define:
- Prefer not to say

Which race category best describes you? (Select all that apply)
- Black (African, Afro-Canadian, African-Canadian descent)
- East Asian (Chinese, Korean, Japanese, Taiwanese descent)

- Latino (Latin American, Hispanic descent)
- Middle Eastern (Arab, Persian, West Asian descent e.g. Afghan, Egyptian, Iranian, etc.)
- South Asian (Sount Asian descent e.g. East Indian, Pakistani, Srilankan, Indo-Caribbean, etc.)
- Southeast Asian (Fillipino, Vietnamese, Cambodian, - Thai, other Southeast Asian descent)
- White (European descent)
- Another race category

B.2 Short Warwick-Edinburgh Mental Well-Being Scale (SWEMWBS)

I've been feeling optimistic about the future
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been feeling useful
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been feeling relaxed
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been dealing with problems well

- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been thinking clearly
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been feeling close to other people
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

I've been able to make up my own mind about things
- None of the time
- Rarely
- Some of the time
- Often
- All of the time

B.3 Post-Study Interview Questionnaire

Understanding Behaviour of Planned Actions:
Can you give a specific example of planning and taking an action that helped?
Can you give a specific example of planning an action, and not accomplishing it, and why?
Can you give a specific example of planning and taking an action, but it did not help?
Has the capabilities that you focused on changed over the last 8 weeks? If yes, How?

Do you feel you were able to address these capabilities?

Understanding Well-being:
Can you give 1-2 specific examples of accomplishments you are most proud of?
How have these helped you to manage yourself better?
Can you share any other aspects of your personal life that you feel have improved since first using the app?
How do you feel about your state of wellness before and after using this app?
Do you think this app will be helpful for newcomers to better manage their transition?

Appendix C

Materials for Prototype Evaluation Study

"Your first task is to sign up for an account. Please only fill in the information you're comfortable with."
1. Press the "Sign up" button
2. Input an email and password (make up some fake information!)
3. Press the "Next" button
4. Add a username
5. Fill in Immigration status, Interests, Job Status, Locations (will not show up!)
6. Press the "Next" button
7. Select Settings options
8. Press the "Next" button

Follow-up questions: Was there particular information you were hesitant to fill out, or did

you think it was ok?
Who do you expect that information to be shared with?

Please navigate and find the organization 'KDCHC' that's closest to your location." "Now, please sign up for an upcoming event that KDCHC is offering."
Go to the homepage
Go to the organizations tab (building icon on bottom)
Press on the map icon
Press on the red pin
Press on the "KDCHC" organizations card
Scroll down to the Upcoming events header
Open the events dropdown
Press the "Sign-up" button
Would you prefer to look up locations on a map or through a list?
What would you expect the sign-up process to look like? Would you expect to go on a different website to sign up?

I'd like you to find an article related to building a resume." "Now that you've found the article, can you share it with a friend? Go to the articles tab (newspaper icon on bottom)
Press the "Filter by capabilities" button
Toggle "Find meaningful work" in the modal
Press the "Save" button
Press the "What do I include in my Canadian resume?"

Appendix D

Materials for Field Study

D.1 Newcomer Notebook Template

Week 1 (Jan 18 - Jan 24)

During week 1, which **3 capabilities** changed the most? For each of these 3 capabilities that changed the most, **circle** "Better" or "Worse" and explain why.

Capability	**Changes**	**Why?**
Be who I want to be	Better Worse	
Care for others	Better Worse	
Communicate thoughts and ideas	Better Worse	
Enjoy and protect nature	Better Worse	
Feel safe and express concerns	Better Worse	
Find meaningful work	Better Worse	
Have good physical health	Better Worse	
Have social connections	Better Worse	
Improve emotional well-being	Better Worse	
Maintain home country connection	Better Worse	
Manage basic needs (food, shelter)	Better Worse	
Play and explore	Better Worse	

Figure D.1: A page of a newcomer notebook used by participants during eight weeks of the field study.

D.2 Post-Study Interview Questionnaire

Planned Actions
Can you tell us one capability that you have planned actions for? Did it go well or not, and why?
Did you find the recommended actions and content useful / not useful? Can you give me a concrete example?
What did you think of the planning process in general?

Changes in Capabilities
Tell us about a capability that improved in the last two months. Can you please explain how? Does the app have anything to do with this change?
Tell us about a capability that declined in the last two months. Please share what you're comfortable with; feel free also not answer this question. Could the app have helped?

App Features
What are your favorite features in the app and why?
What feature did you find most frustrating and why?

Chatbot
What was your experience with the chatbot?
What other functions could the chatbot serve that you would find beneficial?

Future newcomer engagement
If we were to move forward with deploying this app for real to all newcomers in the KW region, how should we continue to engage newcomers in the development of the app?