

Be Our Guest: Intercultural Heritage Exchange through Augmented Reality (AR)

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ABSTRACT

This paper explores how interactive applications can help mitigate the adversity of facing cultural differences between migrants and the host community, and between migrants of diverse backgrounds to foster intercultural exchange. Based on literature about situated cognition, immersive theater, and affordance, we designed and built *Be Our Guest*: an augmented reality application where a user is invited to the houses of people from different cultures and is asked to help with one of their cultural rituals around simple everyday objects. We detail the various phases we took to collect the cultural stories and construct the application. We then report the results of a user study with the developed application. Our findings show that participants were easily immersed in the augmented space due to the app's narrative, visuals, and interactive nature. Moreover, they enjoyed exploring cultural rituals, including their own, and felt more confident connecting with people from other cultures.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in HCI**.

KEYWORDS

HCI, migrant, immigrant, host community, culture, heritage, communication, Augmented Reality, AR, immersive theater, exploration

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1 INTRODUCTION

Scholars have depicted the disparities and tensions among people of different ethnic backgrounds surrounding daily practices such as language use, greeting acts, and socializing norms [33, 44]. Incessant negotiation of pluralism in such contexts is essential for everyone to maintain dignity and social integration [23]. Despite the nuanced nature of these differences, many would find the confrontation unnerving and prefer avoiding it due to the discomfort that comes with difference [7]. This is a particularly critical stance for most minority ethnic groups who may feel conflicted by the difference in hegemonic social practices compared to their own ancestral practices (e.g., eating with non-conventional utensils, method of greetings). Multicultural societies, therefore, have difficulty in both challenging the hegemonic and confronting the non-hegemonic. This difficulty posits a problem for poly-ethnic nations with steady immigrant influxes such as Canada. Since this negotiation is primarily delegated to the larger political atmosphere, breaking through routine consciousness in everyday dynamics is a challenge, particularly for those who want to but have a limited ability for confrontation due to their minority status or inability to engage in rhetorical argumentation.

Current research in HCI with immigrants often focuses on their practical needs, such as language learning and job seeking, with an increased interest in the social dimension of mobility, including effectively engaging with the host community [65]. However, research in this domain usually focuses on one-way communication: either helping the migrants comprehend the local culture (e.g., [52, 78]) or aiding the host community to understand the newcomers' needs (e.g., [21, 71]). Moreover, HCI research often places all migrants in a single group and lacks the necessary examination of cultural communication between migrants of different backgrounds. This is a problem because for social cohesion to be achieved, deeper connections must emerge from positive instances of relationship-building that incorporate mutual respect and dialogue between diverse groups [54].

The objective of this paper is to investigate how interactive technology can help with mitigating the adversity of facing cultural differences between migrants and the host community, as well as

foster intercultural communication among migrants of diverse backgrounds. As such, and based on literature about situated cognition, immersive theater, and affordance theory, we present our exploration of designing and implementing *Be Our Guest*: an Augmented Reality (AR) application that invites a user to visit households of different cultural backgrounds and reenact various scripts. Each script consists of a snippet of a cultural setting surrounding simple domestic everyday objects (e.g., a cup). The paper has the following research questions:

RQ1: How can AR, coupled with reenacted scripts, support cultural sharing between the host community and immigrants, and among migrants of different backgrounds?

RQ2: What are the limitations of following a curated approach where app designers rather than users pick, script, and present the stories?

We worked with 23 immigrants and non-immigrants in Canada to develop and test the application. Through observations, interviews, and reflection, we illustrate how *Be Our Guest* could immerse users into various cultural settings. We also discuss the applications' viability as a learning tool to help an individual explore others' cultural rituals as well as their own heritage and propose HCI research directions.

The primary contribution of this paper to HCI and migration scholarship is introducing immersive theater through augmented technology as an approach to intercultural exchange. In doing so, this paper (a) mends a gap in HCI discourse, which is primarily focused on one-way communication between migrants and the host community, by treating both groups as equal participants in creating and using the AR too, (b) advances HCI design research on cultural exchange by presenting an AR-based tool for sharing cultural rituals, and (c) provides insight into the collection and integration of cultural stories about everyday objects from diverse backgrounds into an AR app.

2 RELATED WORK

2.1 Migrants and Communicating with the Host Community in HCI

Research about migrants in HCI explores a diverse set of topics to support their integration into their new environments such as technology usage patterns [64], information access [60], health [10], career [45], and education [81]. Relevant to this paper is work about building connections between immigrants and their host communities. For example, Duarte et al. [21] used participatory design and research theories to create a safe space for intercultural collaborations between the migrant youth and the young members of the host community by allowing them to co-design a mobile service based on the migrants' needs. Wong-Villacres et al. [82] studied how schools' liaisons leverage technology and the human infrastructure to bridge - culturally and linguistically - between immigrant parents and the educational systems their children are in. There have also been some implementations deployed to support such connections. For example, *Come_IN* computer clubs offered a space to share practices among children and adults of diverse ethnic backgrounds and support their local daily practice in the neighborhood [70, 86]. Walter et al. [78] created a mobile application for newcomers in Germany to learn about the local culture

using pictures to overcome the language barrier.

To the best of our knowledge, there has been no exploration of the simultaneous exchange of cultural information between immigrants and host communities in HCI research. This could be due to how such communication depends on varying complex factors, including language proficiency and power differences, which migrants usually struggle with [34, 35]. Thus, we expand on existing work in HCI that aims to connect migrants with the host community by creating an augmented technology-based application that allows for two-way communication, i.e., migrants and non-migrants share information about each other's cultures. Furthermore, our work aims to support the sharing of cultural information between migrants of different backgrounds - which is a topic not commonly explored in HCI research.

2.2 Cultural Heritage Dissemination, Storytelling, and Interactive Technology

Cultural heritage refers to any tangible (e.g., buildings, books, artifacts) and intangible asset (e.g., language, traditions) produced by a society and has been passed down from generation to generation [47]. Storytelling, as the foundation of communicating human experience, is one of the oldest existing forms of art that can transfer cultural content and knowledge [31, 75]. Storytelling of cultural heritage warrants the democratization of valuable information and is conceived to alter the receiver's knowledge and culture as they can become acquainted with alternative ways of thinking, which could promote wider social acceptance [57, 75]. Thus, storytelling is an excellent approach to intercultural learning because it maintains the complex nature of culture, is malleable, can reflect diverse perspectives, and is accessible to a variety of different audiences [59]. Storytelling has been used abundantly in HCI research and in diverse contexts such as exploring how online, collective storytelling can help women cope with harassment and build solidarity [17], aiding families to contemplate their children's habits that impact their physical activity [67], and helping children reflect on situations involving school conflicts [63]. Most relevant to us is how storytelling has been used to support the sharing of cultural heritage. For example, "Our Home Sketcher" is an augmented paper-based home design tool that allows immigrants to narrate their oral histories and aspirations within domestic settings [66]. Through digital storytelling, Oakley et al. [53] conducted a study where middle-school students in China and Australia shared digital stories about their everyday lives, local cultures, and traditional tales. We extend this work by building an AR application that utilizes interactive storytelling about daily cultural rituals to engage with people of different backgrounds and diverse cultural heritages without the need for uncomfortable confrontation.

Interactive technologies have widely been used to provide immersive experiences, virtually and in-person, to share information about cultural heritage due to the increase in the computing power of personal smart devices and the availability of complex technologies [5]. For example, "Google Arts and Culture" is an online platform and a mobile application of cultural artifacts and art pieces in different formats (e.g., images, videos) collected from many cultural organizations worldwide [30]. The users engage with the artifacts in creative formats, from trying different heritage outfits using AR

to recreating traditional vases using virtual pottery [30]. Liu et al. [46] built “Hua’er and the Youth”: a virtual reality (VR) game that supports participatory performance to engage and educate people about the connotations of the Chinese performance art of Hua’er. Many museums worldwide have also been creating narratives through the spatial organization of both physical and digital artifacts to help convey their messages and offer their visitors engaging experiences that combine learning and entertainment [75]. For example, Othman et al. [55] developed a game-based mobile guide for children visiting a heritage village, where the game invites them into a scavenger hunt and asks them to look for certain artifacts throughout the various physical locations on the site. “Viking VR” is a VR exhibit where a museum visitor gets to see and hear how a 9th Century Viking encampment is set up [69]. Our project is inspired by such work, and the application we developed, *Be Our Guest*, is engaging (a story is narrated), interactive (the user interacts with simple, physical and virtual artifacts, and performs tasks), and accessible (the user does not need to be in a specific space or have special tools). To the best of our knowledge, there does not exist any such interactive application to exchange cultural rituals that meets all these criteria simultaneously.

3 “BE OUR GUEST”: SYSTEM DESIGN

Be Our Guest is an interactive AR application that displays various cultural heritage practices surrounding common objects (e.g., a cup). In this application, we simulate visiting the homes of people from diverse cultural backgrounds and experiencing some of their daily or seasonal cultural rituals. The simulation is created based on real stories collected from immigrants and non-immigrants. It takes the form of a ‘script’, where a story is narrated, and the user is asked to perform certain actions and interact with virtual and simple physical objects in an attempt to make them experience different cultural customs. In this section, we detail the process we engaged in to develop and build the application. We start by presenting the key theoretical concepts underpinning the design of *Be Our Guest*, combining situated cognition, immersive theater, and affordance theory. We then show the several iterations we went through to collect reenactable stories from immigrants and non-immigrants. We finally display the technical aspects of the application and how it is used.

Before we move any further, we must acknowledge that the authors’ backgrounds and experiences have informed the design of this application and possibly affected how we interpreted our findings. All the authors are of immigrant background from the Middle East and Asia and have degrees in computer science. The first author is trained in Architectural Design and has experience in Game Creation and Design, while the second author has a background in Cognitive Science and Linguistics. Most of the authors have experience working with underprivileged communities. The first author is particularly active in migration research and has served as an interpreter and mentor for newcomers in Canada for several years. We received approval for the study procedures from our university’s ethics review board before conducting the work.

3.1 Conceptual Framework

The design of *Be Our Guest* revolves around facilitating intercultural communication, i.e., the exchange of information between individuals from dissimilar cultures [61]. Intercultural communication involves more than just the typical venues of communication such as verbal and written word; rather, it encompasses the broader exchange of beliefs, values, and etiquette [35]. Such an exchange focuses on the recognition and respect of cultural differences, leading to mutual adaptation and multiculturalism rather than mere assimilation [18]. We are interested in supporting intercultural exchange without the need for direct confrontation to avoid any discomfort that could accompany it [37]. In order to explore this, we turn to theories of situated cognition, immersive theater, and affordances.

3.1.1 Situated cognition. Situated cognition is a theoretical approach to learning which posits that “*gaining knowledge*” is inseparable from “*doing*”, arguing that an individual *learns* by acquiring information in “*a situated activity that has social, cultural, and physical contexts*” [2]. It is based on the concept that people construct meaning within communities of practice because knowledge is dependent on the use of a variety of tangible and intangible artifacts such as technology, language, and prior knowledge [56]. Situated cognition draws on the strong interdependence on one’s physical body and brain function because the body’s senses are highly active and are crucial means of perception and reconnaissance, offering an outlet to our world that is inaccessible otherwise [49]. Prior research also highlights that cognition is configured by the use of tools [43, 62] because they extend our bodies and facilitate actions that might otherwise be impossible [9]. The role of situated cognition is well established in multiple disciplines and strands of learning, from medicine [83], to mathematics [32], to linguistics [42]. The act of learning in a situated context involves three interacting components; (1) people (individuals, relationships), (2) artifacts (objects, technology, prior knowledge), and (3) activity (participation in authentic events) [56]. Therefore, to effectively facilitate an intercultural exchange, *Be Our Guest* places the user in a situated activity in which they contemplate the environment, the artifacts (virtual and physical), and the actions they are instructed to perform, comparing them against a myriad of previous experiences (if any). To explore further how people, artifacts, and activities could work together to narrate a story, we turn to immersive theater techniques.

3.1.2 Immersive theater, storytelling, and presence. Theatre remains a long-standing form of storytelling that enables the continuation of culture and is often used as a catalyzer of change [12]. We focus on *immersive theater*, which is an umbrella term that describes performances employing *immersive* techniques, techniques that are bound by the concept of centering the performance around the audience and engulfing them, often both perceptually and psychologically, in it [38]. Unlike conventional theatrical performances where actors perform on stage and the audience simply watches the show unfurl, immersive theater brings the audience to the center of the stage, making them both witnesses and actors, and thus blurring the distinction between theater and real life [48]. Immersive theatre can be a highly effective mechanism for learning, as research has demonstrated in various fields such as political studies [14], earth

science [74], and social justice [41], because it supports engagement, develops cognitive skills, and fosters a sense of ownership over the event compared to more passive approaches to learning.

The techniques that bind works of theatre under this genre are loosely defined, often relying on the integration of different elements of ‘immersion’. However, they importantly emphasize the apparent agency of the audience member, internally, within the performance [79]. Gochfeld et al. [26] explore this in relation to ‘mixed reality’ to enhance the effects of theatrical storytelling. They immersed their audience in the narrative of their adaptation of “Alice in Wonderland”, *Holojam in Wonderland*, using VR along with strategically placed physical artifacts such that the player came in contact with them whenever they physically moved with their VR headset [26]. Another project to note is “A Breathtaking Journey” [39] which was designed to arouse empathy for refugees. Here, the player is placed in the shoes of a refugee who is fleeing from a war-torn country, hiding in the back of a truck to reach a safe locus. The virtual experience was delivered through a VR headset and headphones, augmented with a range of physical artifacts including a mask for scent diffusion, a tangible contraption mimicking the inside of a truck, an unbalanced motor to simulate movement, and a controlled shutter to drop objects on the player during the game [39]. Overall, the use of mixed reality throughout these projects was successful in creating a pleasant narrative environment where the audience truly internalized the sensation of having been on the journey through their embodiment of the characters.

Complete perceptual immersion using simple methods is commonly used in HCI research to accentuate the life experiences of under-represented groups as seen in ([36, 40, 51, 84]). Almost all of these tools utilize VR and are meant to evoke empathy. The user is usually either an *experiencer* of the hardships of a minority (e.g., [36, 51]) or an *observer* of their situation with minimal engagement (e.g., [40, 84]). *Be Our Guest* deviates from this line of work in terms of its end goal. Our use of AR instead of VR works to refocus the narrative of the performance around the participant’s own identity, where they act in the narrative as *themselves* - observing and interacting with the actions of the ritual through the lens of their own past experiences. Since migrants tend to be at a lower power stance in society, we chose to place them on an equal stand with the host community rather than working to elicit empathy. Our application engages on behalf of cultural groups to recreate positive, domestic moments and deliver them to people of other cultural backgrounds. It does this by spatially transporting the user to the environment of the host and allowing them to explore and interact with virtual and physical objects of another group’s ritual to help them engage both cognitively and sensually, all while being in the comfort and safety of their own space. The use of dialogue helps instruct the participant through the actions of the ritual, while also creating an inviting atmosphere that mirrors one’s warm encounter between a host and their guest.

The concept of ‘immersion’ is often also used in Video Games, taken to be a marker of pleasurable and enticing gameplay in its ability to transport players to alternative realities [50]. Michailidis et al. [50] introduce a subset of immersion - the concept of *presence*. Presence is used here in the sense of “*spatial presence*”, where it refers to the player’s feeling of “*being there*” in the game while still retaining their distinct self, and the sensation does not “*present the*

characteristics of an altered state of consciousness” [50]. This is encouraged by a “*feed-forward loop*” with the environment, where the player continuously matches their representations of the real world against the virtual one [50]. *Be Our Guest* seeks to utilize this mode of immersion: immersing the user spatially by integrating foreign, virtual objects into their own environment while maintaining the barrier between them and the virtual world. This is in contrast to VR applications.

3.1.3 The role of affordances in building connections. We now draw on Gibson’s [24] *theory of affordances* to highlight the cultural upbringings that influence one’s cognitive behaviour and social interactions. Gibson coined the term *affordance*, which describes a specific usage that an object or environment can offer to an individual. This usage would naturally depend on the physical characteristics of the object (e.g., girth, shape) and the ways in which the laws of physics act upon it (e.g., whether it lends itself to sitting). However, the individual, in the realm of the physical constraints of the object, is entirely the one that decides the usages that the object is able to offer them. For example, it is common knowledge that a chair is used for sitting; however, its flat surface affords its usage as a table as well, and its mass and appendages (chair legs) afford its usage as a weapon if one were compelled to use it as one. In this project, different cultural objects that may be familiar to an outsider (e.g., a teacup, the participant’s own hands) are re-introduced through the scripts that carry the cultural practices of the hosts. Through performing the relevant sequence of instructions and carrying out the actions, an outsider is then introduced to *new* affordances of objects that they were previously unaware of. As such, the outsider becomes more cognisant of new usages brought about by a long-standing history of cultural practice and ritual and the nuance of its involvement in the lives of people from other cultural backgrounds.

3.2 Story Collection and Script Creation

A critical step for the project was to collect information about cultural rituals surrounding domestic objects and generate a series of steps that can be reenacted based on the object’s usage. Rather than reading about these rituals, we decided that it was more authentic (and ethical) to obtain such information from people of various cultural backgrounds to avoid misrepresentation. Thus, we explored different approaches - using both open-ended and strict instructions, interviewing within group settings and individually, and with and without the presence of a researcher - to reach the most effective method of obtaining stories that could be replicated in an AR setting. Figure 1 displays a summary of the phases we engaged in, which we detail next.

Throughout the time we collected the stories, strict COVID constraints were in-place in the country the primary researchers were based. This greatly limited the number of participants we were able to work with. Our priority was to diversify the stories we gathered, and thus we used *snowball sampling* [29] and asked people we knew to participate and suggest others from different cultures. Using their recommendations, we recruited more participants. We acknowledge that any story we collected is not a representation of a whole culture but a version of many about how some daily cultural rituals are carried out.

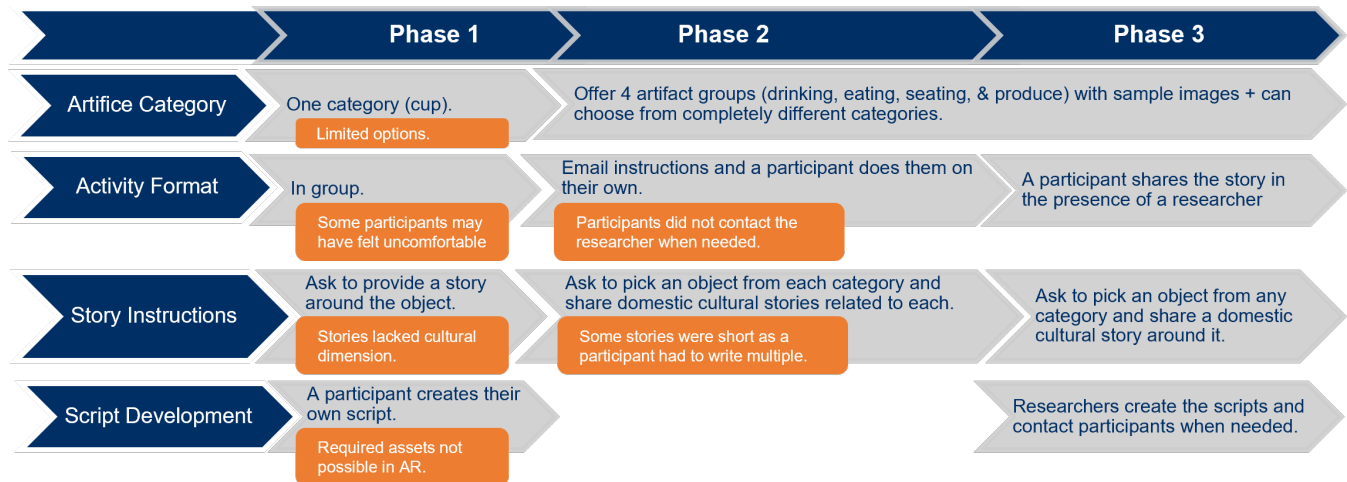


Figure 1: A summary of the different approaches we used in each phase, the issues we observed (the orange boxes), and how we improved them

3.2.1 Phase 1. We identified several categories of everyday objects that differed visually among cultures but performed similar tasks. These categories include drinking utensils (e.g., cup, *Chawan*, *Is-tikan*) and musical instruments (e.g., flute, *Bansuri*, *Ney*). For the initial phase, we focused only on one category (drinking utensils). We held a virtual session via Zoom with 6 people from different cultural backgrounds, genders, and ages (Table 1). The participants were not compensated. The first author moderated the session, while the last author was also present and took part in it.

We started the session by giving the participants an overview of the project including its AR feature. We then gave participants instructions to imagine a cup of their liking, close their eyes and remember a short story about this cup from their own experience (whether it was happy, sad, or ritual). Then we asked participants to draw or supply a photo of this cup and provide the steps someone had to perform in order to replicate their experience. We shared a sample story created by the first author about a Turkish coffee cup and the generated steps from it. We gave them half an hour to complete this task. During this time, some participants inquired about the task such as whether it was acceptable to provide a not-accurate picture of the artifact as they do not currently have it or if it was appropriate to write about their family in their home country. The first author responded positively to all these inquiries to offer as much freedom to the participants as possible. After everyone finished writing their stories and the steps, we assigned each participant a story from another participant of a different cultural background (to ensure no stories were shared among people of similar heritage) to act out their narrative. After that, we held a focus group to reflect on the process. We asked them about the instructions, what they learnt from the story they tried to reenact, and their suggestions for other artifacts.

We made several observations from this process. First, the created stories were very personal and lacked cultural heritage aspects. This was because we simply asked the participants to pick a ‘cup of their liking’ rather than one that was vital to their own cultural heritage, especially since many might not be practicing parts of their cultural rituals on a day-to-day basis. Second, the created

stories required many external assets to be reenacted, namely the existence of other people and going outside. This was due to the fact that the instructions we provided did not specify that the actions needed to be reenactable using simple available objects inside the house. Third, we were not able to polish the stories as a group because, unlike previous work about storytelling in groups [80], our cohort members came from diverse backgrounds. This meant that while they did draw some similarities, they did not ask detailed questions, which could be due to fear of being judged or mocked [37] - a concern we are trying to address in this project. Lastly, the generated steps were general and could be interpreted widely and differently depending on who was doing the reenacting. We concluded that the instructions we provided were too broad and that generating the action steps from the stories should be done by the researchers.

3.2.2 Phase 2. Based on the results from Phase 1, we developed a second set of instructions. This time, we highlighted 4 object groups that were commonly used domestically: ‘Drinking Utensils’, ‘Eating Utensils’, ‘Seating’, and ‘Produce’. For each category, we provided 10 photos that displayed a sample of the various forms the object could take in different cultures. We also gave the participants the option to select objects from a completely different category that had cultural significance to them. The participants were asked to pick a photo (or provide their own) from each category that best represented an object that had significance to their culture and was still used by them or other people from their cultural heritage. Then they had to write the traditional name for the object (if any) and think of how and where this object was used traditionally. Finally, the participants were asked to share a story (personal or communal) associated with this object and their cultural heritage, and provide photos (of their own or off the Internet) of the typical context/surroundings that this object was usually placed in and/or used. We did not ask them to provide steps about how to reenact their stories.

To test the new set of instructions, we recruited 5 people of different genders, aged 19-20, and each from a different cultural

Table 1: Description of the participants from the three phases and the prototype testing

| ID | Age Group | Gender | Cultural Background | Years in Canada | Participated Phase(s) | Prototype Tested? |
|----|-----------|--------|---------------------|-----------------|-----------------------|-------------------|
| 1 | 31-35 | W | Turkish | 3 | 1 | no |
| 2 | 36-40 | M | Bengali | 4 | 1 | no |
| 3 | 21-25 | W | Indian | 2 | 1 | no |
| 4 | 26-30 | W | Iranian | 4 | 1 | no |
| 5 | 31-35 | M | Bengali | 4 | 1 | no |
| 6 | 26-30 | W | Iranian | 5 | 1 | no |
| 7 | 19-20 | W | Egyptian | 1 | 2 | no |
| 8 | 19-20 | M | Syrian | 16 | 2 | no |
| 9 | 19-20 | W | Iraqi | 0 | 2 | no |
| 10 | 19-20 | W | Chinese Indonesian | 3 | 2,3 | Yes |
| 11 | 19-20 | W | Taiwanese | 0 | 2,3 | no |
| 12 | 56-60 | W | Iraqi | 16 | 3 | yes |
| 13 | 21-25 | W | Senegalese | 0 | 3 | no |
| 14 | 21-25 | M | Indian | 3 | 3 | yes |
| 15 | 56-60 | W | Canadian White | Entire Life | 3 | no |
| 16 | 50-55 | W | Iraqi | 0 | - | yes |
| 17 | 31-35 | W | Turkish | 4 | - | yes |
| 18 | 19-20 | M | Syrian | 18 | - | yes |
| 19 | 21-25 | W | Indian | Entire Life | - | yes |
| 20 | 36-40 | M | Turkish | 4 | - | yes |
| 21 | 21-25 | W | Black Caribbean | 3 | - | yes |
| 22 | 31-34 | M | Bengali | 5 | - | yes |
| 23 | 19-20 | W | White & Chinese | Entire Life | - | yes |

background (Table 1). The participants were not compensated. We sent out the instructions to them, and they filled out a document with their answers and sent them back to us. The second author interviewed them via a video call afterward to find out about their experience with the instructions.

In this round, we obtained better stories in terms of cultural richness and we made several observations. First, most of the participants provided multiple artifacts for the same category. These participants also provided shorter descriptions for each object compared to participants who only picked one object for every category and shared more detailed descriptions of the rituals surrounding each artifact. Second, participants noted that they thought the instructions were broad to some extent, and they did not know how many details to provide, especially since the researchers were not present during the time they completed the task, and most did not wish to contact a researcher for clarification. Lastly, most participants either referred to their grandparents' places when telling the stories or resorted to asking their parents for help because such cultural objects usually did not play a major role in their lives. This was mostly due to how young these participants were (aged 19-20), and even those new to Canada were already leading a Western lifestyle.

3.2.3 Phase 3. From these two phases, we concluded that to collect stories with cultural depth, we must provide stricter and more detailed instructions to the participants. However, the instructions must still leave room for flexible narration about the object's cultural significance. Lastly, we believed that the presence of the researcher was crucial in order to make sure that the stories shared had enough details and feasible actions that could be extracted from

them. Thus, we developed our last set of instructions. Each participant was met by a researcher, and the researcher would explain the project and its AR aspect. Then, they were given the categories of 'Drinking Utensils', 'Eating Utensils', 'Seating', and 'Produce' along with sample images for each category as a guideline (similar to Phase 2). The participants were asked to select only one object from any given category (or from a completely different category) and describe a ritual from their cultural heritage surrounding this object in a manner that was detailed enough for another person to perform the ritual and learn its importance. Along with their story, the participant was asked to share photos that they believed best represented their chosen object, describing the typical materials it was made of (e.g., clay, metal), its shape and size, as well as information and photos of other objects that must exist in the setting it was used in. This was necessary to accurately 3D model the objects and fully emulate the cultural ritual experience virtually. For assistance, we provided a written sample of a ritual story created by the second author from her heritage background.

For this phase, we recruited 6 immigrants and non-immigrants of different genders, aged between 19-60, and each from a different cultural heritage (Table 1). Two of the participants in this phase also took part in Phase 2. All participants were compensated 10 CAD in cash. The second author met with 4 participants, while the first author with 2. All meetings were virtual, done in English, audio recorded, and transcribed.

Many participants had questions about the scope of the 'category' of everyday objects, with some choosing important monuments while others selecting body parts as their chosen utensils (e.g., hands) as these objects were intricately involved in their daily routines and/or had religious significance. The process of choosing

the object involved many back-and-forth discussions between the researchers and the participants in order to verify that the chosen object was suitable for performance. On some occasions, we had to meet some participants multiple times until we were able to collect the final story. The two participants that were part of Phase 2 were asked to choose one of the objects they had written about previously and explain it in more detail, emphasizing the different parts of the object and the actions that were involved in the ritual. Although participants were asked to describe the ritual as a ‘performance’, most of them included contextual information about the emergence of the ritual, the time of day/year it occurs, and common cultural opinions on the ritual. For example, while describing the significance of *chai* (tea) to Indian culture, the participant mentioned that it is a common belief that having a lot of tea promotes good bowel movement, so it is consumed many times throughout the day. In total, we collected 6 stories: 3 about tea ceremonies (from Iraqi, Indian, and Senegalese cultures), 2 about eating with the family (Taiwanese hotpot on Chinese new year and Indonesian dinner of fish in banana leaf), and 1 about creating a traditional food item (Canadian maple syrup).

After the stories were collected, the first two authors collectively and iteratively created a script from each story. We started by extracting all the ‘actions’ from the stories. We then considered if each action could be easily reenacted. If it was not and removing it would not affect the cultural dimension of the story, it was disregarded (e.g., we removed the need to heat the tubing after putting it in the tree in the Canadian maple syrup script). Moreover, we combined some actions together to make the script flow smoother (e.g., adding multiple types of spices all at once to the boiling water to prepare the Indian tea instead of adding them one by one). After we had our set of actions, we started laying out the scenes. The scripts always started with a narrative about the scene setting followed by actions to be performed. Some actions were placed one after the other, while others were separated by a description of the setting or cultural information about the rituals/artifacts. While creating the scripts, we made frequent contact with the participant and shared the scripts with them to inquire about certain details, the manner in which some actions were performed, and the modifications we made to ensure the authenticity of the presented rituals and to make the storyteller have the final word. Figure 2 shows portions of some of the generated scripts.

Creating the scripts with performative instructions out of the collected stories was a challenge because of the variety of types of objects chosen. Simpler objects like teacups and hands were described in greater detail in terms of their cultural significance rather than their usage since the afforded actions of those objects are limited. Thus, the challenge was to balance the amount of contextual information the user was provided and their performative counterparts, engaging a variety of senses in the experience to enhance their connection and engagement with the story.

3.3 Prototype Implementation

We built the AR application using the Unity Game Engine [76] with an integrated Vuforia Engine [77] for object recognition. The application was deployed and tested on a Google Pixel 4a smartphone

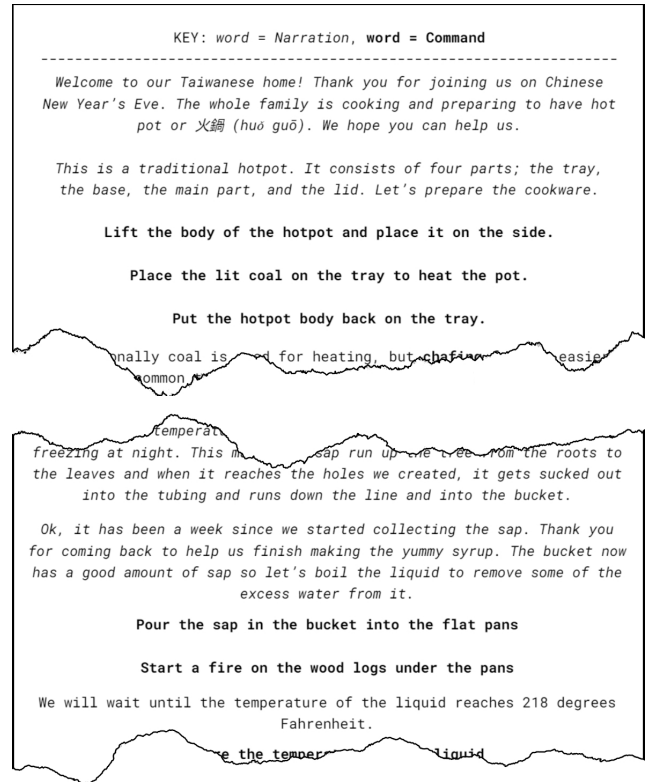


Figure 2: Sample generated scripts: Taiwanese hotpot (top) and Canadian maple syrup (bottom).

(128 GB of storage, 6 GB memory) with an Android operating system 12 (API 31). To use the application, the user must have a simple physical utensil close by (e.g., a cup). The user opens the application on the phone, and a camera view fills the screen. When the user points the camera towards a utensil and it is recognized, the utensil starts to ‘morph’, in camera view, into different forms this object can take in different cultures (Figure 3). The user clicks on a form, and the scene changes into a virtual environment where the object (in the selected form) is placed in relation to other objects often occurs with (Figure 4). The user can then move the phone around to explore the full setting through AR.

When a scene starts, an audio script starts playing. A ‘host’ welcomes the ‘guest’ and begins to narrate an exposition of the setting. Then, some simple commands are given (e.g., “Pour boiling water in the teapot.” [Iraqi scene]). When a command is narrated, the objects related to this action are highlighted (Figure 4). The user can then move the objects around on the screen to perform the action. If the command involves the actual physical artifact, the user physically moves the object (e.g., “Have your first cup of tea.” [Senegalese scene]). For a command to be considered done, auto-checking is used. For example, when asked to put the mint in the teapot, the application checks whether the user has moved the mint object to the teapot object. Between actions, a narrator provides some commentary about simple cultural customs surrounding the scene (e.g., “We know. It may feel weird but when you eat with your



Figure 3: The different shapes a detected drinking utensil morphs into (left to right): Iraqi, Indian, and Senegalese cups.

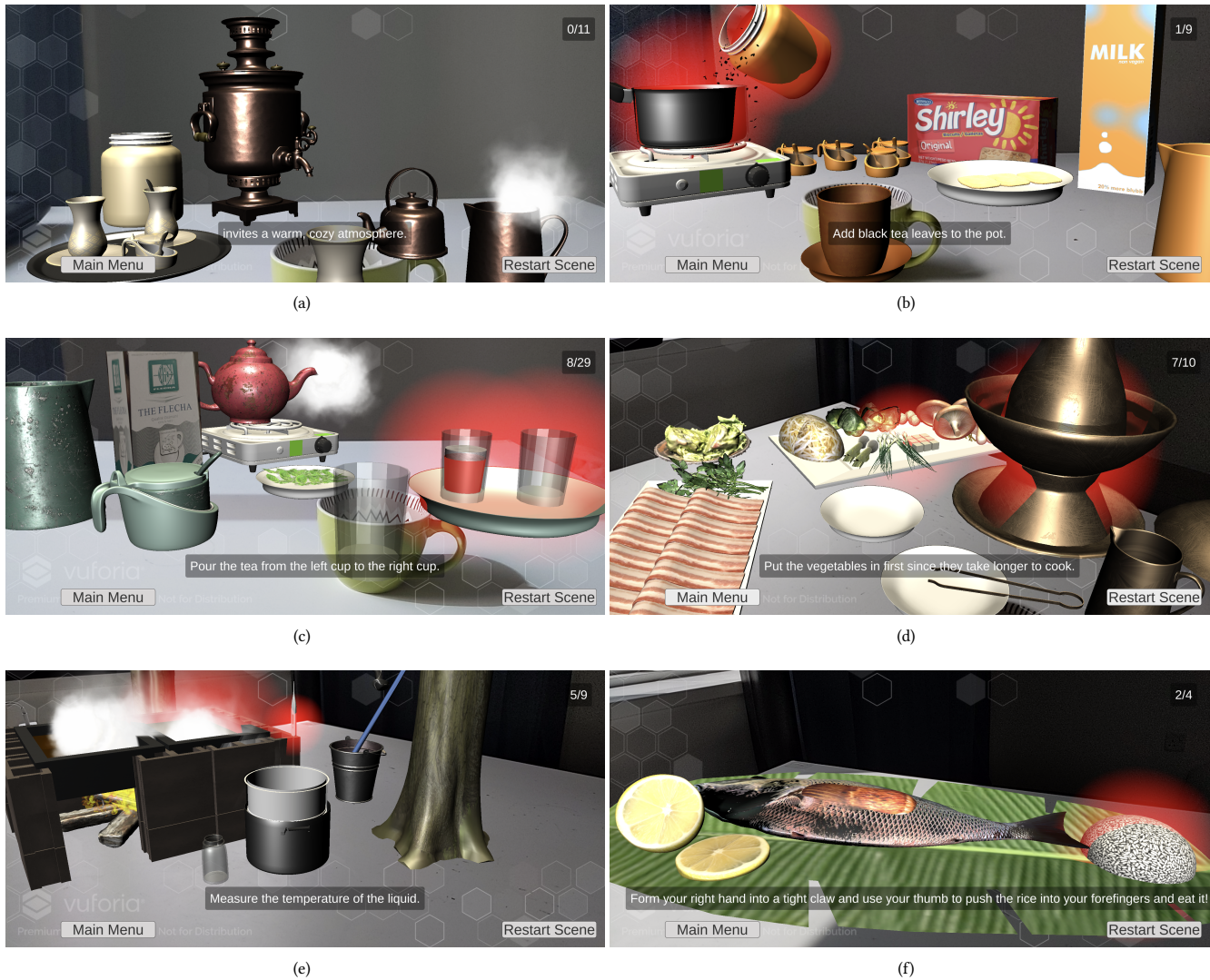


Figure 4: Scenes from the application: (a) Iraqi, (b) Indian, (c) Senegalese, (d) Taiwanese, (e) Canadian, and (f) Indonesian.

hands ...” [Indonesian scene]). Each scene would take around 3-5 minutes to complete. The user can choose to restart the scene or go back to the main menu, where they can repeat the whole process of detecting and selecting an object. All narrated sounds are accompanied by closed captions for accessibility. Also, there is a counter shown at the top corner of the screen to display the number of steps involved in each scene and how many have been

completed. Lastly, the application screen adapts to portrait and landscape rotation for maximum viewing.

We implemented several design features to make the scenes as authentic as possible. Most of the 3D models and all the particle effects in the application (e.g., steam escaping from the teapot) were obtained through online sources. The rest of the 3D models were built from scratch by us because we either were not able to find



Figure 5: Participants trying *Be Our Guest*.

them online or we wanted to duplicate specific brands/shapes of the objects that the participants shared with us (e.g., the tea brand in the Senegalese scene). Every scene had a color theme depending on the narrations. For example, the Iraqi storyteller commented on how a guest who was not a family member or a close friend must be served using a tea set with golden ornaments. Thus, all objects in the Iraqi scene have a gold-ish undertone. Furthermore, because we wanted to emphasize the experience of being present in different homes, two of the scenes' audio narrations were recorded by the participants themselves who provided the stories (Taiwanese and White Canadian), while the rest were recorded by the authors.

4 USER STUDY METHODS

We tested *Be Our Guest* to determine its usability as a medium for learning about the cultural practices of others. We used *snowball sampling* [29] and asked a number of people we knew to participate and recommend others. Using their testimonials, we recruited more participants. We stopped at a theoretical saturation, i.e., when no new additional data were found that developed our findings [25]. We ended up with 11 participants, a mix of genders, aged between 19 and 60, had been in Canada between 3 months and all of their lives, and self-identified with various backgrounds (Table 1. 3 of the study participants were also story creators. All participants except 2 had never experienced AR before. All sessions were conducted individually. 6 were moderated by the first author, while the rest were by the second author. Each study lasted between 45-60 minutes and all but two were conducted on our university campus (Figure 5). The other two were conducted at the participants' homes. Each study was divided into two parts. During the first part (which took around 60% of the time), the participants were given an Android smartphone with the application deployed on it, informed about the application, and asked to attempt as many scenes as they wished. During the second part of the study, the participants were interviewed and asked about their experience with using the application. Each participant was compensated with CAD 15 in cash.

We used two methods to collect data: observations and semi-structured interviews. During the first part of the study, we observed participants while they used the application and took notes and photos. We refrained from asking questions during this stage to avoid any influence. Semi-structured interviews with the participants were conducted during the second part of the study. We started with questions about the immersion of the application, which were based on the evaluation questionnaire of "Immersive Experience" presented in [22] about sensory/behavioral engagement, physical presence, and cognitive absorption. We then asked questions about what they liked and disliked about the tool, their thoughts on experiencing others' cultures, if they felt certain emotions after experiencing the application, and their thoughts on who would be interested in the tool. We also asked the people who produced the presented stories (3 experienced it live while we sent the other 3 a video recording of a participant experiencing their scenes) whether the created experiences met their expectations. Interviews were audio-recorded and transcribed before analysis. The first two authors began with an extensive analysis of the transcripts to identify codes. Our initial pass through the data resulted in roughly 15 codes (e.g., enjoyment, ease of use, improving engagement, drawing similarities, deployment opportunities, migrant children, standardizing culture). We then iteratively refined and discussed the codes to ensure that they were representative of all the data. Related codes were clustered into high-level themes, and these themes are the sub-categories of our Findings section.

5 USER STUDY FINDINGS

Each participant experienced all the scenes. We report our preliminary findings from testing *Be Our Guest* in terms of its immersion and the usefulness of the tool to learn about others' and one's own cultural rituals.

5.1 Immersion in the Scenes

During the trial, all participants expressed their enjoyment of the AR application without us asking. Each said at least one of the following phrases: "This is so cool!", "Interesting", "Nice!", "This is so much fun!", "Beautiful", and "Amazing". All participants said that once they got familiar with the application, it was easy to get immersed and comprehend the augmented space. The application kept them attentive and focused to understand what was being narrated and perform the actions. Furthermore, they felt comfortable, in-control of the scene, and more spontaneous than hesitant in acting out the instructions. In addition, they said the experience was emotionally pleasing and they would be interested in trying the application again. 8 participants (P10, P12, P14, P17, P18, P20, P21, P22) indicated that they felt like guests in someone else's presence, while the remaining three felt as if they were in a friendly environment such as a cooking class or a restaurant:

"For the hotpot one [scene]. I know, like a lot of my friends whenever they go, they just put down their story, like on Instagram, and I always see it and I've never been, but then this actually made me feel like I was in the restaurant. And I was like, you know, engaging in it and all that." (P18, M, 20s)

Two participants (P10, P20) even said the experience was relaxing

and therapeutic because they were enjoying the process of making the drink or eating:

“It was like, therapeutic. There’s this feeling when you engage with the ritual, you feel something spiritual, but you cannot define it ... I felt like okay, there’s something interesting and I just kept smiling ... and then my mind is entering the flow situation... I would wonder how diverse the world is and how small we are.” (P20, M, 30s)

Several reasons were given for such engagement. First, the application was hailed for being easy to use and accessible to anyone without the need for complex technology or extensive technical skills. Second, the instructions were direct and clearly communicated, enhanced by the accompanying audio narration and closed captions. Third, the virtual representation was rich with different cultural objects laid out in the virtual scenes and enhanced by the use of effects (e.g., running water, steam). Fourth, the conversational aspect of the scripts (e.g., “Welcome to our house”, “Enjoy!”, “Please have a biscuit”), as well as the use of traditional terminologies (e.g., “Samawer” [a double boiler in Iraqi], “chai” [tea in Indian]) made it seem as if other people are present. Lastly, the AR feature allowed them to explore the scene as they moved the phone around:

“I think it was really cool like the augmented reality part where it’s like interacting with the cup. If you move the cup, everything moves, It’s very, very well done ... when I moved the cup, or when I moved the phone, everything was very well in a different angle.” (P14, M, 20s)

An important aspect that contributed to our participants being immersed in the experience was how all but one participant (P23) felt like active players in the scene. All but two participants (P22, P23) preferred the ‘being active’ aspect of acquiring knowledge as they indicated they learn by doing, and if they were passive in the process, they would not pay attention to what is being narrated:

“I think the experience and the information, the knowledge comes together. I like it. I feel like I [will] never forget what I just heard from the instructions. It was powerful. It creates a power for me in terms of memory and experience.” (P17, W, 30s)

Our participants made suggestions to improve the immersion of the application. First, five participants (P10, P16, P17, P19, P23) suggested adding more details such as traditional paintings, rugs, ornaments, music, and sound effects (e.g., water boiling, tea pouring). Second, six participants (P12, P14, P16, P18, P19, P20) said that the mobile screen was too small, so they could not see all the objects at the same time. This made it uncomfortable for some when they had to pan the phone to pull an object from one side to another for certain tasks. They believed that a tablet or AR glasses would offer a wider field of view. Lastly, two participants (P14, P16) said that the textures of some objects did not look realistic (e.g., a glass cup appeared more metal than glass). This is a known problem in computer graphics since live rendering coupled with tracking is computationally challenging [1].

5.2 Perceiving Unfamiliar Cultural Rituals

All participants praised the interesting cultural experience the AR application offered and said it was a pleasant method to learn about others’ customs and practices as the narration offered a story and description of each stage, as well as the reasoning behind why certain actions were carried out. Participants said they felt joy and excitement during the application trial because the app allowed them to experience situations they otherwise would not be able to. Also, it introduced them to novel information such as the fact that pouring the tea back and forth produced foam, a large number of spices are added to the Indian tea, and how extracting sap takes days:

“What was most interesting to me is the maple syrup [scene]. I live in Canada and I see maple syrup but I never knew how it’s produced. So it was really very interesting to learn how these things are like and how maple syrup is extracted or how it is made in Canada ... Even I lived in Canada for 16 years I find it very interesting to know ... It was very interesting to hear from someone who knows Canadian culture and they have their roots in Canada.” (P12, W, 60)

Some participants (P10, P20, P22, P23) praised the application for presenting some cultural nuances that were not well-known, and perhaps even frowned upon, in Canadian society such as slurping tea and eating with hands (P20, P23):

“The Indian [scene] and the slurping habit, this is sometimes something for people who come from India for example, in the Canadian culture they wouldn’t say this kind of stuff, because it’s not the kind of norm that people have in Canada. And so, being brave enough to say this that hey, sometimes we put this to the saucer and just slurp it through the app, I think that the app takes this responsibility of saying the uncomfortable stuff to the other people in other cultures ... Sometimes people are shy about talking about their own culture because they think those are uncomfortable ... And if they talk about that, other people might, you know, judge them.” (P22, M, 30s)

All participants agreed on the usefulness of the application to help immigrants communicate their cultural practices and values to the larger community. All of them found it interesting that the application focused on food and noted that some cultural items, like tea, are very common among multiple cultures and thus, it would be something people of various backgrounds could connect with as they would recognize all the similarities and the differences and would focus on the smaller parts of their cultures that tend to overlap. Many indicated that they felt happy because they believed this could be a way to connect with their friends from other cultural backgrounds. All but three participants (P18, P22, P23) said that they felt more connected with the presented cultures after using the application, and several drew connections between the rituals they reenacted and some practices from their own cultural heritage. For example, P19 noted how kids asking for money during the Taiwanese new year scene reminded her of a similar ritual people do in her culture for *Eid*, P16 was surprised that in Iraq, they also call the tea ‘chai’, similar to India, and P10 expressed her amusement

that some steps in the Senegalese tea ceremony seemed similar to some tea practices in Malaysia :

“It is interesting how you pour a little bit and then you pour it back and forth to make it frothy [the tea in the Senegalese scene]. For some reason it reminded me of the Malaysian *the athletic or pull* tea, because the way they make it as they literally like pour the tea and they stretch the tea pot. So it’s just like a long string.” (P10, W, 20s)

All participants agreed that the application would lessen the stress that people might feel when entering a new culture and could be a starting point to get connected with people from different backgrounds. Our participants indicated that they would feel more at ease when going to the house of someone from a different culture if one of the rituals in the application would be at play in real life as they would know “*what is going on*” and not be surprised or feel nervous about making an offensive gesture. Moreover, they said the narration offered them enough information to start a conversation with individuals from other backgrounds and that they would feel more confident in asking them questions:

“This could be a topic I can talk with others about. I have an Indian guy at work. I will talk with him now. I remember he said that there must be milk with the tea. Now I discovered that there is ginger and fennel seed and other stuff so I will talk with him about it. I see a White Canadian and we talk and I tell him that I know how maple syrup is made.” (P16, W, 50s)

All participants said that after trying the application, they were now curious about other cultures and were motivated to try at least one of the presented scenes in real life:

“It was cool to see that they do it three times [tea in the Senegalese scene], and it’s like a different flavor profile every time because I really want to try that. I want to see how it would change ... It was like a cool little tidbit of information that I’d never known before. And now I’m curious to see it in real life.” (P19, W, 20s)

Our participants recommended various venues where the application could be deployed. They indicated that the application would be useful for anyone who wanted to learn about other cultures and cultural etiquette, especially in Canada, “*regardless of their ethnic background because of the existing multiculturalism*” (P22) . For example, four participants (P17, P19, P20, P23) said the application could be useful for tourism when someone travels to a new setting. P11, P12, and P19 wanted the tool to be made available at museums and centers for international exchange in cities and universities. Five participants (P12, P14, P16, P19, P21) said that children would be very interested in such an app because it was simple and fun to use, and that it would be important for children from a young age to learn about cultural differences for social cohesion:

“Just younger kids. I feel like it’d be really helpful for them because they probably know less than us. And that’d be a good way to introduce them to it. I think it’d be fun for them, as opposed to just sitting down and like listen to a teacher [talk] about it.” (P21, W,

20s)

5.3 Experiencing One’s Own Culture

Participants who attempted scenes about their own cultural heritage said that they were “*honored*” that their culture was being represented and felt “*emotional*” even though many said they had never experienced the displayed rituals fully in real life. Three participants (P12, P16, P19) felt nostalgic when they tried these scenes as they remembered their families.

“It was a little bit nostalgic because it reminded me of when I go back to India, like all of my uncles and aunts and stuff, like sitting around drinking tea, because here, it’s more just my parents doing it. So it’s not as much of a social thing.” (P19, W, 20s)

All except two participants (P16, P22) said the application could be useful for second and third-generation immigrants to learn about their cultural heritage and connect with their roots, especially since “*newer generations will be more technologically oriented*” (P20), and it would be better than simply reading or watching videos about their heritage practices. As a matter of fact, two participants (P14, P19) indicated that the application taught them something new about their cultural heritage such as the social dimension of drinking tea and the type of ingredients that went into making some food and drinks. Furthermore, our participants said that when children of immigrants would go back to their heritage countries, they might get confused and could miss nuances of some cultural practices, but the AR experience could ease their worries and help them comprehend what they are supposed to do and not do:

“Often what I find with myself and some friends from high school, who’re a little a bit more I guess disconnected or don’t really know the language, then they’re trying to make an effort to learn the language and stuff like that, either through some online thing or just by talking to the parents more... So I think having some of that [the application] experiences is good” (P23, W, 19)

Participants who had doubts about the potential of the application in delivering information to children of immigrants shared their reasons. P16 said that people from her ethnic background did not want their kids to learn about their cultural heritage because the parents were often not proud of their heritage. P22, on the other hand, worried about standardizing cultural rituals:

“Because of the pluralism of the same thing, even in the same geographic region. So for example, in different parts of India, they make tea differently ... So even if you’re telling people that this is not standardized, you should still learn stuff from your parents” (P22, M, 30s)

We asked the participants whose stories were used to create the scenes if the created experiences met their expectations. All responded positively and said that they were unsure of what to expect but were pleasantly surprised and impressed with the final product and were happy that they were given the agency to share some nuances of their cultures through such a tool:

“It [the app] did capture my story. I think anyone who

weren't from Iraq and never read about it or heard about or know about it, it will be very interesting for them to know more about the Iraqi culture. Even like *Samawer* and tea are experienced in other countries like in Turkey and maybe in Iran or other like Central Asia, but in Iraq it has its uniqueness. So yes, when I saw it, even though I know it [how the scene will play], I enjoyed experiencing it" (P12, W, 60)

6 DISCUSSION

Our findings illustrate that the AR application we built was able to successfully - and easily - immerse our participants in various domestic spaces with cultural depth due to its accessibility, narrative, visuals, and ability to make the user an active actor. All our participants enjoyed experiencing the domestic cultural rituals of others and believed this could be a starting point to get connected with other members of the community. The majority of participants started drawing similarities between what the application allowed them to experience and their own backgrounds, and some even learnt new things about their own heritage. In this section, we discuss our findings - from the application creation to its trial - in terms of using AR to explore cultures and advancing HCI research in this realm.

6.1 Cultural Exploration through Immersive Engagement

Our study shows that AR, coupled with reenacted scripts, could not only support cultural sharing between the host community and immigrants and among immigrants of different backgrounds, but also connect people of migrant origins to their roots if they had limited exposure to the intricacies of their cultural heritage. We were able to achieve this cultural learning (RQ1) because the application was immersive - as our participants emphasized - as well as because the narrator and the audience, regardless of their background, had equal weight where both were portraying and performing as their 'selves'. Our findings demonstrate how *Be Our Guest* could offer agency to the storytellers to communicate their culture by narrating domestic heritage customs in augmented space without the need for confrontation. Moreover, the interactor could experience the ritual story through a stage that consists of both physical and virtual elements, using them for hearing, seeing, and performing. The 'scripts', when being performed by a person from the 'other' group, engage on behalf of their authors in contesting, proposing, and prescribing desired behaviors. This break in human-human confrontation gives the different sides time, space, and autonomy to reduce the discomfort of such conversations and build understanding.

Reflecting on our tool creation experience and user study results, it is evident that there are several limitations to using a curated approach where app designers, rather than users, choose, script, and present the stories (RQ2). Every scene took a fair amount of time and effort to build as we had to collect the stories, create the scripts, and construct certain 3D objects from scratch if they were not readily available, which meant we could only build a selective number of scenes using limited types of artifacts. Moreover, since we only had images and not the actual artifacts, we did not

know their interior build and had to make some assumptions which could result in misrepresentation. Furthermore, some of our participants expressed their concern with the danger of standardizing cultural rituals from one region/culture because there could be an astonishing contrast between the standardized version compared to the diverse sub-cultures present, resulting in delivering misleading information [16]. Our suggestion towards wider adaptability and scope is to democratize *Be our guest* so that anyone can contribute their experiences to the project, thus joining the recent rise in using digital crowdsourcing to preserve cultural heritage [15, 73, 85]. A framework could be created where people share their stories and name not only the cultures they identify with but also the heritage region and community, so individuals from similar settings can polish the narratives collectively. Then, people from similar backgrounds can create 3D models of the artifacts. Afterward, there would be an accessible interface where models are entered, and prefab events and effects are available to be assigned to objects (e.g., if object x collides with object y , action z is achieved).

6.2 Broader Takeaways

Beyond the immediate findings regarding the prospect of AR in exchanging cultural norms, connecting people to their identities, and empowering immigrants to voice their feelings, our study offers two broader lessons for HCI. First, this study connects HCI design with theatre studies, which is a less explored area in HCI. As AR technologies are becoming increasingly popular, we argue that theories, concepts, and practices of theatre studies can play an important role in helping AR designers, practitioners, and researchers explore various new applications. Conceptualizing 'augmented reality' as a prop for theatrical performance allows the designers to create a 'third space' [8] for the immigrant users. Unlike many digital social media, AR offers this new stage for performing 'within' the subject's current living environment. This overlap between real and 'unreal' through bodily performance changes people's relationship with their place [19]. Thus, allowing an immigrant to 'live' and 'perform' in the virtual 'home' challenges the definition of migration both from theoretical and practical perspectives. A rich line of recent work in VR and AR has demonstrated how 'unreal' objects can assist people in performing tasks better, entertain them, and make better connections among them. Our work extends this line of work and shows how AR technologies can also be used to recreate an individual's identity. Building on the scholarship of critical theatre studies [11] and social science work on dramaturgy [27], we show how AR technologies can also give people the agency to develop their own identity through performance. Our work was definitely exploratory in nature and small in scale. However, the results clearly demonstrate the potential of advancing toward such goals by using the knowledge of performance arts and theatre studies.

Second, our study demonstrates the importance of a critical exploration of 'self' in HCI. While the 'self' has long been a contested area of study in psychology, sociology, political science, and many such domains (see [6] for an overview), it has not received much attention in HCI. *What do I become by using a technology?* - is a question that is yet understudied in HCI. Our study sheds light on this issue by presenting AR technology as a tool for the users to be cognizant of their body, identity, personal history, family history,

and cultural heritage - both when they were exploring an ‘unreal’ object of their own heritage and one from a foreign heritage. HCI work on ‘reflection’ [13, 20, 72] and ‘critical design’ [3, 58] has long advocated for such technologies for creating consciousness among the users. However, the existing HCI work in AR/VR is predominantly focused on designing tools that lack such critical reflections, save for very few exceptions. Our study, therefore, does not only advance this facet of HCI by pushing AR as an important tool for critical reflection, but we also prompt a reflection of the user’s physical and material presence. For example, an able-bodied female may experience the ‘unreal’ stage quite differently than a male with physical disabilities. Thus, this tool brings an important association with ‘body’ in critical reflection in the digital world to explore ‘self’. We believe that such association is critical in advancing future HCI work in critical accessibility studies [28], feminist HCI [4], and intersectional HCI [68].

7 LIMITATIONS AND FUTURE WORK

We did not use any quantitative measures or a baseline case to evaluate the usability of the application. Future pilot testing is necessary to formally assess the application’s performance in comparison to other cultural information exchange tools such as videos. The evaluation would focus on key factors such as technical stability, task completion time, error rate, user engagement, and user satisfaction. We also acknowledge that the number and background of the collected cultural stories and participants were limited, and each participant came from a relatively homogeneous household. It is possible that with more users and demographic variety, we may gain further or different insights. Moreover, stories could incorporate multiple objects in one scene. For example, if only one artifact is detected, certain narratives are triggered, but if multiple are captured, other narratives are evoked. Furthermore, interactive storytelling could be implemented where the initial setting is the same, but a user’s experience would depend on how they interact with the artifacts. Also, some personalized features can be added such as asking the user to enter their name and the aural narrative would voice their names to make them feel as if they are truly being hosted. Lastly, some of the actions the user must perform could be more complex such as standing up, moving around, and talking.

8 CONCLUSION

We addressed a gap in HCI research about migrants and recognized the need for two-way cultural exchange between immigrants and host communities, and among migrants of diverse backgrounds. Based on theories on situated cognition, immersive theater, and affordance, we developed an AR tool that simulated visiting the homes of people from diverse cultural backgrounds and experiencing some of their daily/seasonal cultural rituals. As we engaged with 23 immigrant and non-immigrant participants in developing and testing the tool, our findings revealed that the tool was successful in making the interactor feel immersed in the settings and learn about other cultures as well as their own due to the authentic atmosphere it evokes and its interactive nature. We also provided insights from our journey to implementing the tool for future developments of similar instruments and showed the limitations of the present system.

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