

# Moving into a Technology Land: Exploring the challenges for the Refugees in Canada in Accessing its Computerized Infrastructures

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## ABSTRACT

While a growing body of literature in HCI is focusing on the initial needs of the refugees soon after their migration, most challenges associated with the long-term process of their integration with the host communities using technology have still remained understudied. This work builds on a 3 year-long fieldwork with the refugees in Canada, extended observations, and interviews with 26 participants (19 refugees, 4 refugee sponsors, and 3 refugee workers) to illustrate how refugees encounter various challenges in accessing necessary services in Canada through its computerized infrastructures. This paper documents the intricacies and nuances of this problem extended over their struggles in obtaining information, getting social support, learning new technologies, securing their digital activities, and the gender dynamics associated with these activities. Our analysis generates several design implications to address these issues. Moreover, we discuss the challenges' entanglement with some of the broader concerns in HCI regarding infrastructure, inclusion, and mobility.

## CCS CONCEPTS

• Human-centered computing → Collaborative and social computing → Collaborative and social computing theory, concepts and paradigms → Social recommendation • Social and professional topics → User characteristics → Cultural characteristics

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## KEYWORDS

Refugees, social inclusion, access, technology, computing infrastructure, HCI, ICTD, Canada.

## 1 Introduction

Research on refugees has been increasingly getting importance in HCI literature over the last few years [11,14,17,19,21,67,68]. This growing body of work is often inspired by a global rise in forced mobilities due to war, armed conflicts [70], natural disaster [69], and famines [71]. Previous research has mostly focused on important immediate necessities of the refugees. However, challenges associated with their long-term settlement including access to healthcare [22], education [44], employment [49], equality [65], among others have not received enough attention yet in HCI. Several studies have established that inadequate access to these resettlement needs can significantly lead to social exclusion and stall the process of assimilation [8,53]. Many problems that some researchers have already addressed are often computer-based solutions such as in [4,11]. However, the challenges of the refugees in accessing the computing devices themselves have not been studied well.

These issues are particularly important for countries like Canada, which is welcoming a large number of refugees every year and has modern computerized infrastructures for most public services. Canada is one of the top 5 countries that receive refugees for resettlement [61]. Since 2015, the country has welcomed over 100,000 refugees, mainly from Syria and Iraq due to civil armed conflicts in these countries [35]. These refugees face challenges that differ from other types of migrants in Canada due to numerous factors [44]. For example, refugees struggle with the hosting country language because they are not required to submit a language proficiency test like other migrants [36,40]. Moreover, only 14% of the refugees admitted into Canada over the past few years had some type of post-

secondary education such as apprenticeship, diploma, and bachelor's degree [37]. Furthermore, refugees are often brutally forced to leave their homes and many of them have traumatic experiences which hamper their process of learning and integration [59]. For these refugees, adapting to the changes they encounter with computerized services is often a big challenge.

Canadian lifestyle relies heavily on technology use to access services and information ranging from transportation, to banking, to finding affordable rent [56]. However, refugees often come from low socioeconomic environments and/or places where technology is very limited in terms of usage and infrastructure [37]. Hence, their lack of technology skills significantly undermine efforts to obtain employment, acquire information, complete online financial transactions, and access digital government services after coming to Canada [27]. Furthermore, refugees do not often have the necessary social support to draw help from for these tasks [57]. This problem is also compounded by several social, cultural, and political factors, and constitutes a big challenge in their assimilation process [22,46,53].

The objective of this paper is to provide a deep insight into the refugees' challenges in accessing the Canadian computerized infrastructures and their impact on the newcomers' assimilation process. To achieve this, we draw from our 3-year long fieldwork and interviews conducted in the Greater Toronto Area (GTA) in Ontario, Canada. The contribution of this paper is in three-folds: (a) this paper documents the struggles that the refugees have in accessing various services through digital tools, (b) it discusses the opportunities and the challenges in addressing these issues through design and policy interventions to build more sustainable and inclusive societies, and (c) it demonstrates how these challenges are associated with the broader politics around infrastructure, mobility, and inclusion.

## 2 Related Work

### 2.1 Mobility, Infrastructure, and Inclusion

To better understand the problems of the refugees, we need to concentrate on the tensions between mobility and infrastructure. A rich body of work in geography, urbanism, and refugee studies illustrate the challenges that come with different kinds of mobilities. For example, Doreen Massey [54] draws on radical geography to explain that space and society have a reciprocal relationship. Our experience with space and mobility is determined by the

privilege we draw from capitalism, gender, ethnicity, and access to technology. Forced migrants, who do not often have many of these privileges, find themselves confined within a "confusing plurality of cultures". Such disparity in mobility can weaken the leverage of the already weak [55]. This line of work is further advanced by John Urry who defines the challenges of mobility by the migrant's network capital, i.e. the number and type of connections they have [72]. Urry emphasizes that a migrant's social exclusion is not only caused by social inequality, but also by a combination of distance, inadequate transport, and limited ways of communication. Studies by Caidi and Allard [12] and Lloyd et al. [52] support this claim and show how offering access to necessary information and services may address some important aspects of this exclusion. They note that this access is part of an individual's social capital, which is defined by Lin [51] as "resources embedded in a social structure which are accessed and/or mobilized in purposive action". However, it is evident from these studies that the social capital of migrants is inadequate due to their inherently limited mobility which can lead to their marginalization.

This disparity turns us to understanding infrastructure from its core values and functions. There are diverse ways to conceive infrastructure. Larkin [50] states that infrastructure can be seen as a network and an individual's 'distance' from the infrastructure determines the quality of service they get. This "distance", as Hönke and Cuesta-Fernandez describe [28], is created by flows and enclosures. Hence it is not necessarily visible in terms of metrics but can be visualized or felt. In our context, a computerized infrastructure comes in two forms: the physical one such as a mobile device; and the virtual one such as an online platform. Because this infrastructure is used heavily in the hosting communities, the service quality is determined by the physical distance, i.e. access to some digital devices, and the virtual distance, i.e. how easy it is to use the tool or the service. Jackson et al. [43] explain that infrastructures are governed by organizing processes. Once established, systems tend to continue in particular directions, or build on one another, such that making major alteration becomes difficult. Hence, it is important to understand what values embedded in the core of infrastructure and examine its inclusiveness.

The political values that a state embeds in its infrastructure thus determine the quality of access of migrants to the critical services of their life. Celebrated political philosopher, Iris Marion Young, has expanded on this issue

and developed theories to suggest ways to ensure inclusiveness in a shared public infrastructure. Young [82] has suggested three actions to ensure proper access of a community to the social and political sphere of another community. First, greetings – the host community should welcome the newcomers with proper manner. Second, rhetoric - the host society should learn the ways of communication of the other community. Third, narrative – both groups should be able to communicate with each other by telling their stories. This shows us that, for an infrastructure to be inclusive, it requires to reach out to the ‘others’ and embraces them with care and respect. Thus, Young’s theory provides us with an analytical tool to assess the inclusiveness of an infrastructure for the migrant communities. In this paper, we build on this theory and analyze the inclusiveness of the Canadian computer infrastructure for a massive number of migrants and refugees that the country is hosting.

## 2.2 HCI and Refugee Research

A growing body of HCI research has been active in camps and informal settlements to identify refugees’ challenges. For example, Fisher et al. [21] identify refugees’ needs in Za’atari refugee camp in Jordan to inform humanitarian response, and explore [19] the spatial, temporal and infrastructural challenges that need to be considered when designing digital tools for the refugees. Talhouk et al. [68] characterize contextual and cultural factors to inform the design of digital technologies that offer refugee in rural Lebanon Access to Antenatal Care (ANC), and they [67] implement a radio show run by refugees to deliver healthcare information to the displaced community. To explain their communication behaviors and recognize design opportunities, Xu and Maitland [78] report that refugees in the Za’atari refugee camp depend heavily on mobile phones and social media for communication. The authors [79] then explore the potential of carrying Asset Based Community Development (ABCD) by refugees. In the Jalazone Palestinian refugee camp in the West Bank, Aal et al. [1–3] and Yerosis [81] discuss the impact of employing intercultural computer clubs (*come\_IN*) on the displaced youth. Ahmed et al. [6] introduce the notion of “residual mobilities” to present the experiences of mobility and technology used by involuntary migration and illustrated creative practices of infrastructural hacking by the displaced slum dwellers in Dhaka, Bangladesh. These studies illustrate the challenges of the displaced people in the camps and the informal settlements, and the potential of technology, policy, innovation, and collaboration to assist in enhancing the lives of these refugees.

Besides addressing the challenges in the refugee camps, several HCI studies have also been conducted to understand the obstacles refugees in the resettlement countries face over the long term and how to combat them. For example, Irani et al. [41] evaluate the ease of integration for refugees who have relocated to the USA. In Germany, Duarte et al. [17] study the potential of intercultural collaboration among migrant and resident youths using participatory design and participatory research strategies. Almohamed et al. [9] demonstrate how information and communication technologies (ICTs) can support refugees in rebuilding their social capital in Australia. Some researchers have created digital prototypes for the forced migrants too. For example, Brown and Grinter [11] implement Rivrtran, a messaging platform that provides interpretation among individuals with no common languages in the USA. Sandre and Newbold [62] explore the effectiveness of telemedicine services in bridging the gap between refugees’ health and health-services accessibility in Canada. While all these technologies are making noticeable progress in making information and commodities available for the refugees, many of these design interventions envision technology as a savior, while the challenges that the computing infrastructure, the physical and the technical, itself imposes often remain silent. We focus on these issues here with a vision to making such HCI initiatives more inclusive for refugees.

It is important to understand the role technology plays in the life of refugees in the resentment countries. Coles-Kemp et al. [14] show how refugees in Sweden use mobile phones, the positive role such devices play in refugees’ lives, and the security threats that came along with it. Similarly, Kaufmann [45] reports about how refugees in Vienna use smartphones to cope with everyday challenges such as finding their ways around the city and learning the local language. Alam and Imran [3] examine the impact of digital access on social inclusion for refugees in Australia. They conclude that there is a digital divide among refugees based on inequalities in physical access to digital technology, the skills necessary to use the different technologies effectively, and the ability to pay for the services. This growing body of work highlights several challenges, risks, and limitations for the refugees in using the computer services in the host countries. This body of work also warrants two important insights to move forward: (a) an understanding of how refugees perceive, fight, and negotiate such challenges, and how these challenges contribute to their overall struggle in assimilating into the host community, and (b) how such

challenges are associated with the inherent politics of computer infrastructures situated in the values and policies of the host nations. Our study joins this conversation by addressing these two pressing issues, and contributes to the scholarship of “HCI and refugees” by presenting new challenges around access, learning, gender and security in Canadian context, and by providing a set of theoretical tools to better analyze and design for addressing the infrastructural biases in computerized systems.

### 3 Canadian Immigration System for Refugees

Canada has a central immigration facility across all provinces and is run by Immigration, Refugees and Citizenship Canada (IRCC). To resettle refugees from outside Canada, specific organizations, such as the United Nations High Commissioner for Refugees (UNHCR), identifies refugees for resettlement [31]. Canada considers three options for settlement, all of which are one-year sponsorship programs for financial and emotional support. In the Government-Assisted Refugee (GAR) program, the refugees are given income support from the government while social workers give basic social support [31]. In the Blended Visa Office-Referred (BVOR) program, the government offers 6 months of financial support while private sponsors provide the rest and the full emotional support [38]. Lastly, the sponsors in the Private Sponsorship Refugee (PSR) program offer emotional and financial support to the refugee for the full sponsorship period [39].

Sponsors often play an important role in the settlement and assimilation process of refugees. Private sponsors are groups of at least 5 local people who offer support for the refugees [31]. There are two methods that can be used to link refugees with private sponsoring groups. The first one is when sponsors do not have a specific refugee in mind so the IRCC matches the group's offer of sponsorship to a refugee family in need that has already been identified by the Canadian Visa Officers (CVOs) abroad [59]. The second method is where a group of sponsors identifies specific refugees in need of resettlement [59], and the CVOs aboard assess the refugees in question [32]. The government provides training programs for sponsors on how to offer assistance for refugees [29]. It directs sponsors to provide the refugees with accommodation, enroll the kids and parents in appropriate schools, teach them about banking, and take them to trauma treatment centers. Sponsors are encouraged to respond to refugees inquiries and provide advice during the sponsorship period [60].

Refugees are granted permanent residency status from the moment they arrive in Canada, similar to any other type of migrant. The government funds ‘welcome centers’ that help newcomers settle down and adapt to life in Canada. The services these centers offer include but are not limited to language classes, building a resume, and searching for jobs [77]. However, these services are targeted towards newcomers generally – who are mostly skilled workers/economic migrants with higher education and English language level [33] – and not refugees. The refugee population tends to have higher settlement needs such as longer time to improve their languages and one-to-one mentorship [57].

### 4 Methods

There were two phases for collecting data. The first one was an ethnography conducted by the first author, who is of Iraqi roots and is fluent in Arabic. She worked as a volunteer interpreter and mentor for refugees at the Arab Community Center in Toronto, Canada from February 2016 until November 2017. Her duties included interpreting conversations, building social bridges between refugees and their sponsors, and translating documents. She helped 7 refugee families and their sponsors in the resettlement process. In some cases, because the refugees were settling in a city different from the sponsors’, she acted as a city guide to advise them about the location of potential dwellings, public transit, markets, among others. She documented (in written notes) her work experience and observations with the refugees and their sponsors. In this stage, we focused on making a broad understanding of the challenges the refugees face in their long resettlement journey such as finding a place to rent, exploring the city, and learning the language. In the second phase, which ran from June 2018 to September 2018, we focused on the refugees’ usage of technology and computing services. We conducted semi-formal interviews with 19 refugees, 4 sponsors, and 3 refugee workers. The study took place in The Greater Toronto Area (GTA), the most refugee recipient metropolis in Canada, accepting around 20% of the total number of refugees admitted into the country [37].

To recruit refugees, we used ‘snowball sampling’ [25] where we asked a number of refugees and refugee workers we knew from our previous volunteer work to participate and recommend other refugees. Using their testimonials, we recruited more refugees. We stopped at a theoretical saturation, i.e. when no new additional data were found that developed our findings [24]. Table 1 illustrates these participants characteristics. The interviews were conducted

at their homes or at a public place they liked. Each interview lasted for 40 to 90 minutes. The questions we asked were structured around a set of high-level topics. We asked about types of technologies they owned and used, the ways in which their technology usage had changed since coming to Canada, how they improved their digital skills, and how they used technology to positively boost their social and professional lives. Since all refugee participants were more comfortable in using Arabic to communicate, all interviews were held in Arabic. The interviews were audio-recorded and transcribed prior to analysis. Each participant was compensated with CAD 20 in cash for their time and we asked only for their oral consent before participation to make them feel more comfortable.

Gender	Male: 11	Female: 8	
Age	Min: 18	Max: 59	Avg: 34
Family size	Min: 2	Max: 12	Avg: 6
Number of families	12		
Regions of Origins	Syria: 17	Iraq: 2	
Mother Language	Arabic: 18	Kurdish: 1	
Transition Country	Turkey: 7	Jordan: 7	
	Lebanon: 2	Egypt: 1	
	N/A: 2		
Type of sponsorship	GAR: 8	BVOR: 1	
	PS: 10		
Date came to Canada	2016: 14	2017: 3	
	2018: 2		
	First: Jan 2016		
	Last: Feb 2018		
Education	Master: 1	Bachelor: 3	
	Diploma: 2	High school: 5	
	Middle school: 5		
	Primary school: 3		
English Level (ESL) <sup>1</sup>	Finished: 2	Level-8: 2	
	Level-7: 2	Level-5: 3	
	Level-4: 3	Level-3: 3	
	Level-2: 1	Level-1: 3	
Living Status:	Married: 15		
	Single with family: 4		
Children:	Yes: 13	No: 6	

**Table 1. Summary of the 19 refugee participants' demographic characteristics**

We recruited 4 refugee sponsors through our previous volunteer work with the refugees. Three of them were part of a group that sponsored one refugee family from 2016 to

<sup>1</sup> The language levels follows the Canadian Language Benchmark (CLB) for English as Second Language (ESL) [13]

2017 while the other sponsor was part of another group who started patronizing a refugee family in 2018. The participants were 3 females and 1 male, in their 50s and 60s, 2 were retired, 1 was working full time while the other was a part-timer. We asked about their sponsorship process, how they came to teach refugees what they taught them (especially digital tools), and what issues they encountered over the years with the sponsorship process. The interviews were done in English, lasted 1-3 hours each, and conducted at the sponsors home. None of the interviews were recorded so we captured it through detailed handwritten notes. We did not compensate these participants. Participants were asked to give oral consent.

We also interviewed 3 refugee workers who have been involved with refugees over the last few years in the GTA. They were people we knew through our volunteer work with the refugees. Our 3 refugee workers were all male, in their 20s and 40s, from 3 different institutions, and offered different services to refugees including running English tutoring programs, consulting refugees about their daily lives needs, and organizing social events. We asked about the role they played at their intuitions to help refugees, their experience working with refugees, the types of technology used by and the skills of the refugees, the pieces of advice they gave refugees, and the interesting stories they encountered that involved refugees and technology. In 2 of the interviews, participants were sent the questions via email and they emailed back their answers in a written format. We used this method because the two participants had packed schedules and, since we knew them from our previous fieldwork, we would have been able to ask for extra information later one if needed. The other interview was conducted at the participant's working place, lasted 30 minutes, was audio recorded, and later was transcribed before analysis. We did not compensate these participants. For consent, in the structured interviews, we emailed the consent form to the participants and asked them to email back their consent in a written sentence. Oral consent was used for the face-to-face interview.

We then started our qualitative analysis using a text analysis software called QDA Miner [83]. We began with a comprehensive reading of the transcripts during which we identified codes. Our initial pass through the data resulted in roughly 30 codes (e.g., digital fraud and continuing education). We then iteratively refined and discussed the codes to ensure that they were representative of the data. The resulting codes were formalized in a codebook that was used to perform a detailed analysis of all the

transcripts. Related codes were then clustered into high-level themes. Our findings represent themes with the largest number of sub-domains.

## 5 Findings

In this section, we present our findings from our ethnography work and interviews. We will use three symbols to reference quotations: R for a refugee participant, S for a sponsor participant, and W for a refugee worker participant.

### 5.1 Novel Experiences

This study shows that our refugee participants' use of technology was significantly different in their home country than that in Canada. In their home country, all but 4 refugee participants report that, if it existed, there would only be one phone for the entire family which they used for normal calls. They also indicate that internet connection was expensive, network coverage (via data plan, ethernet, or Wi-Fi) was limited, and Social Media (SM) was prohibited to some extent. This limitation in accessing ICTs is due to the fact that the majority of our refugees are from Syria, a country where it was expensive for an average local to buy a mobile device [74] and Internet access was highly regulated during the pre-civil conflicts [63]. Only 6 (2 females and 4 males) of our refugees used computers, mainly to enter data for work. Three of them, who has a higher level of education, utilized emails, design software, google maps, and online banking. The refugees we interviewed express no need for technology in the first place at that time because they lived among their family and friends, and all tasks needed to be completed in-person such as government services and banking transactions. In the transition country, i.e. where the refugees first crossed their country's borders requesting asylum, our refugee participants report being able to obtain smartphones and have internet connections. They also learned SM to connect with family and friends back home, similar to the finding of other studies conducted in Middle Eastern refugees camps [20,78].

In Canada, all of our refugees have a smartphone and all, except one, have a data plan. All the refugee families we interviewed have Wi-Fi access and at least one computer and/or one tablet at home. Moreover, the local libraries and community centers offer free Wi-Fi and computer access. Most refugee participants indicate that even their children (who are as young as 8) have a smart device. Our refugees tend to use their smartphones on a regular basis and very seldom they utilize any other type of digital device. The

number one mobile application refugee participants used in Canada is WhatsApp. They use it to communicate with their family and friends, mostly outside Canada, through text messages and video and voice calls. They also use the smartphone for Google Maps for car directions and public transit instructions; YouTube to watch TV series, get food receipts, and learn the English language; and, finally, translation apps (mostly Google Translate) to translate individual words or full web pages. Almost all refugee participants have these apps in their mother language (which is provided by the apps' developers). When it comes to more elaborative usages, financial-related tasks are the most advanced thing most of our participants do. Most of our refugees use online banking to check their account status and many pay at least one bill online such as hydro and school expenses. They complete all these transactions through their smartphones except one who uses the computer for it. Only 4 of our refugees use a computer in Canada, and they are the ones who used it before immigrating. They use it to complete online transactions, look for information, watch movies, and work on design software. This shows that our refugees now, willingly or unwillingly, use computing technologies in various aspects of their lives.

### 5.2 Accessibility

While our refugees have access to physical computing infrastructures on a regular basis, our work reveals that they face significant challenges when accessing services – such as governmental resources, obtaining information, and communicating with the host community – which are mainly available virtually. In this section, we present major sources of these access challenges. First, language imposes service access restrictions. Refugees struggle with language is a known problem, especially since unlike economic migrants, they are not required to provide a proof of language capabilities before migrating [22,44]. Digital apps and services websites use terminologies our refugees are not familiar with - even after translating - which makes it hard for them to navigate the system. Hence, the problem is not with the language itself, but the technical terms used:

“Refugee (...) wanted to draw money from an ATM machine, he chose option C to draw money because it said ‘Cash’ on it but the option was really for a cash advance which takes money from [the] credit card for extra fees and interests.” (S2, male, higher education, 60s)

Second, there is a lack in the number of digital tools our

refugees are accustomed to. All refugee participants report not being familiar with most applications that they have to use on a regular basis in Canada, such as emails and banking. For example, all but 2 refugee participants either did not know what emails were or they had emails but did not use them before the resettlement. Most of our refugee participants said that they did not understand why they had to use emails and why people “*not just call each other.*” This is because the majority of our participants come from low socioeconomic backgrounds, and hence there was no need to use technology beyond social communication before resettlement.

Third, unfamiliarity with the local systems limits the newcomers’ information and service access. All of our refugee participants indicate that some services in their host community did not exist in their home countries. Moreover, doing things digitally and looking for and comprehending information online is an alien practice for them. For example, several of our refugee participants note that they used to “*put [their] money in the drawer*” and did not use banks. In terms of using public transit, all refugee participants indicate that regulated public transport was almost non-existent in their previous lives and some report having issues with it because they do not know how to look for information about it, which is usually available digitally:

“We taught ourselves [how to use] public transit ... I would ask at the transit terminal or people. I did not know about the bus timing. I was sometimes waiting for the bus next to my house in the cold weather for a very long time. One time, my neighbor saw me and showed me how to find out when the bus would come online.” (R17, male, middle school, 40s)

These access struggles impact our refugees’ assimilation into Canada. For example, our refugee participants, who are interested in working in their field of expertise, express their frustration with having to finish a Canadian degree first or get their previous credentials approved for the jobs they are interested in<sup>2</sup>. They explain that they are not aware of how and where to look for information. They illustrate that in their home country, things were more straight forward because they could just go to one place and ask a person for the needed information (unlike how they are advised here to “*look for information online*”). In terms of

applying for a job, most of our refugee say they look for jobs online, but they do not know how to apply for them digitally because they are not familiar with the system. Moreover, all of our refugee participants say that almost all jobs in Canada require having digital skills they do not possess:

“I want to sign up for a co-op. One of the requirements to be enrolled in the co-op program is to have familiarity with computer programs. So, I need to sign up the computer course. Everything here is online and on the computer. I used to use a computer in my work for accounting. I did a workshop for Microsoft Office in [my home country] but I forgot a lot of it now because I have not used it since I left [my home country] so for about 4 years plus the interface here is all in English so it is a bit harder.” (R13, male, diploma, 40s)

### 5.3 Learning

Our study reveals that it is not only challenging to access services, but it is also challenging to improve their personal techno-skills. Our refugee participants have five major sources of learning: sponsors, friends, kids, language teachers, and volunteers. The amount and type of learning associated with each source are different.

With our privately-sponsored refugees, the first source of learning is their sponsors. They say that sponsors are the main destination they go to for acquiring knowledge and skills, such as how to use public transit, do online banking, and register the kids in school. They describe sponsors as “*available*”, “*obliged*”, “*offering guidance and aids,*” “*taught us everything*”, and “*without them, we would know nothing.*” In case of sponsors absence, our refugees turn to their friends and children (as young as 11 years old), if any, to acquire knowledge from such as how to write emails. This is a great source of support for them emotionally and is convenient as it can be carried out at home. Language teachers are another source of knowledge. For example, about half of our refugees indicate that their language teachers point them to videos they can watch at home on YouTube to improve their language skills. Our refugee participants who have attended English school and our refugee workers who teach language to refugees all agree that a mentor-like relationship between refugees and their teachers builds trust and make the newcomers feel more comfortable in asking their teachers about things they do not know even if they are not class specific. Lastly, several

<sup>2</sup> Regulated jobs in Canada such as teaching, engineering, and medicine require Educational Credential Assessment (ECA) report from approved agencies [34]

of our refugees note that there are volunteers who deliver a certain level of techno-skills to them. For example, some people from the bank would visit the refugees at newcomer centers and teach them about bank-related tasks. Because this learning method is carried out by professionals, our refugee participants are directed towards proper ways of carrying out certain tasks digitally. We find variations in terms of our refugees' digital skills based on the education approaches they have access to and the effectiveness of the learning source.

These learning sources are selective in terms of what is being taught. All our teaching sources, except specialized volunteers, are not experts in refugees' needs and it happens frequently that they get asked questions they are not familiar with. For example, because there is no mention of educating refugees about technology in the sponsorship handbook offered by the government for the sponsors [60], our sponsors teach their refugees what they know, such as facilities they use and services they utilize, which may not cater for the special needs of the refugees. Similarly, friends and teachers are sometimes not aware of certain pieces of information or services. Moreover, refugee kids' techno-knowledge is limited to what they learn from their teachers and friends at school so they cannot educate their parents about more advanced digital skills such as online transactions.

Not all of these sources of learning are easily available for all of our refugee participants. Sponsors, friends, and children tend to not have the time to educate our refugees about technology over a long period of time. With professional volunteers, they allocate specific time and space for the training process. However, if the time and location are not suitable for our refugees, they lose their learning opportunity. In terms of personal interactions between a tutor and a refugee, an openness among the different parties is needed to maximize the benefits. In other words, a teacher becomes an important source of information if he/she is willing to help, and, at the same time, the newcomer does not feel shy to ask their teacher about things they do not know. This is not always possible as some teachers are not willing to become mentors. Moreover, several of our refugee participants express their inclination to avoid asking their tutors not-class related questions, and in some cases even their sponsors, because they either feel shy or they fear of being misunderstood. This is largely shaped by the traumatic events our refugees have witnessed from armed conflicts and the process of displacement which caused them to mistrust others.

While each one of these learning sources has limitations, we note that the presence of a mentor on a regular basis and who can offer tailored assistance for the newcomers seem to reflect positively on our refugee participants. With our privately-sponsored refugees, this mentor role is acted by the sponsors. However, there is a lack of personalized care for our government-sponsored refugees. These refugees note that social workers usually pay them a one-hour visit once a month and they lack knowledge about certain topics such as continuing education. They also report that they are helped by some employees from Immigrant-Serving Organizations (ISOs), which are offices funded by the government to provide settlement assistance to the newcomers [30]. Each refugee family was assigned an ISO that acted as a sponsor and was responsible for them during the first few weeks. However, after this period, our government-sponsored refugee participants were left almost alone and without continuous monitoring. In this case, friends, kids, teachers, and volunteers become occasional mentors. However, as illustrated previously, these learning sources are more selective than sponsors in terms of who gets access to what services. In the case of the absence of a regular mentor, our refugees tend to distance themselves from doing things digitally, mainly due to – according to our data - fear of encountering safety and security issues.

#### 5.4 Safety

Our work shows that our refugee participants are discrete in terms of doing elaborative online transactions - such as transferring money and online shopping - because they believe they are not well informed about navigating the digital systems, they do not understand the process of online dealings, and they fear of being victims of scams:

“I have never bought anything online. It might be easy to do so but I am not sure how it is done. I am afraid I may make a mistake and can hurt me.”  
(R17, male, middle schooler, 40s)

There are several threats our refugee participants are exposed to, such as financial loss, identity theft, and exposure to viruses. Two of our refugee workers report that more than one refugee paid hundreds of dollars due to ignorance in online applications. Two of our refugees faced financial losses due to their lack of knowledge in navigating websites and not being able to understand what the service they were paying for was about:

“[My friends and I] wanted to book for the G driving test. We entered a website and were



charged \$132 and I did it twice, so I was charged twice ... The problem is that we did not read properly. We thought we were on the main driving test website, but it turned out we were at a third-party website where you can get an appointment at a closer date. When we looked again after the incident, it was written that they were a third party and they charge \$45 extra ... We understand some English. If there is something we do not know, we translate using google but, in this case, we just went to the website and there was G1, G2, and G so we clicked on G ... This is a new system for us. In [my home country], we would do nothing online.” (R10, male, diploma, 40s)

About half of our refugee participants express their fear of being hacked if they do online transactions because they believe they do not possess enough knowledge to manage technical issues if they rise nor there is someone who would teach them how to. One of our participants faced an identity theft situation and was not able to manage it easily because of his limited language skills. He was only able to clear the problem at the end because he possesses digital skills that are extremely above what an average refugee has:

“My phone carrier account was hacked. I once entered the account and saw that instead of having two phone lines (one for me and one for my wife) I had 6 lines. They charged under my name 4 iPhones each with their phone plan. I asked the company and they said I had to pay \$5300 ... The account had my personal information and banking information. So, I reported to the police, but my English was not very good, so I found an interpreter to go with me. Because I am good with technology, I was able to look up the details of the ordered phone... I submitted around 20 pages to the police.” (R8, male, high school, 20s)

Our refugee participants are more susceptible to getting viruses because they believe they do not have the knowledge to distinguish between what is threatening and what is not:

“The one who uses the Internet incorrectly is very dangerous especially hackers. Sometimes you enter a normal website it shows a warning. Sometimes you even get emails which are suspicious like enter this link and register that. I downloaded an app to learn English through chat

but turned out to be something else inappropriate.” (R10, male, diploma, 40s)

Limited knowledge about digital systems and safety, incidents about security breaches, and lack of means to handle such issues if they rise made our refugee participants limit themselves in terms of performing financial transactions online. This limits our refugees' access to some services which are only available online such as goods not obtainable in stores or at cheaper price tags.

## 5.5 Equity and Inclusion

Besides the restrictions security and safety concerns impose on our refugees, our study illustrates that our refugee women fall behind men in terms of acquiring information and accessing services, especially if they are in the digital format. This issue is due to refugee women tendency to have lower education, struggle with cultural issues, and hold the burden of the young children.

There is usually only one member in the refugee family who would develop their digital skills to handle the family techno-tasks. Female refugee participants who have higher education tend to handle this assignment for their families. Unfortunately, because most of our female participants are on the lower educational spectrum, and due to the trauma associated with displacement, they step away from such tasks. These women tend to be highly dependent on their husbands or children to do tasks which are not house chore related. They use technology almost exclusively for normal calls, SM apps, and YouTube. All of our male refugee participants want their spouses to be more technologically informed because they express their concern in case their partners are left alone and have to depend on themselves:

“She [my wife] needs to learn these [digital] things and computer in order to help herself here in Canada. No one knows what the future holds. Maybe I may not always be with her. Maybe it can happen and she needs to go to the hospital alone or pay the bills alone or mall alone ... If you know these things on the phone it can make some things easy on yourself” (R17, male, middle schooler, 40s)

However, teaching female refugees is by itself a challenge. Our refugee women participants with higher education depend on themselves to learn digital tools or through their husbands and friends. Enhancing the digital skills of our female refugee participants with lower educational level

depends on the type of sponsorship. In private sponsorship, our sponsor participants report that they teach male and female adult refugees how to complete certain tasks digitally. Some skills are taught for both males and females, such as online banking, while other skills are taught based on who handles certain tasks. For example, the father of the refugee family is taught how to pay the hydro bills online while the mother is trained on how to pay for the kids' school expenses digitally. However, with our government-sponsored refugee participants, we see a large gap in terms of the technological knowledge between men and women. Due to the lack of direct guarantor and formal technology-teaching classes as illustrated in a previous section, we see refugee participants learning from their fellow refugees, friends, teachers, and volunteers at the newcomer centers. Our male refugee participants benefit from these methods because they are raised on taking initiative, and so they learn by themselves, share experiences, try things with their peer, and are - relatively - more comfortable in asking workers at newcomer centers about things they do not know. However, our women fall behind as their peers are females who share the same social culture. Moreover, many refugee women participants who are in their thirties and above with lower educational level do not seem to want to have a regular work outside the house as this is not the norm for them, so they see no importance in improving their technological skills. Nevertheless, they state that it is normal for them to do 'work upon request' from home. For example, they can cook food and sell it upon request from other people.

Balancing learning the language, improving personal skills, and working to support the family is a serious challenge for our refugee participants, especially for women who want to go to English school and skill-enhancing workshops but cannot because of their kids:

"My husband works two jobs from morning until midnight. Both are minimum paying jobs. Even with child support, our income barely pays for rent and food. I cannot work because the kids' school hours are from 9 – 3. I cannot find a job from 10-2 and still go to English school. During the summer, I cannot go to school because there is no place to put the kids. Kids camps are expensive and far away from our place that the cost of public transit can add up. When we first came here, my son was very young, and I had to wait 4 months to get him into daycare. There are many things I liked to go to such as workshops and volunteer opportunities

but cannot due to my kids." (R16, female, higher education, 40s)

As we can see, refugee women fall behind in terms of improving their personal skills because of their low education, cultural constraints, and family duties. As a result, it is particularly hard for them to access, learn, and protect themselves in digital technologies.

## 6 Discussion

In the above section, we have shown that our refugee participants have access to the physical infrastructure of computing such as digital devices and network connections. However, and as the Canadian lifestyle is heavily dependent on technology, we have presented how the current computing infrastructure is excluding refugees from acquiring information and accessing services such as jobs and public transport. We also show the five sources refugees use to learn about technology, services, and information access and illustrated the advantages and disadvantages of each one of them. We shed the light onto some safety and security issues our refugees were susceptible to. Moreover, we demonstrate how refugee women face more exclusion in terms of acquiring digital skills and improving personal traits due to limited educational level, cultural constraints, and family duties. While economic migrants face similar issues as evidenced by other studies [5,12], refugees are more susceptible to being marginalized when it comes to accessing the computing infrastructure because of their limited educational background, lack of knowledge in the local language, and the trauma they have experienced. In this section, we discuss how these findings generate important lessons for HCI and frame our conclusions using mobility, infrastructure, and social inclusion theories.

### 6.1 Design Implications

As our findings suggest, many of our refugee participants have problems in accessing certain system digitally because they have low literacy in language or technology. In terms of accessible interface, there are some HCI and ICTD researchers who have implemented different types of user interface (UI) for low-literate users. For example, Medhi et al. [58] create an image-based, text-free UI application for employment search for illiterate domestic workers in India. Sherwani et al. [64] present a prototype for speech-based health information access for low-literate health workers in Pakistan. Ahmed et al. [7] execute a mobile phone interface that helps low literate users perform common phone tasks by receiving remote help from other community members

in Bangladesh. However, all of these implementations have limitations in our context. Namely, images cannot be expanded for complex work, a speech interface is highly unreliable, and effective community collaboration needs large social capital. Hence, we need to think about other possibilities. Considering the mass migration movement that is happening around the globe, we believe that new HCI frameworks can be developed to consider inexperienced users by designing and evaluating UI that limit systems' possibility of user exclusion. For example, some frameworks could focus on how UI design decisions correlate with refugees' expertise and introduce new HCI concepts that might improve existing designs.

The current learning resources for teaching refugees about digital access and skills have many limitations, mainly due to inexperienced tutors or restricted location and time where and when the teaching is taking place. If we want to make learning easy and effective, we need to address availability, personalization, and openness. We suggest we learn from the strength of remote learning offered by several HCI researchers. For example, Keogh [47] explores how the WhatsApp messaging service could be used to teach English for foreign undergraduate students in the USA. Takagi et al. [66] develop a remote IT education system with live visualization and streaming between the teachers and learners for the senior citizens in Japan. By appropriating these technologies for our context using platforms our refugees are familiar with along and incorporating appropriate interactive activities, we can teach refugees how to improve their digital skills, especially women who cannot leave the house frequently due to their kids. Moreover, because remote learning is done through digital communication mediums, the end-user can feel more comfortable in using technology over the long-term as they will experience 'learning by doing': hands-on, experimental, and interactive [16,26,48]. When designing such a system, we need to develop a refugee-oriented curriculum that not only aligns with their values and understand the potential trauma they suffer from but is also useful for them to acquire the information they require the most. Current remote-learning technologies do not address these problems. Hence, similar to [15,42] work about improving classroom learning, we propose holding participatory design workshops with refugees and potential teachers to better understand the needs and the expectations of our end-users.

Creating intercultural communities can increase empathy among the different groups involved and form a mutual

foundation for the newcomers' integration into the hosting communities [18,73]. The current refugee-sponsor pairing is a representative of this relationship. We believe that establishing similar grouping between the refugees and the local community that revolves around technology usage can be useful. There exists previous work that has been done in this field. For example, Weibert et al. [75,76] and Yerousis et al. [81] show that temporary but regular community computer clubs can provide newcomers and refugees with access to computing infrastructure, offer them guidance on how to improve techno-skills, and support intercultural and intergenerational cooperation through computer-based project work. Likewise, Xu and Maitland [79,80] engage refugees with NGO workers in collecting various types of data about the displaced people living in their area to maximize the role of ICTs in building communities. We propose implementing similar initiatives at the newcomer centers or the children's schools where technology activities correspond to refugees' interests such as practicing basic computer skills, observing online transaction flags, and learning from home security strategies.

## 6.2 Broader Lessons

Beyond making the immediate design implications, we position our results within the larger scope of mobility, social inclusion, and infrastructure to build more sustainable societies. From our findings, we conclude that there is an urgent need to think about how to build a new social capital for the refugees because the refugees' social capital was minimized when they moved into a new environment. As Young [82] has suggested, the host community has a duty to step forward and help in the newcomers' integration process. The welcoming society can reach out and establish bridges between itself and the new group. This can increase refugees' social capital leading to social inclusion. From a researcher perspective, such an approach requires broader initiatives that go beyond technology design. The research community can help by taking a supporting role and inspire and motivate people to take the lead. Further research is needed to find ways how the host community can better 'welcome' and 'embrace' the migrants both online and offline.

For inclusion to happen, our refugees have to go through an extensive re-appropriation process in order to adapt to the computing system in Canada. As Jackson et al. [43] demonstrate, an infrastructure is built on certain assumptions and some infrastructures are built on each other so it is difficult to make major adjustments to them

later on. In Canada, the computing systems that provide information and services were likely designed for the local populace, including skilled worker migrants, who are often educated, are competent in the local language, and have certain techno-skills obtained during their education or work. Refugees tend to not have these qualities. Neither the systems nor the refugees are to blame here, but the current events that are taking place around the world are causing mass migrations, mainly from limited techno-communities moving into computer-based environments. As a result, the HCI community is obliged to think about designing a new type of infrastructure that is not dependent on language, education, or social capital. As for the existing systems which cannot be altered easily, we need applications that can “bridge gaps” between the two extreme users to make them accessible.

Lastly, it is important to address the gender implications for refugee research. Our study highlights how gender plays an important role in how well the assimilation process is progressing. Our refugee women fall behind men in terms of learning opportunities and getting access to information and services due to personal values and family duties. Other HCI researchers have also pointed this out. For example, Gineló et al. [23] note that making ICT available for everyone in Bangladesh over the years did not promote digital inclusiveness for women because females access technologies based on their individual’s demographic profile and location. Breslin and Wadhwa [10] illustrate that women’s use of technology tends to be based on stereotypical notions that females do not like or are not skilled at technologies. This shows that this problem has also appeared in many another context, and yet not enough working solutions have been implemented. When offering help for these women, we need to consider Young’s [82] notion of *Rhetoric*, where the helper learns the ways of communication and values of the newcomer. There are few researchers who do take this notion into consideration. For example, to design digital tools that teach English vocabulary for migrants, Ahmad et al. [5] note that migrant women need friendly and non-rigid learning environment because their men are forced to go out into the society, therefore they overcome the challenges quicker than women. Similarly, Talhouk et al. [67] use a female-run radio show to deliver health information for women refugees because female displaced population feel more comfortable in discussing personal issues with others of the same sex. As a result, the HCI community can take a supporting role here by creating frameworks that design for women with special circumstances and skills.

## 7 Conclusion

In this paper, we focus on the challenges the computing infrastructure itself imposes on the newcomers. We contribute to the field of “HCI and refugees” by presenting the challenges the computing systems create for refugees in terms of access, learning, gender, and security within a Canadian context. We focus on these issues with a vision of making HCI initiatives more inclusive for refugees. We also provide a set of theoretical tools to better analyze and design for the infrastructural biases in computerized systems in order to make societies more sustainable. Future work should focus on technology policies and design for resettled refugees.

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