Tampere University

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WELCOME. DESIGN IMPLICATIONS FOR A CULTURALLY AWARE ROBOT

Helping Arab immigrants to adapt to their new culture

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ABSTRACT

Valentina Ramírez Millán: Welcome. Design implications for a culturally aware robot
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Migration is one of the biggest global challenges society faces today. Factors such as war, climate change, and unemployment force people to leave their home and look for a better life elsewhere. Locally, at the end of 2015, 339,925 foreigners lived in Finland, which is around 6% of the total population. The most prominent cultural group of foreigners in Finland comes from Arab countries. When immigrants arrive in a new country, they face a formidable adaptation process. Recently, social robots have been used to assist vulnerable populations, namely the elderly, children on the autism spectrum, and, in small amounts, immigrants.

Nonetheless, social robots that are used to support immigrants are not culturally aware. Cultural awareness refers to the robots' capability to identify user culture and behave appropriately. The design of culturally aware robots is an important research area of cross-cultural design. The cross-cultural design of interactive technologies can be harnessed to develop products to be used by people of different ethnicities or in different territories and societies in order to create favorable user experiences across cultures. In the field of robotics, cross-cultural design has mostly studied specific robot behaviors, such as proxemics or speech intonation, to match a particular culture. However, only a few studies focus on culturally aware social robots that support immigrants.

This work aims to develop use cases and design implications for a culturally aware social robot that helps Arab immigrants with the cultural adaptation process. The empirical study's target users are Arab immigrants living in Finland; they are females and males who speak English and are between 22 and 30 years old. This study is both explorative and qualitative, and it follows human-centered design principles and constructive design research methodology. Two empirical studies were conducted, using semi-structured interviews, scenario evaluations, and validated questionnaires.

During the empirical studies conducted in this thesis work, immigrants were found to suffer from social isolation; they need to be self-reliant and practice the local language. Likewise, the empirical studies allowed us to identify behaviors and cultural variables of the Arab culture that a social robot should adapt to in order to become culturally aware. Additionally, this work developed three scenarios where a Nao robot is culturally aware of Arab culture and supports Arabs' needs as immigrants. The scenarios were used to assess the value of the use cases, which are specific situations where the social robot can be used as support. The use cases were based

on the needs of immigrants, which were determined in the pre-study. The findings indicate that participants evaluated the use cases as useful support for them in their first months after arrival.

Regarding the Nao robot's cultural competence, the participants assessed the social robot's behavior as according with the attitudes and communication styles of Arab culture; only minor changes were suggested. Further work should explore long-term interaction in order to avoid repetitive behavior in interaction and enhance the user experience. Ethical concerns, such as the replacement of humans by robots, may arise and need to be considered in future work.

Key words: Social robots, Cross-Cultural robotics, Immigrants, Human-centered design, cultural persona, Arab immigrants, Culturally aware social robot.

PREFACE

” If our actions towards robots reflect our empathy, then there’s some hope for humanity”

Kate Darling.

I believe we are in the right moment to design the kind of relationship we want to have with robots in the future. Thanks to Aino Ahtinen, my teacher, supervisor but above all my mentor, she introduced me to world of robots, and showed me that the field needs a human side, designers, psychologists, philosophers that advocate for people in a field dominate by productivity.

Thanks to my husband who is always by mi side, and to my family that from the other side of the world always make me feel supported.

Valentina Ramírez Millán
Tampere, Finland.
13.11.2020

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1 Introduction

This section introduces the thesis's background and motivations, which led to the development of the research gap and research questions. Furthermore, this chapter explains why culturally aware social robots are proposed as a way to help with the immigrant adaptation process.

1.1 Motivation

Current global challenges, such as wars and climate change, force populations to leave their homes and look for a better life in other countries. Most of the time, *immigrants* face a challenging adaptation process. Among the obstacles encountered by these populations are language barriers, religious influences, philosophical doctrines, types of communication, and personal space. Likewise, the change in social status as a result of migration creates other problems like discrimination, making it harder to start a life in a new country. Even though racism is not always explicit, people who cannot adapt correctly can suffer from social isolation, leading to a lack of a sense of belonging, which affects their general sense of well-being (Maslow, 1999).

At a local level, Arabs have been the most prominent cultural group of i*mmigrants* in Finland since 2015 (United Nations Department of Economic and Social Affairs, 2017). Pasi Saukkonen (Saukkonen, 2016, p.15) stated that *"Finland needs to invent and develop other channels for the newcomers to find their place in the host society. There should be opportunities to learn the language and the Finnish way of life and to establish social contact with the native population outside the labour market."*.

Along with immigrants, the elderly are currently one of society's most vulnerable groups. Both immigrants and the elderly share the need to be self-reliant, and both suffer from being isolated in their community. Because of this, *social robotics* has already been used as a potential solution to provide independence (Simo, Avelino, Duarte, & Figueiredo, 2018) and emotional support (Kolstad, 2019). However, previous solutions that use *robots* for these populations do not present specific *design implications* to match the robot's behavior and functionalities with the *user's culture*. Thus, *social robots* behave without regard to a person’s *culture*. The literature recognizes emotions and culture as critical factors for a robot's behavior and adaptation levels so that they can achieve higher levels of acceptance and adoption among humans (Bruno et al., 2019; Jeon, 2017). However, social robots nowadays rely mostly on the data gathered from the user's general behavioral and usage data (Martins, Santos, & Dias, 2019). Further-

more, the studies that embrace *the users' culture* as a guideline for interaction focus on specific behavior in specific experiments, and they are not contextualized in a *use case*. Until now, far too little attention has been paid to scenarios with *culturally adapted behavior* to provide *support to immigrants*.

This work aims to develop *use cases* and *guidelines* for a culturally aware *social robot* that would support Arab immigrants in their adaptation process. The words "guidelines" and "implications" will be used interchangeably, and both refer to the guiding principles that need to be developed for a culturally aware robot.

This work is explorative and qualitative; it follows a *human-centered approach*, where the target group's needs are at the center of the design process in order to find pain points in the context of use. Additionally, we adopted the constructive design research methodology. We built a prototype using scenarios to test their validity with users.

Furthermore, this thesis promotes further research in *cross-cultural design* by developing an *Arab Cultural Persona,* along with a design implications framework that unifies the context of use and adapts the robot's behavior to the users' culture. Thus, this material supports future solutions for assisting immigrants.

It is acknowledged that developments in this work, considering current technology, will not solve the societal problems exposed here. However, this work aims to establish interaction guidelines for a robot that might help future work. Likewise, it is essential to note that this robot is not intended to replace social workers or humans.

1.2 Research gap and questions

According to (Goodman & Kirkwood, 2019), integration is one of the most critical factors in the adaptation process of an immigrant to their host country. Cultural brokers are agents that enable the transition of populations from one culture to another and aim to reduce the conflict associated with cultural change (Jezewski, 2016). (Kirmayer et al., 2011) underline that cultural brokers can improve clinical treatments for immigrants when cultural differences create an obstacle to understanding the local culture. Social robots are starting to be used as social brokers, mostly in immigrant language training. However, currently, robots are not culturally competent. They facilitate crossing from one culture to another through language training, but they do not behave according to the users' culture, even though the literature (Bruno et al., 2018) supports the need for this.

Furthermore, research that focuses on Arab culture is practically nonexistent: *"Previous work in cross-cultural HRI studies has mostly focused on Western and East Asian cultures. In contrast, Middle Eastern attitudes and perceptions of robot assistants are a barely researched topic."*(Salem, Ziadee, & Sakr, 2014, P. 1)

Similarly, the work in cross-cultural robotics focuses on specific robot behavior, such as proximity levels, but few studies develop use cases that support immigrant integration, such as the one created by (Carolis, Palestra, Penna, Cianciotta, & Cervelione, 2019)

Therefore, there is a pressing need to develop 1) design implications that provide guidelines for how a social robot working with Arab immigrants should behave 2) use cases where the robot fulfills the purpose of supporting the immigrants.
Hence, the following research questions were formulated:

RQ1: What needs of an Arab immigrant could be supported by a culturally aware social robot?
RQ2: What behaviors from the Arab population are suitable for a culturally aware social robot?
RQ3: What are the design implications and use cases for a culturally aware social robot that helps Arab immigrants adapt to their new culture?

The first question tries to establish the users' needs by putting the user at the center of the design process. Here, the research aims to highlight the main pain points of the adaptation process when an immigrant adapts to a new culture and to find areas where a social robot can be a potential solution.

The second question continues with the user perspective and reflects the in-depth search for the most relevant social cues and Arab cultural behaviors that could be mimicked or adapted by the robot when interacting with Arab immigrants.

Finally, the third research question embraces a design angle. The most relevant findings are presented as guidelines for future designers who aim to use social robots to assist Arab immigrants.

1.3 Structure of the thesis

This research work has three main components (Figure 1). First, the Research module consists of an introduction, related work, and methods used. Second, the Hands-on module interprets the area where the empirical studies were done. It starts with the pre-

study where the first set of data was taken and uses it to develop the cultural persona and the scenario or use cases. The Hands-on module ends with the design evaluation of the use cases. Third, the Final outcomes module includes the design implications, the discussion, and conclusions.

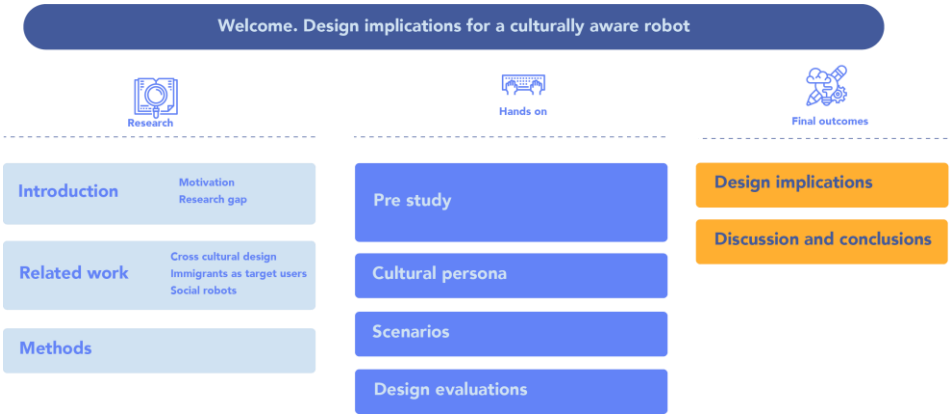

Figure 1. Thesis Structure

2 Related work

In the development of the design implications for a culturally aware social robot, different theoretical perspectives and a multidisciplinary approach are combined. The first sub-section provides an overview of cross-cultural design models. In the second sub-section, various sources are integrated to develop a comprehensive understanding of the target population and their needs. The final sub-section explains social robotics' current state in relation to the primary research focus of this work (Figure 2).

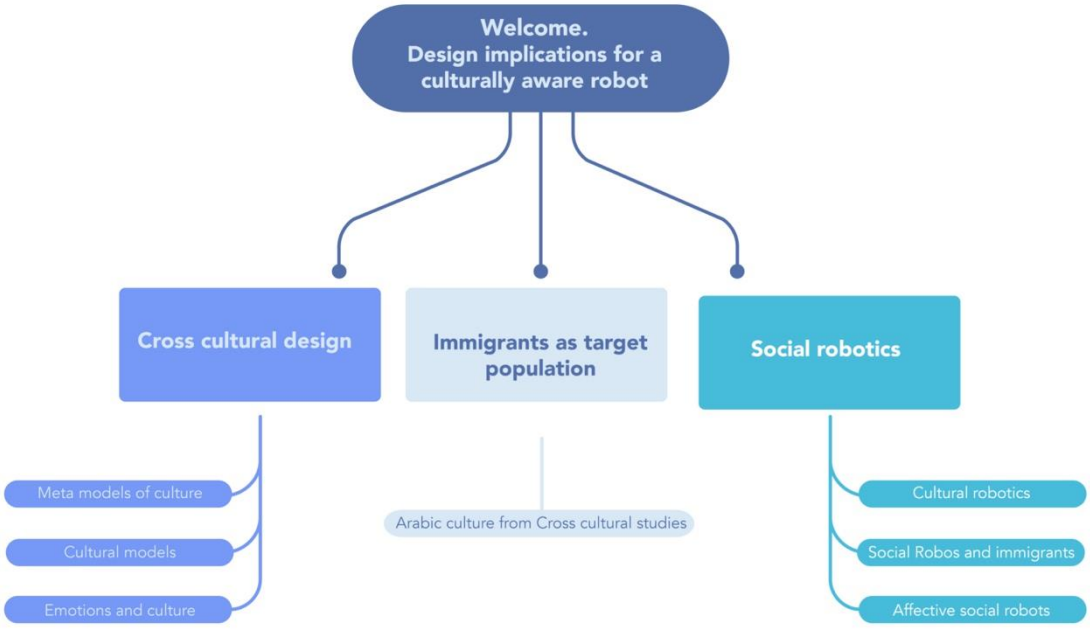

Figure 2. Structure of the related work

2.1 Cross-cultural design

Among the many definitions of culture, one of the most accepted versions is the one by Geert Hofstede. For him, culture is *"the collective programming of the mind that distinguishes the members of one group or category of people from another"* (Hofstede, Geert H., Hofstede, & Minkov, 2010, p.6). Such groups or categories could be nationality, age, gender, hobbies, ethnicity, profession, sexual orientation, or religion. The mind's programming or mental models as described by (Hofstede et al., 2010) refer to a person's patterns of thinking, feeling, and acting. These mental models partially predispose people's attitudes, behavior, norms, and values; they affect individuals' perception of the world around them and their cognitive process in everyday tasks. Designers understand the importance of users' culture in the design process due to its significant influence on individuals. In fact, there is a well-known field called cross-cultural design, which is dedicated to developing products for people in different territories, societies, or of different ethnicities so as to create favorable user experiences across cultures. Com-

panies rely on the translation of language to localize their products; however, language is not enough to provide cultural adaptation. A good illustration is the case, explained by (SHEN,) of the American company "eBay" and its unsuccessful introduction to the Japanese market. The company bought a local domain and translated their website into Japanese; however, they did not consider Japanese cultural values, such as the level of trust and degree of risk implicit in the interaction of this leading auction website. Three years after their Japanese launch, the American company decided to withdraw due to high abandonment rates and the local population's lack of engagement. This example reflects the results when businesses lack proper cultural understanding.

Metamodels of culture

Culture is learned, not inherited, and it is expressed in habits, manners, conduct, symbols, clothes, and verbal and nonverbal communication, among others. These aspects belong to different layers, and language corresponds to a small and visible one. These deeper layers need to be understood by designers to create a unified user experience.

Metamodels of culture are theoretical tools that are used in cross-cultural design to understand and study the differences between cultures and their layers. They are used to explain the specific aspects that define a culture, such as languages, values, writing systems, the meaning of colors, etc. These are classified in dimensions or variables. Metamodels help designers identify the layers of culture on which they should focus their products, either objective and visible or subjective and hidden characteristics. Different studies are required to understand the different layers; the deeper designers want to go, the more explorative, qualitative, and profound studies they need. For instance, ethnographical studies are used to understand deeper levels of cultures.

Among the best-known metamodels of culture are the Iceberg model (Hoft, 1996), the Onion (Trompenaars & Hampden-Turner, 1993), and the Pyramid Model (Hofstede et al., 2010). The Iceberg model (Figure 3) represents the visible and invisible aspects of a culture. In it, there are three layers: surface, unspoken rules, and unconscious rules. The surface is where the visible aspects of a culture are located, such as language, date format, and currency. Unspoken rules go one level deeper and include symbols and etiquette that is more hidden. Finally, the unconscious rules layer focuses on nonverbal communications, the perception of time and space, and values that shape the societies that belong to the culture.

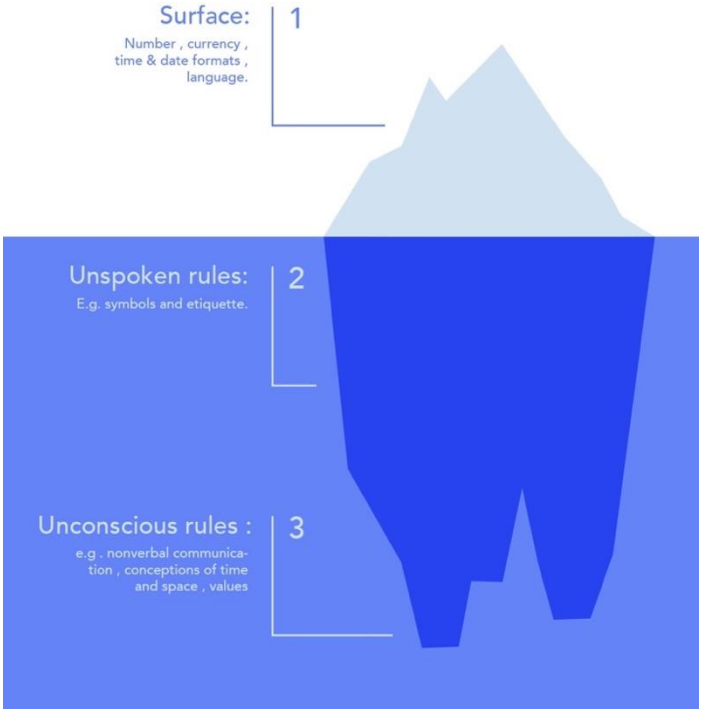

Figure 3. The Iceberg Model

(Hoft, 1996)

The Onion (Trompenaars & Hampden-Turner, 1993) (Figure 4) uses the onion figure as a metaphor to describe the components of a culture. The outer layer displays the symbols and rituals; these are the explicit aspects of a culture, followed by norms and values. Finally, the inner layer houses the basic assumptions that are implicit and correspond to the central beliefs that determine conduct. The Iceberg model and Onion model share similarities in how they explain the visible and invisible aspects of a culture, although they vary in the order of the layers. Nonetheless, ultimately, they express the same point of view about the components of a culture.

On the other hand, the Pyramid Model (Hofstede et al., 2010) (Figure 5) uses the three layers, personality, culture, and human nature, to demonstrate the attributes that *"program the mind."* The lower layer, human nature, denotes the universal aspect, which Hofstede describes as an *"operating system,"* that establishes physical and physiological operations, such as feelings and emotions. The second layer, culture, refers to learned traits and is specific to a group or category. This category corresponds to the categories of values, rituals, and symbols that the previous models used. Finally, the upper layer represents the personality of an individual. This layer is the only one that is not shared; it is like a personal series of mental programs partly inherited from the per-

son's unique set of genes and partly learned from contextualized stimuli and personal experiences.

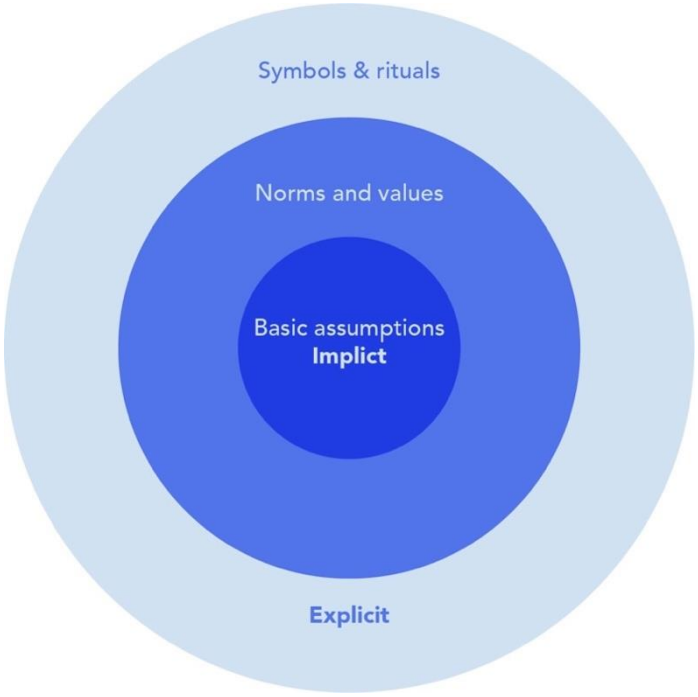

Figure 4. The Onion Model

(Trompenaars & Hampden-Turner, 1993)

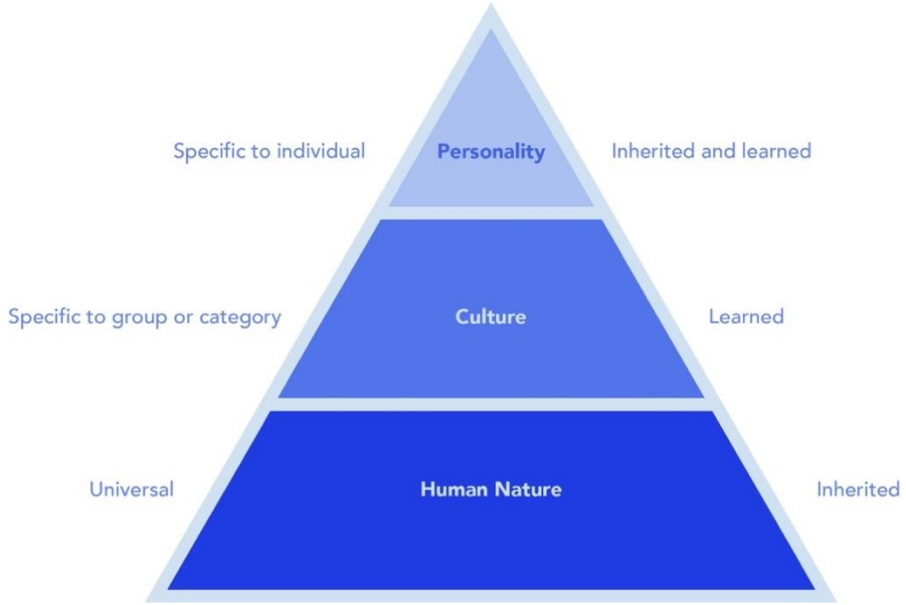

Figure 5. The Pyramid Model

(Hofstede et al., 2010)

Cultural Models

Cultural models analyze the differences and similarities between cultures by using international variables, also known as culture dimensions. These instruments help designers get evidence that reflects the target population's cultural needs, an essential theoretical tool of this work. The knowledge acquired in this section is used to describe the target group of this research and the development of the cultural persona in Section 5. Cultural dimensions categorize information and can be used to avoid cultural mistakes and the reinforcement of bias. They help teams identify the most suitable form of communication in a specific territory and detect cultural metaphors that can easily be missed, among many other benefits. One significant consideration is that one country does not strictly belong to one dimension. Each one has elements of other dimensions. However, nations do have a predominant manner of conduct, which is the basis of the classification. For this work, three well-known cultural models will be described and used as a basis for the results: The Lewis Cultural model (Lewis, 2006), Hall's Cultural Model (Hall, Edward T., 1966) and Hofstede's Cultural Model (Hofstede, Geert, 2010)

The Lewis Cultural model (Lewis, 2006) (Figure 6) explores three dimensions to categorize cultures and is depicted as a triangle where color expresses the dimension's extent. A list of groups of countries is also displayed, which helps with the assessment of them. The first dimension is *linear active,* which refers to cultures that follow schedules and plans; they are used to doing one thing at a time. Their communication type is polite and direct; body language is restrained, they are used to talking half of the time during a conversation, and their display of emotion is partial.

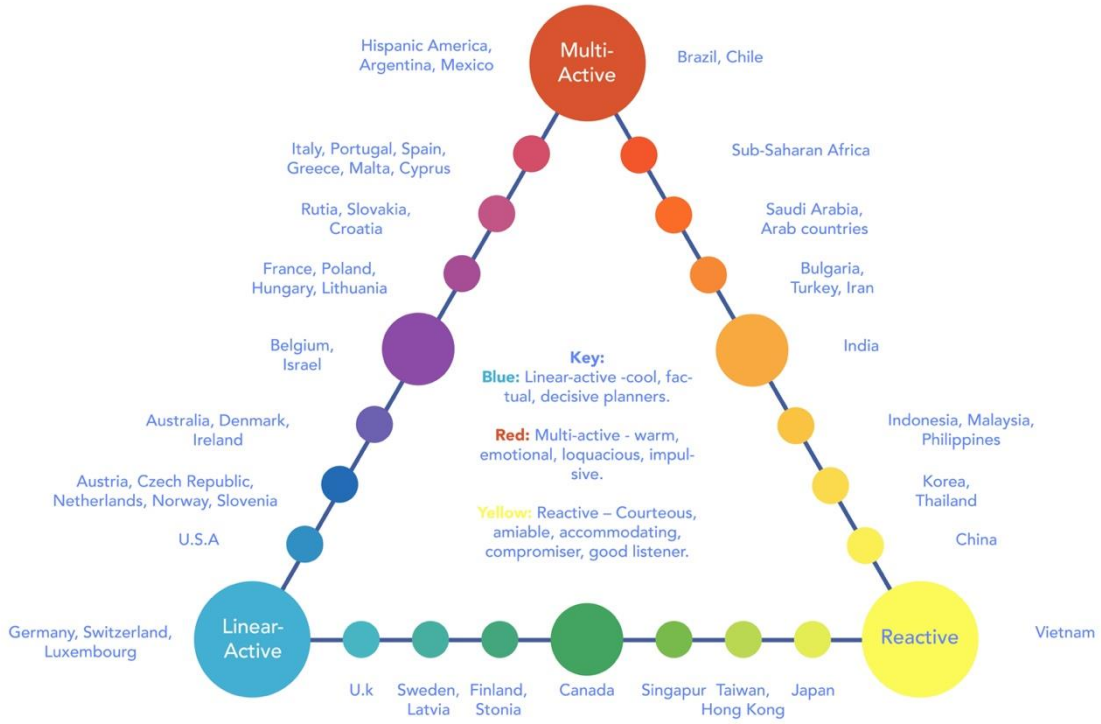

Figure 6. The Lewis Cultural model

(Lewis, 2006)

Next is the *Multi-active* dimension, which is opposite *Linear-active*; the people who belong to these cultures perform multiple tasks simultaneously, and their plans change with the situation. They are emotional; for them, feelings come before facts. They have expressive body language and talk most of the time during a conversation; demonstration of feeling is widespread.

Finally, a Reactive culture is *long-term* oriented and tends to see the big picture in situations; they are recognized for being patient. Their type of communication is polite and indirect, and they react based on their conversation partner´s reactions. Their body language is subtle, and display of emotion is not socially accepted.

Hall's Cultural Model (Hall, 1966) includes the following international variables: *context (high and low), space, time, speed of messages, information flow, and action chains.* The *context* dimension investigates the background in which a message is inferred. It extends the use of situational cues, which are contextual signs that convey information about actions, events, or communication guides to the interlocutor. Understanding the context variable helps a designer know the right amount of detail a product should have. This cultural dimension is divided into high and low context (Figure 7.). High context cultures rely on implicit communication, and a short sum of words can

express a complex meaning. For cultures that belong to this classification, knowledge is situational and depends highly on the context. Face-to-face relationships are precious, and activities center on the person with higher authority.

On the other hand, in low context cultures, communication tends to be explicit, and knowledge is more accessible and external; consequently, it is easier to transfer because it does not rely intensely on context. People of this culture have more interpersonal relations of shorter duration.

The second dimension of Hall's cultural model (Hall, 1966) is *space*, which is subdivided into territoriality, personal space, multisensory space, and unconscious reactions to spatial differences. Territoriality is the degree to which "ownership" is conveyed. One clear example is architecture and the extent of power that buildings transmit in different cultures. Personal space denotes the level of proximity allowed among people. It is like an imaginary bubble that encircles the individual that others are not allowed to cross. Multisensory space is the extension of the imaginary bubble to the five senses; for instance, volume of speech is tolerated differently by people from different cultures. Finally, the unconscious reaction to spatial differences indicates the meaning that can be inferred from the distance that a person keeps when conversing with others.

The third dimension of Hall's cultural model (Hall, 1966) is *time*, which is divided into *Monochronic* and *Polychronic*. Monochronic refers to the linearity in which actions are done and is the opposite of polychromic, where things and events happen simultaneously. Monochromic people are low context and need more explicit information; polychronic people are high context, and their communication is based firmly in context and is more implicit.

The fourth dimension is the *speed of message*, meaning the time it takes to interpret a message in a culture and the preference towards it. For instance, slow messages can be documentaries, poetry, and books, while fast messages can be cartoons, social media, and television commercials, among others. This dimension can influence interactions design so that it ensures that the user remembers and understands the most critical information when using technological and smart devices.

Finally, the last dimension in Hall's cultural model is *information flow*. This international variable denotes the time a message takes to reach its receiver and the action intended with it. In high context cultures, information circulates faster than in low context

cultures, which tend to be more bureaucratic and stick to previously established procedures.

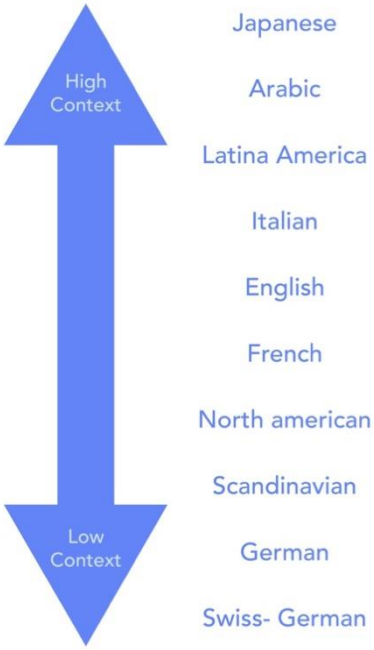

Figure 7. Context dimension of Hall's Cultural model

(Hall, Edward Twitchell, 1990)

Hofstede's cultural model (Hofstede, 2010) follows the definition of culture as "the collective programming of the mind." Hofstede proposes six cultural dimensions to explain the independent variables that distinguish one country from another: Power Distance (PDI), Individualism vs. collectivism (IDV), Masculinity vs. femininity (Mas), Uncertainty avoidance (UAI), Long term orientation vs. short term orientation (LTO), and Indulgence vs. restraint (IVR).

Power Distance (PDI) is the degree of acceptance a society's members with less power give to the unequal distribution of power and how inequalities are managed in the community. In high power cultures, people accept hierarchies without further justification, kids learn obedience from their parents, and religion has a priest. Among the countries with the highest rankings in Power Distance are Malaysia, Slovakia, Mexico, and India.

On the other hand, in low power cultures, there is a tendency to balance power, and people demand explanations for inequalities. Parents treat kids as equals, and religion focuses on the equality of the believers. Countries with the lowest level in this dimension are Austria, Israel, New Zealand, Sweden, Norway, and Finland.

Individualism vs. collectivism (IDV) refers to the extent that the members of a society identify themselves as *"we"* instead of as *"I,"* as well as the tight social framework in the community and how their actions respond to the group's needs. In collectivist societies, members are expected to take care of their family, extended family, and clan, and thus loyalty is one of the most important values for them. Some countries with a high level of collectivism are Guatemala, Indonesia, Pakistan, and Costa Rica.

In individualistic communities, the individual's opinion is expected, the self is independent of the community, and individual goals and needs prevail over collectives' ones. The United States, Australia, United Kingdom, and Canada are the countries with the highest individualist rank in the Hofstede dimensions.

Masculinity vs. femininity (Mas) denotes a society's preference toward achievement and success over cooperation, modesty, and quality of life. In masculine society, heroism is highly significant, stronger members are admired, work prevails over family, and men's responsibilities are distinguished from women's; it is rare to see women in political positions. Additionally, religion focuses on a god or gods. Slovakia, Japan, Italy, and Mexico are the countries with the highest rank on the scale of masculinity.

In contrast, feminine societies care about and sympathize with weak members, and work and personal life are balanced. For people in this type of culture, gender roles are not established, and both men and women are equal. Often, women are elected to political positions, and religion focuses on human beings. Nordic countries are at the top of the list of feminine countries.

Uncertainty avoidance (UAI) represents the degree that society tolerates risk and uncertainty. In countries with high uncertainty avoidance, risk is seen as a threat, and consequentially, people try to avoid it. These cultures struggle with innovation, and clarity and structure are expected. Greece, Portugal, Belgium, and Japan are among the countries with the highest ranks in UAI.

In contrast, societies who have low uncertainty avoidance feel comfortable with the future's ambiguity and focus on innovation and change; unorthodox ideas are welcome. Singapore, Sweden, Denmark, and China are the countries with the weakest UAI.

Long-term orientation vs. short-term orientation (LTO) refers to how societies place connections with the past versus the future. Cultures with low scores in LTO are devoted to traditions and norms, and societal transformations are viewed with distrust. For them, understanding what is right and wrong is universal, and the essential episodes of life have happened in the past or the present. They are nationalists and serving other members of society is of significant value. Egypt, Iran, Venezuela, and Canada are the countries with the lowest LTO score.

Cultures that score high in LTO have a more pragmatic attitude. They prepare and persist in the present, knowing that the results will be seen in the future; they adapt more easily to situations. For them, the concepts of good and bad are circumstantial, and they acquire knowledge from other countries instead of putting their nation as sovereign. China, South Korea, Hong Kong, and Taiwan are the countries with the highest score in LTO.

Indulgence vs. restraint (IVR) represents the level of gratification and allowance to enjoy life's pleasures versus the suppression and regulation of needs and fulfillment. Indulgence societies tend to be happier, and they perceive themselves to have higher control over their personal lives. They are less focused on moral discipline and more concentrated on relaxation. Mexico, Colombia, Sweden, and Denmark have the highest score in indulgence. On the other hand, restraint societies are less happy. They believe that what happens to them is not their own decision; they have high moral discipline, and leisure time is not a priority. Pakistan, Russia, Bangladesh, and China are the countries with the highest score in restriction.

Emotions in culture and design

Emotions are an essential part of how people process a stimulus from the environment and react to it. There is no unanimous consensus in the scientific community on what an emotion is (Izard, 2010). Nonetheless, one of the most accepted explanations is Paul Ekman's (Ekman, , p.1) definition: *"Emotions are a process, a particular kind of automatic appraisal influenced by our evolutionary and personal past, in which we sense that something important to our welfare is occurring, and a set of psychological changes and emotional behaviors begins to deal with the situation."*.

Even though there is scientific evidence (Ekman et al., 1987) for the universal facial expressions of the six basic emotions (anger, disgust, enjoyment, fear, sadness, and surprise), the social rules related to displaying emotions vary across cultures. For instance, (Markus & Kitayama, 1991) explore the variation among cultures in the experience and display of emotions based on the notion of self. Two types of definitions of self were studied, and the differences rely on the relation of the self and others, which establishes an **Interdependent** and **Independent self.** The interdependent self is connected to social context and definition of self is based on relationships with others in a particular context. People from this kind of culture tend to be more expressive, and their relationship and status are public. Contrastingly, the independent self is separate from social context. The role of others is for social comparison, and this population tends to manage their feelings and thoughts in private (Markus & Kitayama, 1991).

The definition of interdependent and independent selves can be associated with Hall's cultural dimensions (Hall, 1966) and Hofstede's cultural dimensions (Hofstede, 2010) mentioned previously. The interdependent self can be compared to Hall's high context and Hofstede's collectivism. Likewise, the independent self can be associated with the low context and individualism international variables.

Additionally, culture plays a role in shaping emotional experience: *"Emotions can be viewed as cultural and interpersonal products of naming, justifying, and persuading by people in relationship to each other. Emotional meaning is then a social rather than an individual achievement -- an emergent product of social life"* (Lutz, 1988, p.5). Thus, the display of certain types of emotions varies according to the culture. Table 1. Display of emotion based on the type of self presents the differences associated with the display and experience of emotions concerning the category of self and the social rules associated with it.

Let us consider that emotions influence every sphere of life, including how humans perceive, learn, think, and interact with other humans and technological devices. Additionally, people infer others' emotional states because affective states cannot be observed in a straight line by another person (Picard, 1997).

As stated by (Hanington, 2017, p.165) *"Our emotional state can affect how we focus attention and expectations, with obvious ramifications for how we process information and interact with products, systems, or other people".* Likewise, (Goodrich & Schultz, 2007; Mavridis, 2015) consider emotional capabilities crucial for fruitful interaction between social robots and humans. And thus, the analysis, consideration, and develop-

ment of proper output modalities for users' emotions is a must when designing human-technology interactions.

Table 1. Display of emotion based on the type of self

(Markus & Kitayama, 1991)

Type of emotion	Definition	Display and experience by interdependent self	Display and experience by independent self
Ego-focused emotions	Individual's inner characteristics are the principal reference. Emotions such as fury, blocking, immodesty Anger, frustration, and pride. (own needs, objectives, longing, or capabilities)	It is not socially acceptable to express internal affective states.	More frequently expressed and perhaps experienced.
Other-focused emotions	Preference for other's emotional states as the central referent instead of personal feelings. Namely sympathy, feelings of interpersonal communion, and embarrassment.	These emotions allow the people from this culture to work properly inside the community. They need to be "experts" in expressing and experiencing these emotions.	These emotions are tolerated but not encouraged, since they inhibit the ego-focused emotions and might lead to ambivalence.

To date, several studies have investigated a robot's ability to express affects and be effectively recognized by the user to create a more enjoyable interaction (Beer, Smarr, Fisk, & Rogers, 2015). In the 1990s, a related conversation on the expression of emotion was already occurring. On the one hand, (Picard, 1997) developed design criteria for computers to express affects in order to create pleasant and efficient interactions. On the other hand, Joseph Bates (Bates, 1994) discussed the practices and learning from the animation and art world on how the correct display of emotions supports believable agents' development. Both guidelines are summarized in Figure 8 and will be used as a basis for this work's final design implications.

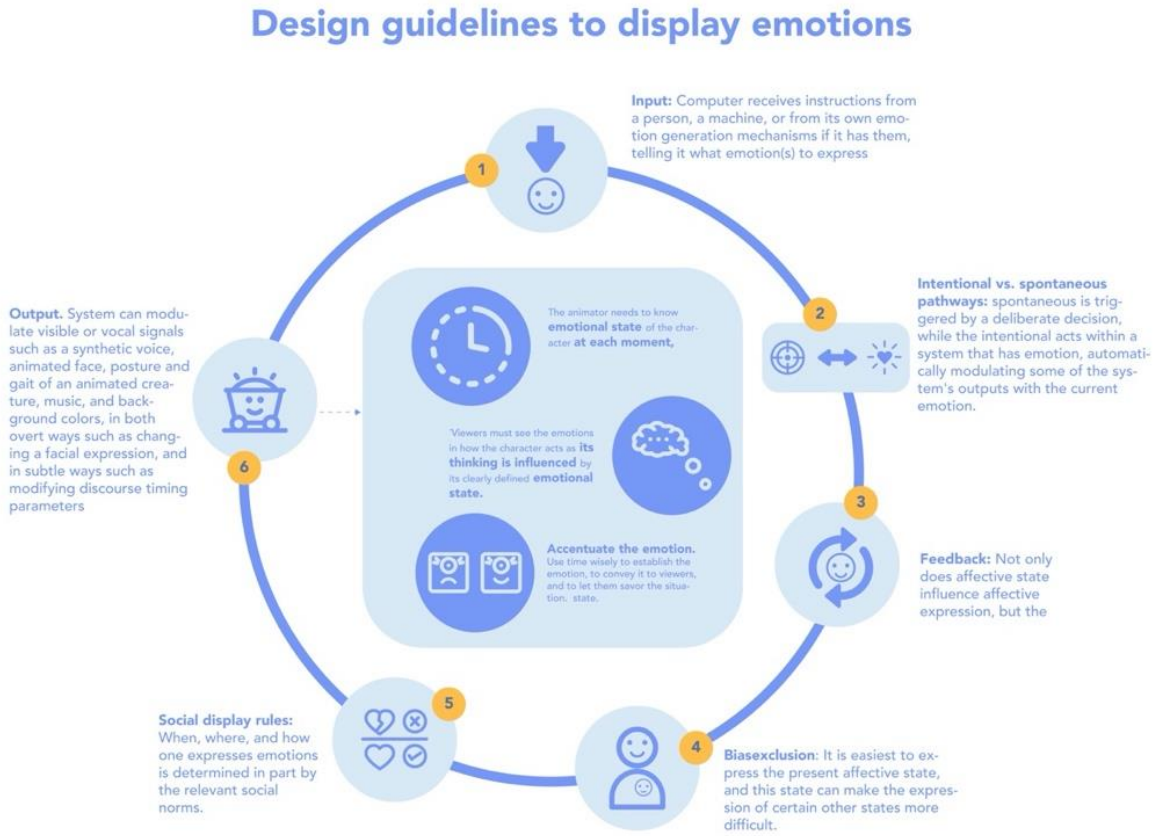

Figure 8. Summary of the design guidelines for social robots' display of emotions

Inner square (Bates, 1994), Outer circle (Picard, 1997)

2.2 Immigrants as target users

Migration is a serious issue and global challenge faced by our generation. According to the UN Refugee agency, 1% of the world's population has been forcibly displaced (UNHCR, 2020). War, climate change, and lack of employment, among other factors, force people to leave their home countries to look for better lives elsewhere.

At a local level, at the end of 2015, the official number of foreigners living in Finland was 339,925 people, which is about 6% of the total population (Saukkonen, 2016). Arab countries have become the most prominent cultural group of people moving to Finland in the last ten years (Figure 9). Additionally, in 2019, Arabic was the third most spoken foreign language in Finland after Russian and Estonian, with 31,920 native Arabic-speaking persons residing in Finland (Statistics Finland, 2019). The relevance of Arab culture in Finland is undeniable. Additionally, the huge cultural gap between Arab and Western culture and the few studies done on social robotics with Arab users are the reason why this work is focused on this specific cultural group.

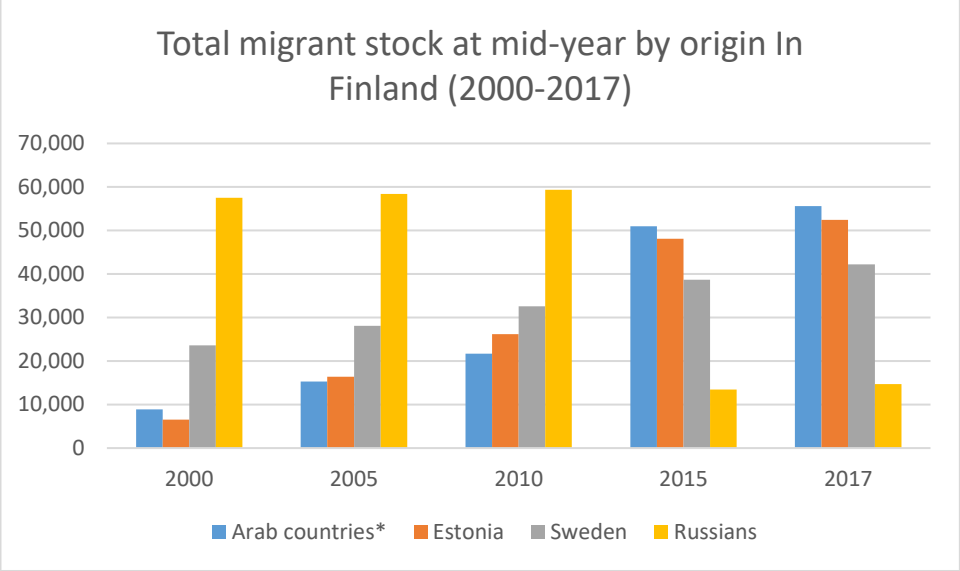

Figure 9. Total migrant stock at mid-year by origin in Finland (2000-2017)

(United Nations Department of Economic and Social Affairs, 2017)

*(Arab countries: Algeria, Bahrain, Comoros, Djibouti, Egypt, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, the United Arab Emirates, and Yemen)

Arab culture from Cross-cultural studies

As previously stated, the Arab population is a relevant minority in Finland. This subsection aims to understand Arab culture in light of the literature from cross-cultural studies and highlight its most important aspects. The findings exposed in this subsection, combined with the pre-study results 4.4, are the basis for the cultural persona (5).

Shared history, language, and traditions make 400 million Arabs from western Asia to North Africa a pan-ethnic cultural group (San Martin et al., 2018). Arabs have assumptions that differ significantly from Westerners and specifically from Finns (Figure 10). The most relevant characteristics will be described in the following section. They were selected by the author of this work based on their relation to the final outcome.

First of all, it is relevant to stress the influence of historical aspects, such as the harsh conditions in the desert where Arab civilization was established. Those led to a cultural adaptation to high population densities, which is still visible today in modern Arab cities. These factors might explain patterns of behavior, for instance, proximity levels, the concept of privacy, and the understanding of the body and the liberties linked with it.

These notions are incredibly different from Northern European countries: *"For the Arabs, the location of the person in relation of the body is quite different. The person exists somewhere down inside the body"* (Hall, 1990, p 157). For instance, while an Arab is allowed to touch or push someone in a public environment, for a Finn, touching a stranger is a violation of personal space. This norm is possibly one of the most challenging aspects of the cultural adaptation process for an Arab when arriving in a Nordic country.

The intense living conditions in pre-Islamic times, which were required to ensure the survival of the kin-based, partially nomadic tribal groups called Bedouins, created a close, tight relationship among members. In the words of (Hofstede et al., 2010) they are a collectivist culture. Interestingly, one quality that differentiates Arab communities from other collectivist cultures like the Chinese is self-assertiveness, which is also present in Western societies. (San Martin et al., 2018) explained that pre-Islamic living conditions were not just harsh but dangerous. This created a culture of honor where men's reputations were based on displays of honor and taking care of the group, which developed as a survival and protection strategy (Richard, 2018). Recent research (Maitner, Mackie, Pauketat, & Smith, 2017) shows that honor still has high value for Arabs today.

On the other hand, Arab cultures are classified as a high context (Figure 7), which means they use a communication style based in context. They use implicit cues to deliver a complex message. Similarly, Arabs are part of the group of multi-active culture countries (Figure 6) categorized by (Lewis, 2006) This means that Arabs typically do multiple things at the same time, displays of feeling are typical, and the body is a tool of expression and speech.

Finally, two essential qualities that differentiate Arabs from Finns (Figure 10) are 1) power distance, or the degree of the acceptance of unequal distribution of power 2) a high masculinity dimension score, meaning an unequal distribution of gender roles in society and a focus on success and competition. Both dimensions influence the perception Arabs may have of their social status and of changes in their country and in Finland.

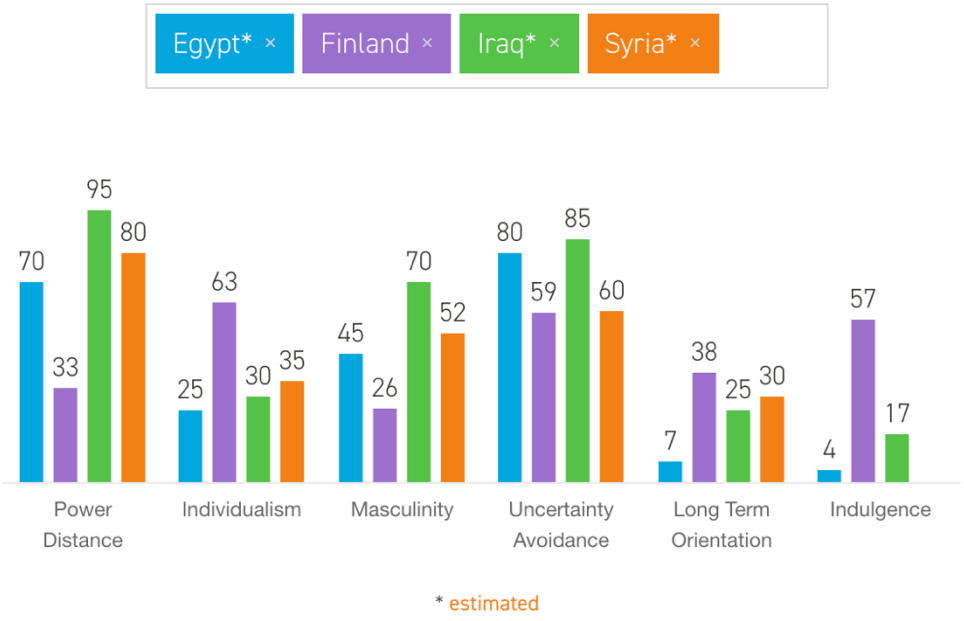

Figure 10. Hofstede Country comparison tool between Egypt, Finland, Iraq and Syria

(Hofstede, Geert, 2020) (The selection of the Arabic countries for the comparison tool is based on the most common population of Arabs that lives in Finland.)

2.3 Social robots

A social robot is an intelligent agent designed to elicit meaningful social interactions from people (Lee, Jung, Kim, & Kim, 2006), beyond the pragmatic use of other kinds of machines. The application of social robots varies according to the context of use, namely schools, hospitals, restaurants, and airports, among others (Saunderson & Nejat, 2019) and the type of user that is going to interact with it.

The increasing rate of social robots in everyday life has required developers to start designing embodied conversational agents that can adapt to their users. However, at the moment, adaptation by social robots to users is based mostly on user behavior and preferences: *"There is very little attention dedicated to adapting systems to a user beyond the general usage of personal and behavioral data. However, characterizing users on a deeper, psychological level can yield unprecedented satisfaction and acceptance levels. Psychological measures on the user can include, for instance, their personality or their emotional state"*(Martins et al., 2019, p.193). Thus, a robot needs longer interactions to learn from its users in order to adapt to them using artificial intelligence algorithms. Likewise, a lack of emotional and cultural understanding from the robot decreases the possibilities of adaptation and the design of social behaviors that mimic standard social rules among humans.

Some robots are developed for particular contexts that require extra consideration, such as when the target group is a vulnerable population, such as the elderly or immigrants. In the case of elderly adults, plenty of researchers have studied social robots' interactions with them (Kolstad, 2019; Lane et al., 2016; Mcglynn, Kemple, Mitzner, King, & Rogers, 2014) in contrast to the few studies on social robots for immigrants as a target group. Nonetheless, the need to study and develop technological solutions that help immigrants adapt to their new countries is pressing, since migration is one of the most crucial global challenges our generation faces.

Cultural robotics

Culture plays a crucial role in a robot's embodiment design, its adaptation levels to a person, and the form in which a person perceives the robot and interacts with it (Šabanović, 2010).

Regarding people's perception towards social robots, (Wang, Rau, Evers, Robinson, & Hinds, 2010) found that robots that follow cultural patterns are more likely to be trusted and listened to. Furthermore, (Salem et al., 2014) discovered that politeness strategies influence Arab participants, who perceived the robot as more anthropomorphized and thought of it more positively than English participants. Similarly, (MacDorman, Vasudevan, & Ho, 2009) found that aspects like history and religion influence the eagerness to embrace robots. For instance, in Japan, robots and nonhuman entities do not represent a threat to the individual's sense of human identity, as might happen in the West. Therefore, there is a greater acceptance of artificial artifacts like robots than in cultures where religions define the essence of individuals and create boundaries towards technologies that defy the sense of what it is to be a human being.

In terms of behavioral design, a further study was conducted (Sanoubari & Young, 2018) to evaluate the use of explicit, neutral, or implicit behavior in a Nao robot taking care of senior users. The experiment compared participants' perceptions from a collectivist country (India) and an individualist country (United States). The results revealed that participants preferred the robot choices that aligned with the culture. Nevertheless, the culturally adapted behavior designed for the robots of this experiment relied on verbal communication. It was the content of the conversation that was implicit, explicit, or neutral. Thus, the use of gestures for the display of emotions was not evaluated. *There is no clear conclusion as to whether participants prefer a specific type of emotional demonstration related to their culture*.

Furthermore, other aspects of behavior have been explored in more detail, leading to more specific design guidelines. For instance, (Eresha, Häring, Lugrin, Andre, & Obaid, 2013) conducted a study that confirms the differences in interpersonal distance between Arabic and German cultures. The study found that German participants placed themselves at a further distance from the robot than Arabs. Likewise, (Joosse et al., 2014) developed a similar study in proxemics and cultural differences, with Chinese, Argentinian, and American participants. As in previous studies, people from high context cultures like the Chinese approached closer to the robots than people from low context cultures like the United States. Furthermore, (Aguiar Noury, Bradwell, Thill, & Jones, 2019) found that aspects like the robot's accent in speech interaction have significant relevance for the user's experience with the robot. (Andrist, Ziadee, Boukaram, Mutlu, & Sakr, 2015) discovered that for Arab cultures, rhetorical linguistic cues in speech are more effective in terms of robot credibility than for English speakers.

Another relevant example is the study *"which country are you from"* (Shidujaman & Mi, 02 June 2018), in which it was found that users had higher valence when the robot performed greeting gestures native to their countries.

Finally, an essential finding for this research is the Cultural Knowledge Base created by (Bruno et al., 2019). It outlines the elements for designing a culturally aware robot that aims to be a social assistance robot. This framework (Figure 11) was the basis for the pre-study analysis structure and the later development of the Cultural persona. (Bruno et al., 2019) explained how a CKB (Cultural Knowledge Base) needs a structured ontology, which is comprised of the following: goals, objectives that are relevant for a specific culture (meditation, praying); actions and social cues that match cultural standards (proximity, volume of speech); cultural norms (the robot can only be in specific spaces at a particular time); environment (furniture); and topics of conversation (food).

(Bruno et al., 2019) also developed three categories for the CKB at a cultural and personal level: culture-generic knowledge, culture-specific knowledge, and person-specific knowledge.

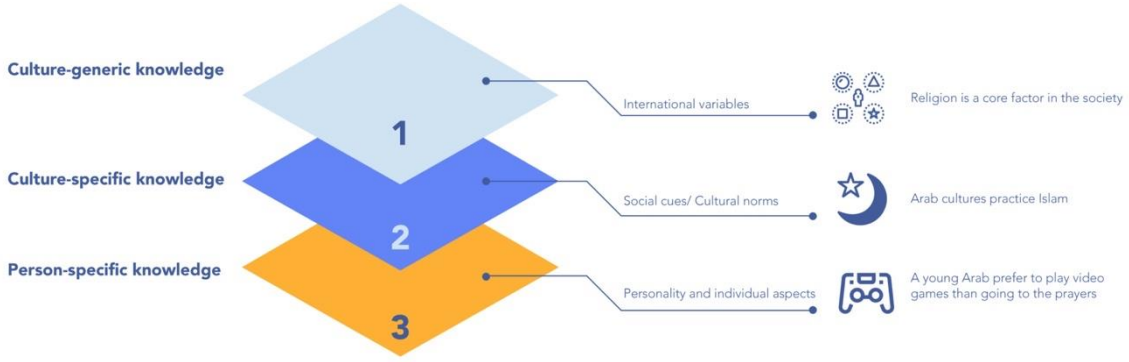

Figure 11. Example of the Cultural Knowledge Base

Based on the framework of (Bruno et al., 2019)

Culture-generic knowledge refers to the general features and motivations of culture, such as attitudes regarding goals, environment, and rules. Culture-specific knowledge denotes specific cultural facts at the ethnic or national level, such as customs, celebrations, and rituals. Person-specific knowledge indicates the unique personality traits that are independent to a person and are not attached to culture. Information in this category is especially important for avoiding the reinforcement of bias and stereotypes.

Social robots and immigrants

Due to the urgency of immigrants' situation and given how technologies such as social robotics have been used to help other vulnerable populations, researchers have started to use this approach to help refugees and newcomers to a country.

Gee robot (Simo et al., 2018) aims to be a robot assistant that helps refugees that have arrived in a host country. The robot answers questions regarding immigration status, everyday life, and cultural misunderstandings. Nevertheless, Gee is not intended to adapt its behavior to the culture or emotions of the family.

Other examples that focus on immigrants as a target population and their language learning needs are, for instance, (Kim, 2016), in which they developed a robot to create equitable friendship and collaboration when facing difficulties with culturally and linguistically diverse learners (CLD) in a primary school in the United States. There is also the case developed by (Carolis et al., 2019) taught immigrants' children related cultural gestures to support their integration in their new country. However, social robots did not adapt their behavior based on the target user's culture in any of these cases. Therefore, there is a vital need for a culturally competent robot when working with immigrants.

Affective Social robots

The presence of emotions in systems and technological devices is an interdisciplinary field known as affective computing, which involves computer science, psychology, and cognitive science. As Tao and Tan (Tao & Tan, 2005, p.981) explained, *"Affective computing is trying to assign computers the human-like capabilities of observation, interpretation, and generation of affect features."*

While the field of affective computing goes beyond robotics, and its complexity is out of the scope of this research work, it is relevant to highlight the importance of the robot's ability to express affects and be effectively recognized by the user to create a more enjoyable interaction (Beer et al., 2015). Joseph Bates discussed the learning gleaned from the animation and art world on how the correct display of emotions supports believable agents' development: *"Emotion is one of the primary means to achieve this believability, this illusion of life because it helps us know that characters really care about what happens in the world, that they truly have desires."* (Bates, 1994, p.6).

An interesting case of use of this technology is the survey conducted in 2017 on social robotics, which used affective computing to measure the engagement of autistic children, while still considering cultural differences. The study used outward behavioral characteristics and proposed that future works use robots as a tool to *"enable naturalistic interaction with the children by being able to automatically estimate their level of engagement and respond to it accordingly"* (Rudovic, Lee, Mascarell-Maricic, Schuller, & Picard, 2017, P. 12).

The possibilities of affective computing and the benefits it can bring to HRI are still under development. Martin, Santos and Diaz explained in a survey of adaptive robots (Martins et al., 2019, p.193), *"Very few of the works surveyed take into account the user's personality or emotional state, but those that do achieve positive results."* The final design implications of this work consider users' emotional expressions and responses as part of the robot's behavior to gain credibility with the target users and increase the naturalness of the interaction.

2.4 Key findings in light of the related work.

Combining the insights found in the related work created a solid base for developing design implications of a culturally aware robot. Hence, this research supports and complements the existing literature around social robots that aim to assist immigrants adapting to a new country.

The Cross-cultural design section highlighted the most relevant aspects of this field of study, including the metamodels of culture and cultural models that are used to compare and understand the differences between nations. These are well-accepted methods used to design culturally aware social robots. These models are used along with the research and support the evidence found in the pre-study. Additionally, this subsection includes a review of the differences in the display and experience of emotions between cultures.

The subsequent section, Immigrants as target users, described the current situation of immigrants globally and locally as a global crisis that needs multiple solutions from different fields, including social robotics. The numbers included there explain the relevance of focusing on the Arab population as the most significant cultural group in Finland, where this work is being developed. Once the culture was selected, this section was complemented by an understanding of users' culture from the cultural models mentioned previously. This data is a significant part of this work's final outcome, since the culture is used to create design implications and customize the user experience to the specific population group.

The last section, Social robots, highlighted how social robots are currently used and focused on the importance of cultural adaptation, affective behavior, and current solutions that focus on immigrants. This section used the Cultural Knowledge Base (Figure 10), which is the main basis for the pre-study structure and a basis for the cultural persona, making it another valuable finding from cross-cultural design-related work.

3 Research process and methodology

The work presented here is qualitative and explorative (Figure 12). It is based first in human-centered design principles, which put the user at the center of the process (*Ergonomics of human-system interaction. part 210, human-centred design for interactive systems (ISO 9241-210:2010)*2010).

According to the ISO 9241-210, six specific guidelines must be followed when using human-centered design: 1) use of multidisciplinary perspectives and skills; 2) a profound understanding of the user, task, and environment; 3) user-centered evaluations that guide and define/modify the proposed designs; 4) regard for the user's experiences of the system; 5) involvement of the user in the research, design, and development process; and 6) an iterative process guided by users' feedback. These principles were actively considered in the whole process.

Along with human-centered design, this work has a Constructive Design Research approach (Koskinen & Koskinen, 2011), which focuses on construct concepts and prototypes. This method is future-oriented and allows designers to go beyond existing technological limitations by using tools like scenarios where users can put themselves in an imaginary situation to validate the concept that the research team is evaluating.

The process started with **literature research** to find the research gaps and start formulating the research questions. We found the **Cultural Knowledge Base (CKB) framework** (Bruno et al., 2019), which served to structure the interviews and **content analysis** for the pre-study.

To obtain responses to the **RQ1** and **RQ2,** we conducted a **pre-study,** where we interviewed seven target users and did a robot demonstration to gather data about preliminary attitudes towards social robots. We analyzed the knowledge gathered using the methodology of content analysis, following the Cultural Knowledge Base.

We developed a **cultural persona** using the pre-study findings and scientific literature. The cultural persona was the primary reference for the **RQ1** and **RQ2** and guidance for the design process. After that, we proposed three scenarios, following the Constructive Design Research method. The scenarios were based on the pre-study findings and were followed by the robot's implementation. Once we did **the implementation**, we tested the scenarios with five target users in the **design evaluations**. The design evaluation used mostly **qualitative methods,** such as semi-structured interviews, and **quantitative methods**, such as validated questionnaires, NARS, and Godspeed questionnaires. We

conducted another **content analysis** and included more literature research to formulate the **design implications** in response to the **RQ3**, the main deliverable of this work. Finally, discussions, conclusions, and further work were written.

This research work is of a sensitive nature due to the target group and their condition as immigrants. Thus, we addressed the ethical considerations regarding participants' involvement in the studies. To collect participants, we created an open call in Facebook groups for foreigners in Tampere. The selection criteria were that they should come from an Arab country and speak English. As compensation, we offered them a 10€ gift card. In both pre-study and design evaluations, we asked for written consent for participation. We reinforced the voluntary nature of the study and highlighted the possible sensitive aspects that might arise when talking about their experiences as immigrants. Additionally, we asked for background questionnaires and permission to record the interviews and the interactions with the robot. The data was completely anonymized and saved in Tampere University's servers.

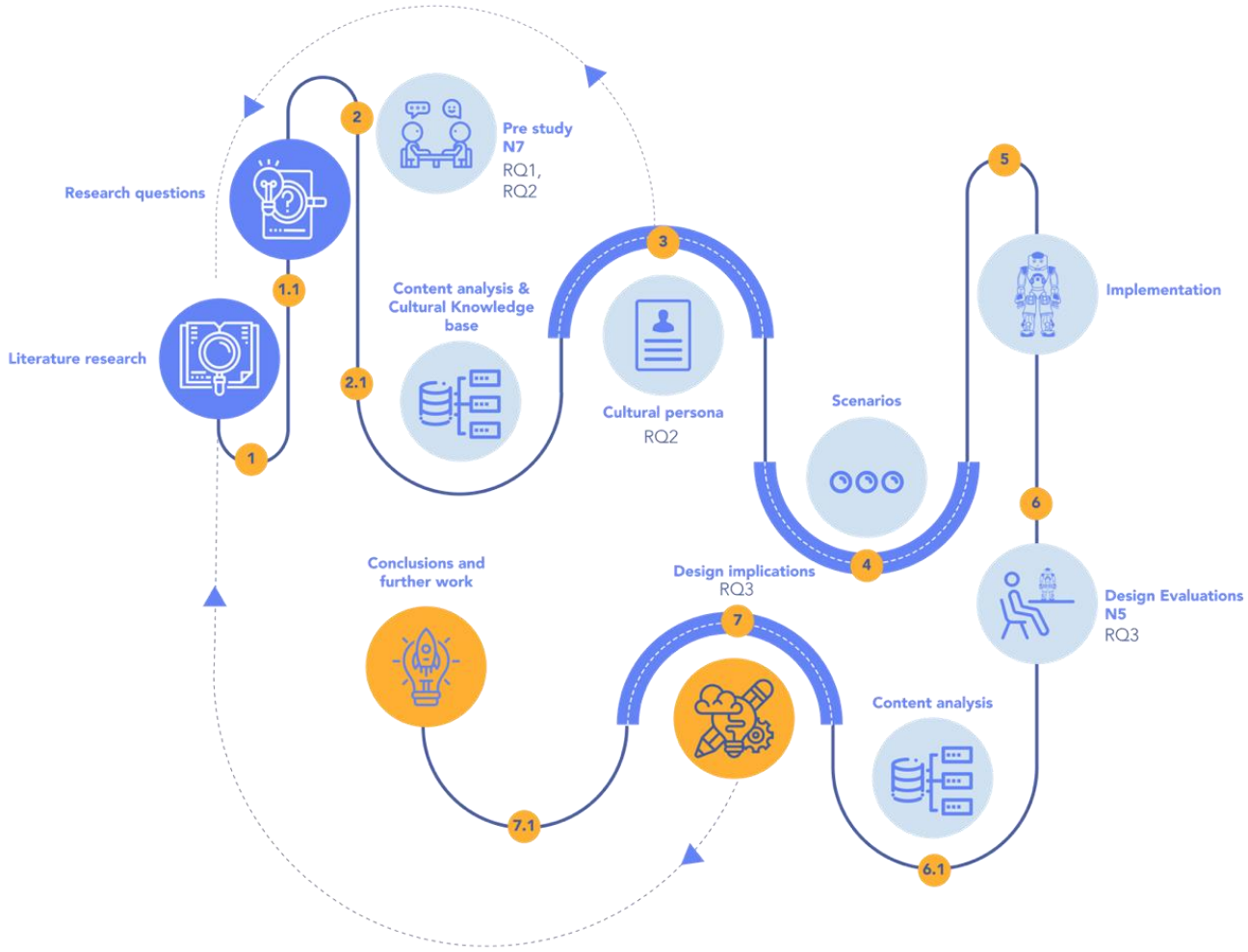

Figure 12. General view of the methods and process of the thesis.

4 Pre-study

4.1 Goals of the pre-study

Following a human-centered approach, the general goal of the pre-study was to gather qualitative data to develop a Cultural Knowledge Base, as was explained in section 2, Related work. The user needs, behaviors, and input from the target group were the most important outcome. These were the main source for the Arab countries Cultural Persona, subsection 5.2, and contributed to generation of the Scenario in section 6.

4.2 Methods and Procedure

The pre-study consisted of a 20-minute individual session in which a semi-structured interview was conducted. Additionally, to determine general attitudes towards social robots, we ran a demo of the robot with participants of the target group.

The semi-structured interviews were conducted with four males with a mean age of 29 and three females with a mean age of 25. A 10€ gift-card was offered as a reward for participation. The Cultural Knowledge Base framework by (Bruno et al., 2019), as explained previously in the Related work section, was used as a reference to elaborate on the questions *Semi-structured interview pre- study*. For instance, we asked the participants: What aspect characterizes your culture the most? What are the people like? Can you tell me about a difference between your culture and Finnish culture?

From the CKB, the following categories were taken: person-specific knowledge, culture-generic knowledge, and culture-specific knowledge. A technology category was added to answer the **RQ1** and **RQ2**.

The demo of the robot consisted of a one-minute robot-researcher interaction. It was a simple interactive dialogue in which the robot greets the researcher and, after introducing himself, asks the researcher if s/he wants to see it sitting down and playing a saxophone. Then, the robot says goodbye. After the demo, participants were asked questions regarding their perception of the robot.

The interviews were transcribed to perform *content analysis*, a systematic text analysis method (Mayring, 2000) that allows for gathering inferences from text (a variety of sources, in which transcription is included) to scrutinize and cluster data. Figure 13 demonstrates the steps of a content analysis. This method starts with the research questions that will be answered in the content analysis, followed by the definition of the main content categories where data is classified, and the description of these categories. Examples or participants' quotes are included, as well as coding rules for these catego-

ries. Coding rules are the criteria used to select a determinate piece of information from the transcriptions for the categories in the content analysis. Finally, this method ends with the interpretation of results, which is writing about the findings that is supported with quantitative results.

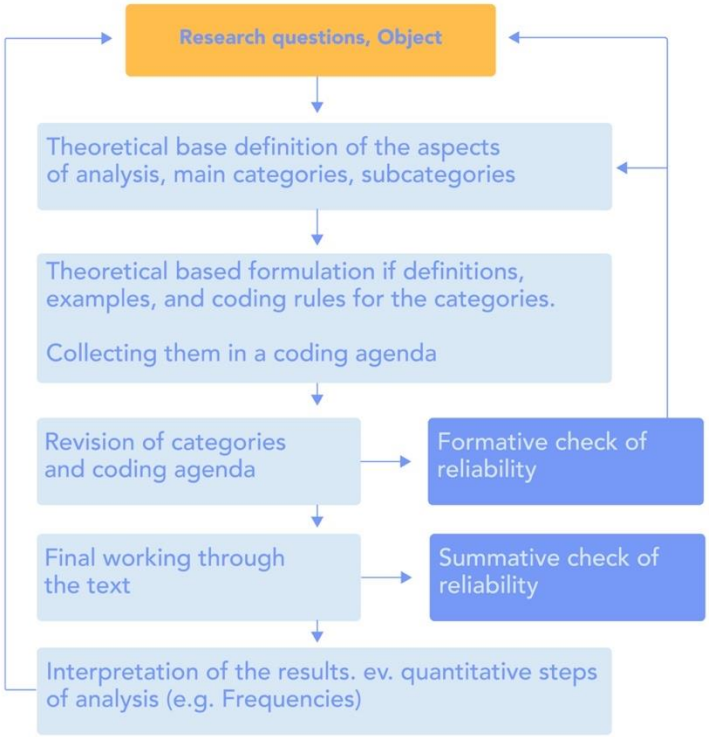

Figure 13. Content analysis model

(Mayring, 2000)

4.3 Participants

To recruit participants, an open search that targeted Arab immigrants who speak English was done using Facebook groups for immigrants in Tampere.

All the participants (Table 2) are the same ethnicity, Arab. As was explained in the sub-section, Target group, in the related work, Arab countries share similar characteristics for behavior, social norms, values, and multiple cultural dimensions.

Table 2. Participant of the Pre-Study

Participant number	**Nationality**	**Ethnicity**	**Age**	**Gender**	**Occupation**	**Previous interaction with a robot**
1	Tunisia	Arab	23	Female	Student	Yes (Pepper)
2	Egypt	Arab	29	Female	Unemployed	No
3	Iraq	Arab	31	Male	Student	Yes (Pepper)
4	Iraq	Arab	29	Male	Student	No
5	Egypt	Arab	27	Male	Software developer	Yes
6	Egypt	Arab	27	Male	Student	No
7	Jordan	Arab	23	Female	Student	No

4.4 Findings

As a result of the content analysis conducted from the pre-study interviews, five categories were developed (Table 3): person-specific knowledge, culture-generic knowledge, culture-specific knowledge, adaptation process, and perception towards robots.

Person-specific knowledge refers to the unique preferences of a participant as an individual. This category is fundamental for avoiding stereotypes. The goal was to explore the extent to which participants have preferences that are attached to their culture or not and can be used as a topic of conversation for the robot in the scenarios proposed. Culture-generic knowledge is information related to people's general characterization, social behavior, societal structure, norms, values, and manners. This information is valuable for building the robot's personality and general attitudes for interacting with the participants. Culture-specific knowledge refers to specific rituals, practices, and traditions. The data gathered in this category is used to give contextual information to the robot and increase cultural awareness when participants mention specific aspects of their culture. The fourth category, adaptation process, aims to address the most relevant needs and aspects when adapting to the host country. From here, relevant needs were detected, which were used to develop the scenarios. Finally, the perception towards robots ex-

plains the attitudes towards and perspectives on social robots and potential uses of the robot to support immigrants and refugees.

Table 3. Categories and subcategories of the content analysis, based on the Cultural Knowledge Base.

Category	**Subcategories**
Person-specific Knowledge	• Food preferences related to culture • Food preferences not related to culture • General hobbies
Culture-generic Knowledge	• Helpfulness and generosity • Religious practices • Funny • Characteristics of communication • High level of social interaction • Social structure • Physical touch greetings
Culture-specific Knowledge	• Rituals based on religion • International rituals celebrated
Adaptation process	• Weather • Issues with the language • Community and social interaction • Residence permit • Technology
Perception toward robots	• Positive • Negative • Robots and immigrants

Person-specific knowledge

As mentioned before, this section of the questionnaire required respondents to give information on personal preferences to avoid stereotypes. In the questionnaire, the person-specific questions were used as an icebreaker with the participants, and in the research work, it was used to build the cultural persona.

Here, four out of seven participants chose a dish from their culture of origin as their favorite food, for instance: *"The national food couscous."* Three out of seven participants mentioned dishes without a specific culture: *"Chicken, any way of cooking it, and potatoes."* Concerning hobbies, seven participants mentioned hobbies that are not culturally specific, namely: *"I read a book or play video games."*

These findings evince how every person makes individual choices independent of their culture, which is supported by the Pyramid Model (Hofstede et al., 2010) (Figure 5) in which the highest level of the pyramid is the personality. In conclusion, for the final design implications, this category of knowledge should be coded into the robot for use with a specific user, so the robot can have the ability to recognize the user; otherwise, this data cannot be used in the interaction. Nonetheless, the person-specific knowledge, as in this case, food, should be combined with data from culture-generic knowledge. For instance, the Islamic religion prohibits pork consumption because of its relation to impurity. Hence, social robots, as well as humans, should avoid topics regarding matters that are against the values of the culture, unless the user has explicitly mentioned otherwise.

Culture-generic knowledge

A common view amongst interviewees was that they define their people as social; seven out of seven participants agreed in this aspect. For them, it is easy to make new friends and talk with strangers on the street. For instance, one participant mentioned: *"It is easier to make friends in my country."* Likewise, they are used to gathering with friends, family, and extended family to share food in a communal setting. This aspect matches the findings of the Hofstede Insights tool (Hofstede, 2020). It explained that Egypt, Iraq, Jordan, and Tunisia are considered collectivist societies, scoring 25, 30, 30, and 40 respectively on the individualism scale. A more in-depth explanation of this dimension can be found in subsection 2.3, Cross-cultural design.

Interviewees also mentioned that they are funny; three out of seven interviewees mentioned that they tell many jokes: "*They call us funny; we tell a lot of jokes."* Similarly, they affirmed that they are loud and rely on hand gestures when they talk. Physical touch is common for them. What stands out in the content analysis is the way people greet each other. All the participants agreed that kissing, handshaking, and hugging are common behaviors in their culture. Therefore, physical interaction is an essential facet for them. Participant 4 commented, *"We shake hands, and we kiss; it's normal."* Even though gestures are gender-specific, men with men and women with women, participants agreed that they would shake hands with a robot no matter the gender. Furthermore, a recurring theme in the interviews was the sense that they are helpful and generous. All seven participants expressed opinions like, "*In our country, people care a lot, even if they don't know you*" and *"you don't need to ask for help; it's somehow offered*." This aspect was recognized as one of the things they miss the most about their culture.

Finally, in terms of societal structure, seven out of seven participants expressed that their culture is conservative and guided by religion; this was exemplified when a participant said, "*The religion guides us."* Multiple social rules, conduct norms, values, perceptions of reality, and expectations about life are framed as religious doctrines. Additionally, tradition and history are at the center of their culture. Participants explained that hierarchies are extremely important for them; for instance, one participant mentioned, *"We have these hierarchies. The more you go up, the more powerful and more powerful you get, and you can dictate what people will do in a way."*

This category's results were used as part of the development of the Cultural persona and for the robot's design behavior in the Design implications.

Culture-specific knowledge

One of the most significant findings in this section was that religion is a crucial aspect of Arab culture, specifically Islamic faith for this study population. While some of the participants are not strict about religious practices, all of them agreed when talking about rituals and festivities.

As was previously explained in the subsection Cultural Models, rituals are a specific part of a culture. For Arab culture, the most crucial celebration is *"Eid,"* which is the festival at the end of *"Ramadan."* Seven out of seven participants indicated this was a common practice for them and the most important celebration of the year; for example, one participant said, *"We have this month called Ramadan, which is like the special month of the year where everyone is fasting. It's more like a ritual thing."*

Ramadan is the name of a month in the Islamic calendar. During this month, Muslims fast during the day, and the month ends with the Eid festival, where they break their fast. Eid is considered a religious holiday for Muslims. It can be from one to three days, and people gather, eat, and pray together. Even though the celebration's specificities vary among countries, the ritual was recognized and practiced by most participants. Some of them even said that they would like to have this holiday off while living abroad. Two other essential celebrations that were highlighted in the interviews were Easter and Christmas. Six out of seven participants mentioned the celebration of these rituals. Easter was mentioned as a festivity with origins in the Islamic religion that continues today. Christmas, for them, is something that does not belong to their faith. Still, many of them accept or even celebrate it because, in their countries, there are Christian communities: *"We celebrate Christmas even though we are not Christians."*

Other rituals and practices that were highlighted by fewer participants were football, *"football, the proper football, like in Latin America, the one where they use their feet,"* and the difference of Western weddings from weddings in their culture.

Adaptation process

Five broad themes emerged from the analysis of this category: community and social interaction, issues with the language, technology use, the wait for residence permits, and the weather.

Firstly, the community and social interaction findings matched the results of the last category, culture-generic knowledge. It was found that the target group describes themselves as social. Seven out of seven participants mentioned that one of the things that they miss the most and could help accelerate the adaptation process is social contact, gatherings, and events where it is easy to meet new people. For instance, one participant expressed, "*There was this community of people from my own country and city even, so that helped a lot, for them to, like, mask whatever challenges are coming and help."* Likewise, they mentioned how difficult it is to socialize with Finns: *" Finns are not social people."* As explained in the subsection Arab culture from Cross-cultural studies, Figure 9 shows the difference in the individualism dimension. Finland scored 63, making it an individualistic country where individual boundaries are very established and there is no tight connection within the community (Hofstede, 2020). The lack of socializing and contact with locals affects one of the basic human needs, "belonging," which refers to the necessity of social connection. This aspect could potentially lead to loneliness, depression, and anxiety (Maslow, 1999). Thus, socializing is one of the most relevant discoveries and a key to creating the scenarios in section 6.

Secondly, all of the seven participants expressed difficulties in learning the local language. Beyond the typical complexity of learning a new language and the barrier of contrasting grammar styles, the participants mentioned how hard it was to find people or places to practice: "*If you're practicing language with people who just learned it, they don't apply it. For me, applying it was the most difficult part."* Again, the difficulties of socializing with locals make it harder for them to find people to practice the local language with them. This result was also used as a basis for the development of the scenarios, mainly since a large and growing body of literature has investigated the topic of robot-assisted language learning (RALL) (Ahtinen & Kaipainen, 08 April 2020).

Thirdly, in terms of the use of technology in the adaptation process, a gap was found for more comprehensive solutions. Five out of seven participants mentioned using Google

Maps and Google Translate to adapt to their new country. These mobile-based applications work for the functional aspects of the user's needs, but they are not designed to solve needs like social isolation or language practice.

Finally, the weather, which was mentioned by a few participants, represents a complex challenge in the adaptation process. Two out of seven participants expressed concerns over the contrast of the weather and temperature in their home countries with the weather and temperature in Finland: *"I came from the Middle East with temperatures of 35-40 and came here to temperatures of minus 25-20. It's a little difficult, and the darkness too."* However, it is beyond the scope of this work to provide support regarding the weather, and thus it is not considered in the development of the scenarios.

Perception towards social robots

This category covers participants' attitudes towards the robot. Of the seven participants, three expressed a positive attitude, three had negative feelings, and one was neutral towards robots.

The novelty effect plays an important role here in the positive attitudes, since just three of them had interacted previously with a robot for a short period. For the other four, it was their first time interacting directly with a robot. Participants mentioned, *"I am impressed by the movements" and "Amazing, I mean the dancing and the music."*

The most surprising aspect of the data was regarding the applications of the social robot for helping immigrants. When the question *"How do you think a robot could be helpful in the adaptation process of an immigrant if it understands the culture of the person?",* a participant replied, "*From the robot, it would be really, like, cool, like better you know, because it's like a robot and it's telling me this and it would be fun. It would be accepted directly."* This comment suggests that people would be more willing to accept recommendations from a robot, as a machine, than advice from a person. Nonetheless, the myth that people automatically embrace computers as credible agents was proved false when Fogg et al. in 1999 (Fogg & Tseng, 1999) explained that computers are not perceived as more believable than humans. Nonetheless, not every culture perceives and accepts social robots in the same way. For instance, (Mavridis et al., 2011) discovered that participants from the Middle East are willing to accept assistance from human-like robots. However, in the health care context, they respond negatively when asked about receiving treatments or instructions. Thus, acceptance and credibility are context dependent. Additionally, participants suggested the use of the robot as a shopping assistant

or language partner. These last two insights were considered in the development of the Scenarios.

On the other hand, even though most of them felt generally positive about social robots, three participants expressed concerns regarding robots. Two participants commented on the behaviors and functionality of the robot, for instance, the gaze: *"But I am afraid of it, not afraid, but because of the movies we watch, I don't feel comfortable that he is looking at me, only a little bit."* One participant articulated worry about ethical aspects, such as replacing humans with robots: *"I was afraid that the next level would be that, instead of interacting with other humans, a Finn would just send me a robot that I would have to deal with, and that would be even more undermining."* This result will be discussed further in section 9.3, Ethical considerations.

It is relevant to mention that a more in-depth test to understand perceptions of robots was done in the Design evaluations.

4.5 Summary of the pre-study

Overall, the pre-study results allow for a comprehensive understanding of the target group, which complements the literature's findings on Arab culture from the Cross-cultural studies section. Firstly, in terms of general aspects of Arab culture, it was found that they are helpful and generous. As a collectivist culture, they take care of their community, and gatherings are part of their social agenda. Religion is a crucial facet and indicates many of the rules they follow and values they hold. They are loud and talkative, and they are used to physical touch as part of greetings. Secondly, in terms of specific aspects of their culture, Ramadan and Eid are the most important celebrations for them, as well as Easter and sometimes Christmas, even if it is a Christian celebration.

Thirdly, as for person-specific knowledge, the results were not clear enough to establish their preferences for food or hobbies related to their culture. Almost half of the participants considered international dishes their favorite food, and the other half preferred dishes from their home countries. Their hobbies were also general activities that could be done by people from any culture. Thus, this section indicates the need to have user recognition as part of the robot's functionalities. Otherwise, this information cannot be used to avoid stereotypes.

In terms of the adaptation process, it was clear that the weather and the language are the biggest obstacles in the adaptation process. Both are equally relevant, but it is out of the scope of this work to provide solutions to the weather problem. Instead, this work will

try to provide a solution for language needs and lack of socialization, another relevant aspect in this category.

Finally, the perception of robots was mixed. On the one hand, participants were surprised and amazed by the robot demonstration. They were able to imagine solutions, such as language or shopping assistance, for the robot when helping immigrants. On the other hand, they were skeptical and worried about the possible replacement of humans with robots, as well as that socialization would feel artificial and cold.

The pre-study findings contributed to the development of the Cultural persona, the formulation of the Scenarios, the final Design implications, and the ethical consideration in the Discussion .

5 Cultural persona

5.1 Method

Personas are a well-known method used in the design process. They offer a common understanding of users' needs and context. Personas facilitate a development team's empathy with the target user of the product they are developing (Pruitt & Grudin, 2003). However, they are typically produced for specific projects and specific requirements without scrutinizing users' culture. For that gap, a group of researchers proposed the development of cultural personas (Lachner, von Saucken, Mueller, & Lindemann, 2015). This version of personas allows a development team to help adapt a specific product to fit cultural groups and, thus, to design better products, as well as get a basic understanding of users' needs.

The cultural persona method was adopted for this research work by taking information from the cultural dimension and qualitative data from the pre-study. The visual approach was also adopted to convey information clearly by using representative icons. Figure 14 shows the sources of information for every part of the cultural persona.

Section 1 combines knowledge from three cultural models (Hall, 1990; Hofstede, 2010; Lewis, 2006) explained in subsection 2.1 Cross-cultural design. Combined with studies of Arab culture from (Maitner et al., 2017; San Martin et al., 2018) this section provides relevant contributions to developing the final design implications.

Section 2 includes detailed information on Arab culture. The data was taken from the Cultural Knowledge Base developed in the pre-study, Section 4. This module complements the robot's cultural "awareness" and affective behavior. Sections 1 and 2 provide the target group's ways of communications, social cues, and values that the robot should be "aware" of and the data that the robot could use in speech interactions.

Section 3 displays a profile example. It includes information from the Cultural Knowledge Base in the pre-study, Section 4. We created one fictional character, a female, immigrant student. The character also exemplifies person-specific knowledge by showing examples of the influence of culture in her daily life as an immigrant and situations where the needs detected are presented.

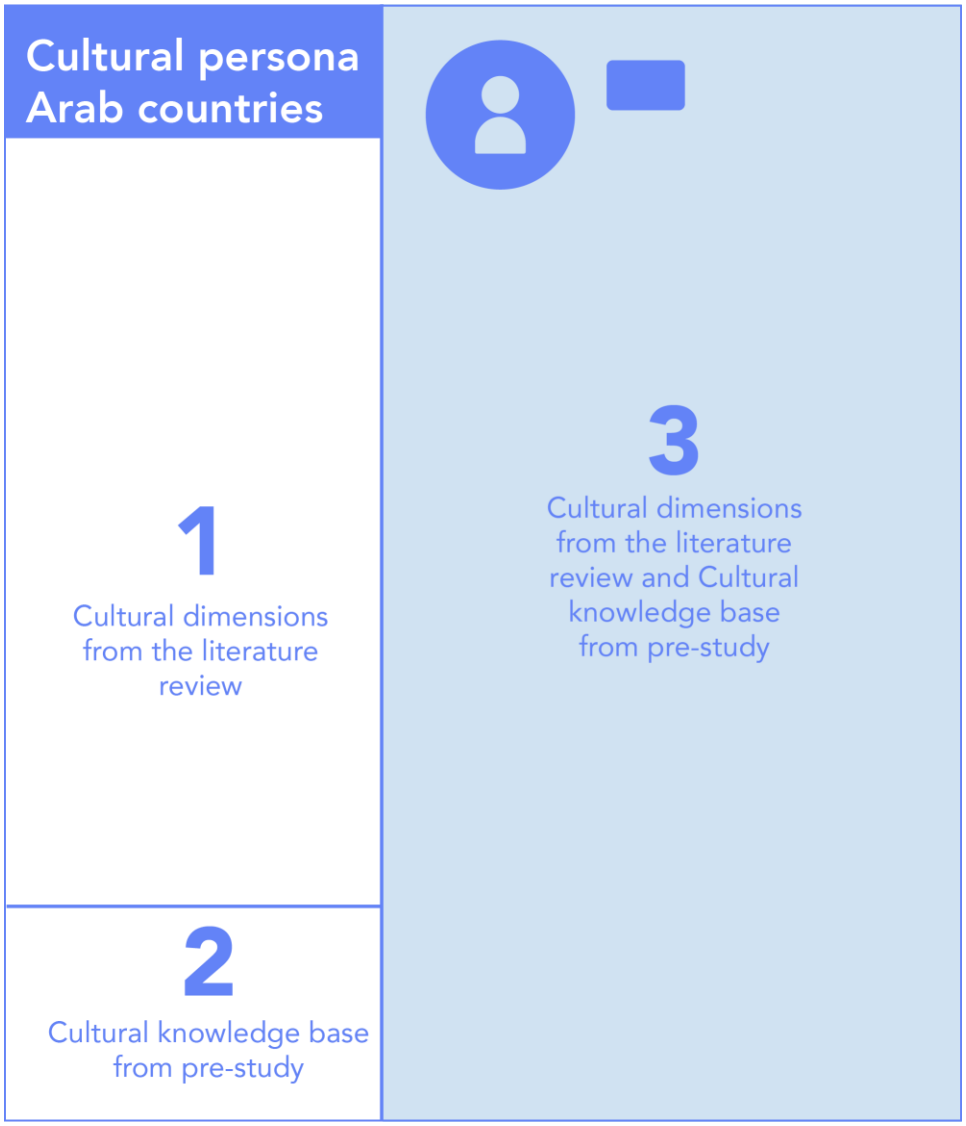

Figure 14. Cultural persona Structure

Based on (Lachner et al., 2015)

5.2 Arab countries Cultural Persona

The cultural persona of Arab countries includes a complete analysis of the target user as a response to **RQ2:** What behaviors from the Arab population are suitable for a culturally aware social robot? This is represented in Figure 15. Arab countries cultural persona.

Figure 15. Arab countries cultural persona

6 Scenarios

Scenario-based design is a well-known methodology in the human-centered design field. It is an experience-based narrative method that focuses on the user perspective (Sutcliffe, Maiden, Minocha, & Manuel, 1998). Scenarios make the use of the system explicit by exemplifying how a system is utilized and allowing creators to validate ideas with the user in a realistic environment, avoiding abstract concepts that may not find a real use and, thus, not represent value for the users: *"They are not only a part of user testing, but they are also a part of developing the user test contexts to ensure that the real work contexts are represented"* (Duffy, Osgood, Holyoak, & Monson, 1996, p. 241). Additionally, scenarios are tools for understanding how the user's actions influence and constrain the system (Carroll, John M. (John Millar), 2000)

According to (Carroll, John M. (John Millar), 2000), the main components of scenarios are: the settings that represent the context of use; the user(s) involved in the proposed system, product, or concept; the goals or objectives the user wants to accomplish while using the system; and finally, the actions the primary user does, since these actions impact the given goals.

The use of scenarios allowed us to put users' needs, which were found in the literature and the pre-study, into a specific context of use. Three scenarios (Table 4) were proposed: "Hanging out," "Supermarket," and "Language friend." The three scenarios proposed represent the real needs of immigrants in their adaptation process to a new country and the use of social robots as support.

The scenarios included the first approach of cultural design implications and behaviors that represent the findings of the pre-study.

Table 4. Summary of the scenarios

Scenarios	Behaviors	Cultural design implications	Context of use	User needs
Hanging out: In this scenario, the robot is socializing with the participant. The interaction is initiated by the robot. The robot will prompt emotional states, reactions, and behaviors according to users' answers. (Fig. 15)	• Greeting (Robot initiated dialogue) • Short conversation. • Emotion recognition	• Handshake (Hello in Arabic) • Arabian proximity distance, 65cm. (Eresha et al., 2013) • Arabian prosodics (not able to implement) • Jokes	Public spaces like a public library, refugee welcome center common areas	**Emotional needs** • Socializing, because of social isolation (Collective and high context culture) • Physical contact • Care
Supermarket: shopping assistant (Explanation of the products in Arabic) (Fig. 16)	• Greetings • Deictic gestures • Multilingual dialogues	• Offering help without asking. • Pointing • Translating to Arabic	Shops and shopping centers	**Practical needs** Guidance in daily life task
Language friend: The robot will behave like a friend so the user can practice Finnish and give recommendations about Finnish culture. (Fig.17)	• Greetings • Multilingual dialogues	• Cultural expressions • Culturally adapted non-verbal communica-tion • Teaching local culture	Public spaces like a public library, language centers, refugee welcome center common areas	**Practical needs** • Practicing Finnish language

6.1 Implementation of the Scenarios

The scenarios proposed for the design evaluation were implemented using the social robot Nao 6th version (NAO6), with 26 degrees of freedom, speech recognition, and seven touch sensors created by SoftBank Robotics (SoftBank Robotics, 2018).

We developed one program per scenario using Choregraph software (SoftBank Robotics,). In every scenario, the robot followed a storyline, and participants were instructed to respond specifically to every section of the interaction. We implemented speech interaction and robot animations to support the speech. For the speech interaction, we used a small vocabulary (20-30 words) that the robot could identify from the user and react to, for instance: “Happy”, “Sad”, “Yes”, and “No,” among others.

For the animations, we used default animations in Choregraph, such as greeting, gestures, Figure 16, and coded animation by the author, such as handshaking.

One of the limitations presented was that Nao robot did not come with Arabic language settings, so the interactions were implemented in English and Finnish.

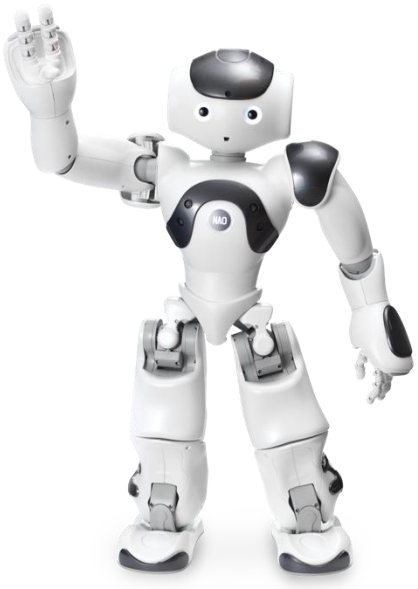

Figure 16. Nao robot greeting gesture

6.2 Scenario 1: Hanging out

This scenario (Figure 17) aims to fulfill the socializing needs an immigrant has when they arrive in a new country, especially since Finland differs culturally, physically, and environmentally from Arab countries (the differences are described in the subsection Arab culture from Cross-cultural studies). As was found in Pre-study section 4, the target users found it challenging to socialize and make new friends with locals. They

missed the gatherings that happened in their homes and continuously felt socially isolated because of that.

This scenario occurs in a public area, such as a public library, an open space in the university, or a shared area in a refugee welcome center. The users are immigrants. Their goal is to have social interaction, such as a conversation with a socially interactive robot. Here, Nao has a social role as a friend or potential friend. Both agents, users and robots, are at the same level of hierarchy (Magee & Galinsky, 2008). Hence, the robot follows the standard social rules for this kind of relationship.

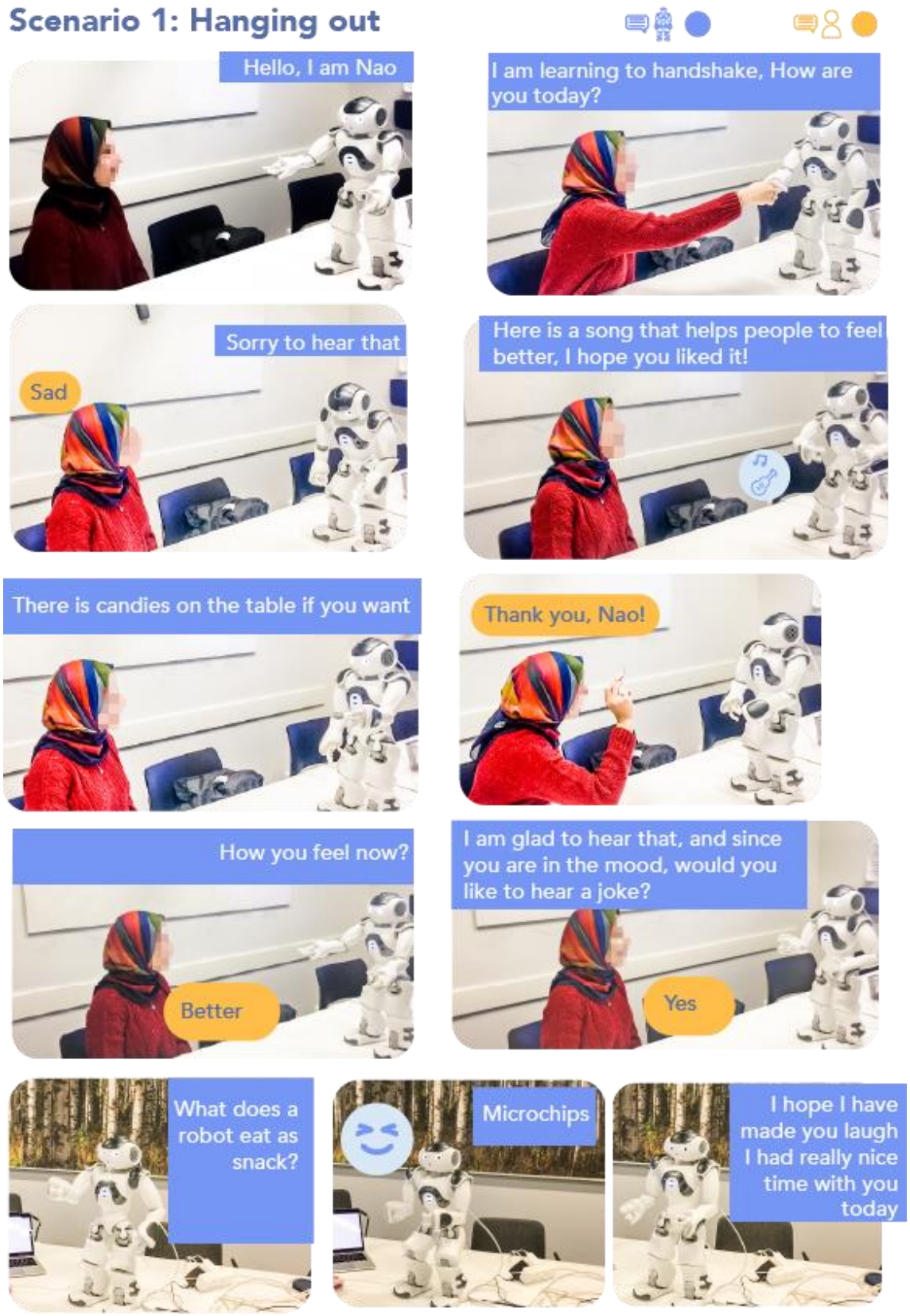

Figure 17.Story board scenario 1: Hanging out

Link to video: https://www.youtube.com/watch?v=COyPE9woMQw&feature=youtu.be

This scenario represents a first-time social interaction in which the social robot introduces itself to initiate the conversation. As part of the greeting and a culturally adapted behavior, the robot proposed a handshake, explaining to the user its limitation by saying, *"I am learning to handshake."* The robot asks for the user's emotional state to continue the interaction and demonstrate emotional awareness. The users were instructed to answer with a sad emotion. The robot had a small vocabulary that included words like "sad," "bad," and "not so good." Once the robot detected the expression, it answered with empathetic behavior and a sad body gesture.

Following the emotional and cultural behaviors, the robot offered to play an Arab guitar song and give candies to the user. Once the user took the sweet, the robot asked for another emotional state report. In this case, the participants were instructed to reply with a positive emotional state using the words "good," "better," or "happy."

After the robot detected the positive emotional state, it proposed telling a joke, following the Arab standard behavior found in Pre-study section 4. After telling the joke to the user, the robot ended the interaction by expressing pleasure with the encounter.

6.3 Scenario 2: Supermarket

The "Supermarket" scenario (Figure 18) addresses the need for guidance in everyday tasks like shopping. As found in Pre-study section 4, immigrants often feel lost when shopping. The language creates a significant barrier; labels can be confusing and asking the seller can be challenging if they do not share a common language. Here, the social role of the robot is as an assistant. It can be considered a lower level on the hierarchy than the client (Magee & Galinsky, 2008). However, the robot offers guidance and aims to have credibility with the user, so the attitude of the robot is humble but confident.

In the "Supermarket" scenario, the robot should speak the same language as the user; however, due to the research's limitations and scope, the implementation of the scenario was done in English. This scenario takes place in a supermarket, specifically in the dairy products section. The users are immigrants, and their goal is to buy milk.

The interaction started with the robot greeting the customer and welcoming it to the market. After Nao introduced itself, it offered assistance to the customer. The spontaneous help offering is a culturally adapted behavior, since Arabs are used to supporting each other and offering help.

The robot asked how it could help, and the participants were instructed to reply that they needed to know what the red milk was. The robot replied with the related information and asked if there was something else the customer needed. The user replied as instructed, saying that they would like to get milk without lactose, and the robot replied with which milk that was. In the end, the robot said goodbye and ended the interaction.
During the scenario, body gestures were used in conjunction with speech. This aspect is another culturally adapted behavior, since communication between Arabs relies significantly on gestures. The gestures were deictic (indicative or pointing cues).

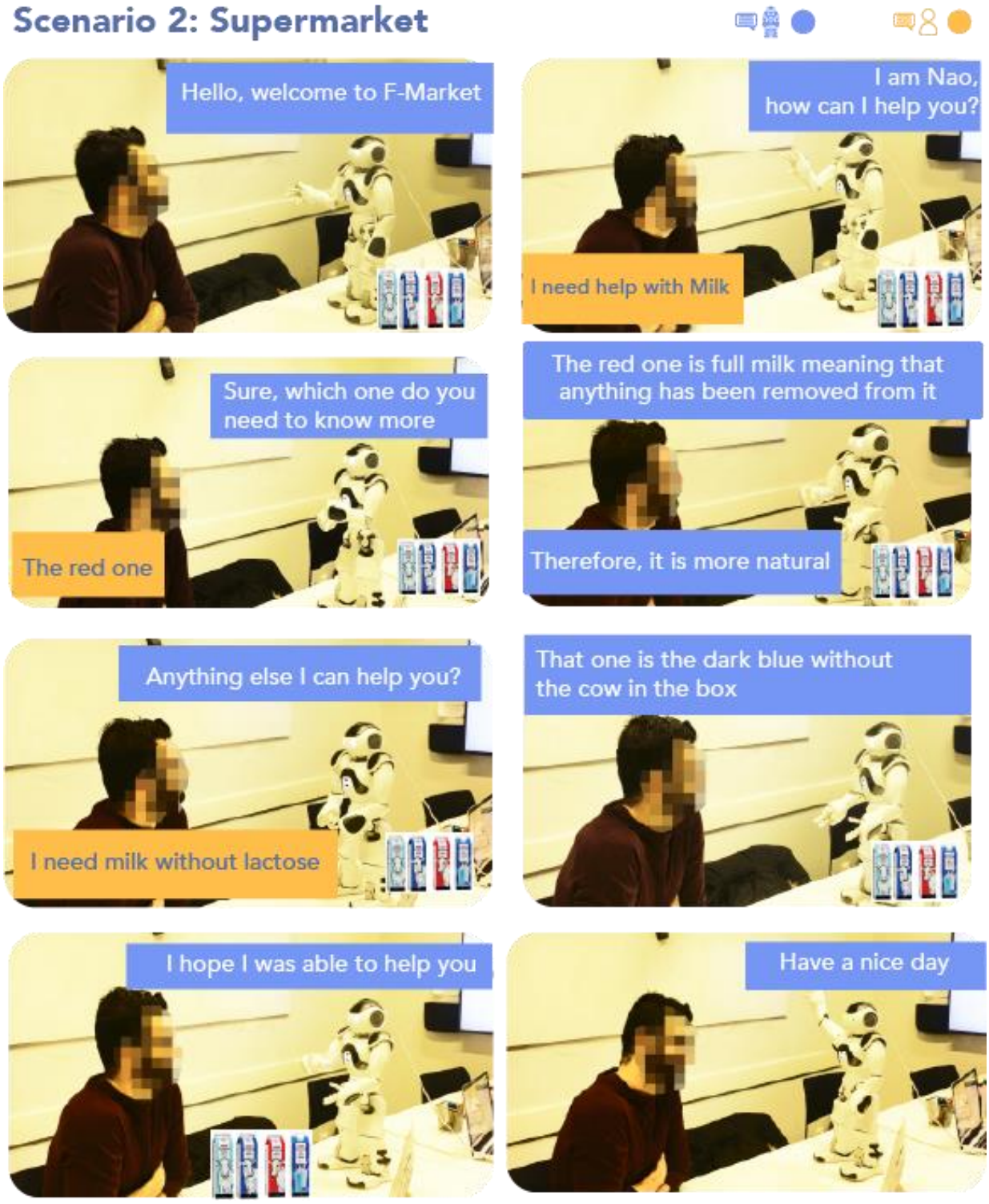

Figure 18. Story board scenario 2: Supermarket

Link to video: Scenario 2 *https://www.youtube.com/watch?v=u_kIA6w789M*

6.4 Scenario 3: Language friend

The third scenario, “Language friend” (Figure 19), is intended to fulfill the need for a language practice companion, one of the target group's most relevant necessities. Immigrants often try to practice the local language. However, finding someone with whom to practice is difficult due to the previously explained social isolation factor.

This scenario occurs in a public area, such as a public library, an open space in the university, or a shared area of a refugee welcome center. The users are immigrants, and their goal is to practice the Finnish language. Even though Nao aims to act as a teacher, it has the social role of a friend, meaning that both user and robot have the same level of hierarchy (Magee & Galinsky, 2008). This decision is based on the idea of providing immigrants with a friendly learning environment that makes them feel relaxed and is not related to the typical language learning settings (Zaga et al., 2015).

This scenario was initially planned to have two levels of difficulty. The hardest one was a simulated conversation through the Wizard of Oz (WOZ) technique (Hanington & Martin, 2012). The robot would ask pre-established questions in Finnish to the participants and encourage them to practice. The second and easier level, represented in (Figure 19)
, is a vocabulary memory game. During the evaluation, the participants preferred to interact with the second scenario, which will be described here. Likewise, this scenario is intended, not to create a system for language learning, but to evaluate the robot's cultural and emotional behavior when teaching and reacting to users’ wrong and right answers.

Nao started the interaction by greeting the user and setting the goal of the situation. Once it explained the dynamics, it uttered words one by one, and at the same time, images appeared on the TV screen. The robot was programmed to repeat the same word when the user pressed the bumper on the foot of the robot and continue with the next word when the user touched the robot’s head. Once all the words were said, Nao asked the user to select the correct cards according to the words it said.

When the user selected the correct word, Nao performed a little dance to express happiness and congratulate the user. When a participant chose the wrong answer, Nao lowered its head and crossed its arms. Both gestures were culturally adapted based on participants’ type of communication and the masculinity cultural dimension in which

recognition for an achievement is needed. At the end, the robot congratulated the user on their work and ended the interaction.

Figure 19. Story board scenario 3: Language friend

Private link to video: Scenario 3 https://www.youtube.com/watch?v=zQiV27sFItE

7 Design evaluations

7.1 Goals of the design evaluation

In the pre-study and literature research, the main goal was to respond to **RQ1** and **RQ2**. These questions have a human-centered approach and focus on the user, their needs as an immigrant, and the behaviors that a social robot could adopt. From the findings of Pre-study section 4, we developed three scenarios or use cases to study and validate 1) the target group, 2) the use of a social robot as support in the adaptation process in a specific context of use, and 3) the culturally adapted behaviors of the robot. The knowledge gathered in the design evaluations serves as the primary outcome to respond to **RQ3,** which focuses on the design guidelines a culturally aware social robot should follow when interacting with Arab immigrants.

7.2 Methods and Procedure

The design evaluation consisted of 45-minute live sessions that included multivariate validated methods, combining qualitative and quantitative methodologies to create a comprehensive assessment of the human-robot interaction. The evaluation took place at the facilities of Tampere University on the Hervanta campus, and along with the robot, a TV screen was used to support the interaction and guide the participants.

Five participants were included: three males with a mean age of 29 and two females with a mean age of 26. A 10€ gift card was offered as a reward for participation.

The first step was to ask participants to fill out a background questionnaire, a consent form, and a negative attitude towards the robot's scale (NARS) (Nomura, Suzuki, Kanda, & Kato, 2006). Every question belongs to a subscale that evaluates specific aspects, described below. NARS was selected to investigate possible ethical implications from the beliefs users may hold about robots. After NARS, the participants were introduced to three interactive scenarios.

Following every scenario, the subjects responded to a semi-structured interview (The questions can be found in the *Appendixes*). The interactions were filmed, and the interviews were recorded. To protect participants' identities, we anonymized the data and stored it in the servers of Tampere University. The videos of the interaction were anonymized by adding a pixelated mask to participants' faces.

After the transcription, we performed one content analysis per scenario: "Hanging out" scenario (Table 5), "Supermarket" scenario (Table 6), and "Language friend" (Table 7).

Each content analysis shares the same category structure: cultural adaptation, value for the immigrant, and improvement of the interaction. The subcategories change in every scenario according to the findings.

Table 5. Categories and subcategories of the content analysis of the Hanging out Scenario

Category	**Subcategory**
Cultural adaptation	• Reaction towards user's sadness • Reaction towards user's happiness • Handshake • Jokes
Value of the scenarios for the immigrant	• Positive • Negative
Improvements in the interaction	• Hug

Table 6. Categories and subcategories of the content analysis of the Supermarket Scenario

Category	**Subcategory**
Cultural adaptation	• Attitude • Greetings • Gestures • International behavior
Value of the scenarios for the immigrant	• Confidence • Autonomy • Convenient
Relevance on the manner of support	• Robot offering help • Robot waiting for user to ask for help • Neutral opinion

Table 7. Categories and subcategories of the content analysis of the Language Friend Scenario

Category	Subcategory
Cultural adaptation	• Attitude • Gesture to congratulate • Gesture to point out the mistake • International behavior
Value of the scenarios for the immigrant	• Better than practicing with a human • Helps generally
Improvements in the interaction	• Other ways to practice Finnish • Personalization • Non repetitive behavior • Clapping • Thumbs up

At the end of the study, the participants filled out a Godspeed questionnaire (Bartneck, Kulić, Croft, & Zoghbi, 2009) to gather quantitative data about users' perceptions of human-robot interaction. The users were asked to answer the questions using a semantical differential scale, selecting values from 1 to 5.

7.3 Participants

The participants from the pre-study were asked to participate in the design evaluations, but two of the participants were not in the country. Consequently, to fill the positions, we asked the other participants to find friends from the same culture who would like to participate in the study. In the end, another participant agreed to participate in the evaluation. However, they did not appear at the session, and the final amount of participants was five (Table 8).

Table 8. Participants in the design evaluation

Participant number	Nationality	Ethnicity	Age	Gender	Occupation
1	Iraqi	Arabic	32	Male	M.S student
2	Egyptian	Arabic	29	Female	B.A student
3	Egyptian	Arabic	27	Male	M.S student
4	Tunisian	Arabic	23	Female	M.S student
5	Iraqi	Arabic	28	Male	M.S student

7.4 Findings

This subsection presents the design evaluation's findings and starts with the results of the scenarios, which were found in the semi-structured interviews' content analysis. Every scenario has two categories of study: value for an immigrant, which reflects the participant's assessment of the scenario's usefulness; and cultural adaptation, which evaluates the robot's specific behaviors according to their appropriateness and the participant's culture.

The following section is the assessment of the users' attitudes toward robots. These findings help analyze preconceptions of social robots and reveal ethical matters that the discussion of this research work should address.

At the end of this subsection is the evaluation of users' perception of the robot, using the Godspeed questionnaires, to obtain a more comprehensive understanding of the robot's anthropomorphism, animacy, likeability, perceived intelligence, and safety. These findings influence the final design implication of this research work.

Evaluation of the scenarios

Scenario 1: Hanging out

The use case "Hanging out" aims to support immigrants in need of "socializing," as indicated by the pre-study. Here, the robot is a friendly agent who establishes a social connection with the participant in a daily life conversation. The robot expresses empathy towards the users' emotional states and adapts the conversation accordingly, demonstrating a basic emotional intelligence level and comprehension of conventional social norms.

The value for an immigrant

A common view amongst interviewees was that hanging out with a robot was beneficial for them. They admitted that in the first month after their arrival, they spent a long time without social contact, and having the opportunity to talk with a robot would motivate them. Aspects like social isolation, comfort, and spare time were cited as the areas the robot can potentially benefit. Five out of five participants agreed in the value of the scenario. For instance, one participant mentioned: *"Now I am seeing emotions in the robot, so that can be a little bit of support for the foreigner, especially if it's their first time coming here, not having that many friends, so this would cheer the person up."* Additionally, another participant added, *"When people have just come here, at the be-*

ginning, they feel a bit isolated, and when you come and see this kind of thing, you feel, oh, finally I see someone."

The positive attitude toward the robot as a potential friend was validated in the NARS questionnaire (Figure 20). In the subscale "emotion," the mean score was 2.7. This result shows that participants agree that if the robot demonstrates emotions, they could have a friendly relationship with it.

Cultural adaptation

There was a sense of the robot's having culturally adapted behaviors amongst interviewees. Generally, participants all described the robot behavior as appropriate for their culture. The embodiment expressions evaluated in the interaction were 1) a handshake for greeting, 2) reactions towards users' emotions, and 3) jokes. The following describes the findings regarding each one.

- **Handshake for greeting:** In all cases, the interviewees reported that the handshake was a proper greeting in Arabic culture. Some participants expressed that the handshake was a way to build trust and safety with the person they interact with, namely: *"For me, as in my culture where I am from, we use a handshake when we see each other. It builds kind of some safety with the person you are seeing, even though you are seeing them for the first time. It gives some extra stuff to make it easier to contact."* Similarly, other participants mentioned the naturalness of the action as a positive aspect: *"I think it is very similar to reality. I like the handshake. It's surprising to see."*

- **Reactions towards users' emotions:** The display of empathy towards user emotions, as an act of caring, was designed in consideration of the findings from Prestudy Section 4 and the literature in the subsection Affective Social robots. As was described in subsection 5.2 Arab countries Cultural Persona, Arabs are a collectivist culture. They often take care of their community, and expression of other-focused emotions is typical among them, especially demonstrating empathy and caring to others. In the "Hanging out" scenario, the users were instructed to report a sad and happy emotional state, and the robot had two different behaviors for each situation.

  In the case of sadness, the robot lowered its head, declared, "I'm sorry to hear that," and played a song to cheer up the participant. According to the answers in the semi-structured interviews, the robot performance was accurate in the sense that participants were able to understand the intentions of the robot empathizing with the users: "*It felt like it was really interacting with what I said. I felt it was real, not just a ro-*

bot but, like, the emotion really was real." and "He showed me emotions. I feel that he understood that I am not feeling good." Moreover, the robot's intention of cheering up the user as a sign of caring fulfilled its goal, as one participant declared, *"Feeling sad and cheering up a person with a song, that's nice. That's a good thing too."* In addition, one participant suggested a hug as a reaction to users' sadness: *"Some kind of hug you know, for example, I'm sad, I want a hug. That would be great."*

When asked about the robot's reaction towards users' state of happiness, the participants were unanimous in the view that the robot reacts according to the emotion demonstrated. For example, one interviewee said, *"Yes, according to the emotion, it was more cheerful."* Another interviewee alluded to the notion of realism in the performance of the robot: *"I felt the same, I got the emotions, not from an artificial thing, but someone real. "* This does not suggest that the participant believes that the robot has real feelings, but, rather, indicates a sense of realism in the expression of joy that the robot intended to convey.

The previous users' perceptions regarding the robot's emotional display indicate that in this scenario, the robot behavior followed the designated guidelines for the expression of emotion (explained in the related work sub-section Emotions in culture and design [Figure 8]). Therefore, these reactions (sadness and happiness) should be included in the final design guidelines of this work.

Scenario 2: Supermarket

The use case "Supermarket" supports the need for guidance in everyday tasks, such as shopping, given factors like difficulty with the local language, differences in the design of products, and the shyness associated with asking for help from a stranger; all of these make visiting a supermarket a stressful experience. In this scenario, the robot offers support to the buyer and answers their questions about the milk section of a fictional supermarket. In the implementation, the robot spoke English. However, the participants were instructed that in a real implementation, the language would be Arabic.

The value for an immigrant

Regarding the value of the “Supermarket” scenario, there was an impression of convenience amongst interviewees. Five out of five participants replied that having a robot to help them when they are confused is favorable. As one interviewee put it, *"Everyone who is not from this country and is going to the market is going to find it difficult. It’s not just the market, everywhere, so if I am going to find someone to ask, it would really take a lot of time. Maybe I will find the person to help, but the robot would always be*

available. I can come directly, and it will assist me in this way." Additionally, another recurring theme was the autonomy that the social robot provides when supporting them in shopping. They expressed feeling dependent on others, as one informant reported, *"I think, yeah, it gives you really good information for every day. When you don't get information about what you need, you will always depend on others because you don't know how to manage. You don't know about things, so you always need help."* In that sense, the robot fulfills its purpose of helping the immigrant become independent and self-reliant. However, one interviewee argued that if the robot spoke Arabic permanently, they would never properly adapt to a new country because they would not be forced to use the local language once they started learning it. For example, one interviewee said, *"How can I adapt here if all the time I just speak my language? Arabic is Arabic. I can't adapt because I have to adapt to the Finnish people."*

Cultural adaptation

When asked whether the robot adopted Arab cultural behavior, most of the comments were encouraging. In this scenario, the design evaluation assessed the robot's behavior in terms of attitude and gestures. The assessment of the attitude involves participants' perception of the robot's disposition in the helping task and the value of the robot initiating interaction by offering help instead of waiting for the participant to ask for support. Examination of the gestures was as support of the dialogue, considering that this scenario was speech-based, and its role as non-verbal communication cues to convey the robot's helpful attitude.

- **Robot's Attitude:** Participants' responses toward the attitude of the robot were positive. They evaluated the robot as talkative and happy, suggesting that a helper in their countries would behave in the same way. Speaking on this issue, an interviewee said, *"It would be a good approach to my culture because we are talkative. We will be happy to assist someone, so it would be the same with the robot, and he was like happy."* Additionally, another participant added, *"In every supermarket in my country there is always someone to ask, "Do you need help?" "Can I help you?" so he did the same."*

  Nonetheless, one interviewee argued that the robot behaves in a way that is not particularly adapted to any culture; it is simply proper behavior for the scenario. The following comment illustrates this idea: *"I will say it is an international behavior. I don't know how else it needs to behave as a culture, but this is a general behavior which is a really polite, understanding, and nice way."*

Regarding the value of the robot offering help instead of waiting for the participant to ask for support, four out of five participants agreed on the benefits of this type of interaction. The interviewees explained that, because they are shy or they do not know the local language, the offer of help is helpful, for instance: *"It's better when it asks for help, especially for immigrants when they are new in the country. We are shy, and so we always need you to take the first step, and we don't know how to behave when we come from a different culture."*

- **Robot's Gestures**: In this scenario, the robot's speech relies highly on diectic gestures to show its social skills and as a way to convey a helpful attitude. Regarding this, two participants mentioned that the gestures suit the Arab culture, being lively and expressive, for example: *"He did everything. He raises his hand, and his eyes and changes the colors."* Another participant added, *"Always moving and attracting my attention, very important thing in our culture. Pointing with his hand and that stuff are really important for us. As I said, it attracts our attention".*

Scenario 3: Language friend

The design of the "Language friend" scenario aims to fulfill the need to practice language with a companion. Speaking the local language is one of the immigrant's most predominant necessities when experiencing a new culture. However, they encounter difficulties with finding local people with whom to practice. In this scenario, the robot helps participants learn basic vocabulary. First, the robot says words in Finnish, and a TV screen projects the image, with the word written in Finnish and Arabic. Once the robot has finished pronouncing all the terms, it invites the participant to practice by randomly saying the words mentioned previously. The participants select the images that correspond to the words from a group of images. The robot congratulates them or points out the mistake with specific embodiment cues.

The value for an immigrant

The single most striking observation to emerge from the semi-structured interviews of this scenario is that the participants, on the whole, demonstrated a preference for a robot language friend over a human or a computer. The explanations vary from aspects such as the participant's shyness with a real person to the flexibility that Robot-Assisted Language Learning (RALL) can provide. First, in terms of shyness, participants felt that a robot was less intimidating by nature of its being a machine. As one interviewee put it, *"I am not too shy to make a mistake or something because he is a robot and it is his job to help me, so no fear. One need not feel too exposed."*

Interestingly, since a computer as a machine does not intimidate them either, participants highlighted the robot's social skills positively, since it is more natural to interact with a robot than a computer. Commenting on this issue, one individual stated that: *"That's the difference between a robot and a computer. This is you interacting, you are speaking like a real person, so that's the plus."*

Furthermore, participants expressed that a robot is a flexible way to learn a language. For example, one interviewee said, *"So, with this robot, you can learn whatever you want and just stop learning when you want to continue learning. You are not forced to study for one hour. It depends on the person, so I think it's a more flexible way to teach Finnish to immigrants."* Even though flexibility is an important quality that increases the adoption of social robots as language companions, four out of five participants argued that the robot should offer personalization options. For instance, one individual reported, *"He must have levels, so when I answer them all correctly, I can go to another level."*

It is essential to highlight that the preference for a robot over a person for a language practice friend raises ethical concerns regarding humans' replacement, which should be considered if this type of design is applied to real-life settings.

Cultural adaptation

Multiple opinions arose in the assessment of the adaptation of the robot's behaviors to Arab culture in the "Language friend" scenario. From a general point of view, the robot's behavior was accepted and validated by the participants. This scenario evaluated the robot's attitude as a peer or language friend and the reactions when the participants respond correctly and incorrectly.

The participants suggested a few additions to the embodiment cues to improve the cultural adaptation.

- **Robot's Attitude:** Concerning the robot's attitude, two themes arose: two participants described the robot's attitude as friendly, easy-going, talkative, and encouraging. They stressed the correspondence of that type of attitude with their culture; for instance, one interviewee said, *"It was really easy to deal with, without any barriers, interacting fast, talking all the time, so it totally matches my culture."* Additionally, other participants highlighted how vividly the robot behaved: *"The way of moving and introducing words, always moving, that's very important."* On the other hand, three out of five participants argued that the ro-

bot's conduct was international behavior. Therefore, these findings do not conclude that the robot's attitude demonstrates cultural awareness; however, they indicate a positive posture from the participants toward the robot's general attitude.

- **Gesture to congratulate:** The robot performed a body movement, *"a little dance,"* moving its hips and arms, saying "Tosi Hyvä" (“Very good” in Finnish) as a sign of celebration and to congratulate the participant for selecting the correct image. Three participants agreed that this gesture was appropriate behavior for the situation, cataloging it as encouraging and cheering. Speaking on this issue, an interviewee said, *"This is totally good, like cheer up.”* However, four participants suggested that clapping would better suit congratulation according to their culture; one individual stated that: *"When you are in class, and you say the right answer, the rest of the people will just applaud."* In light of the findings, the clapping gesture is a demonstration of encouragement in Arab culture. For example, one participant commented, *"Cheering up was by clapping."* Thus, this gesture should be included as part of the behavior to congratulate the participant for responding correctly.

  One crucial aspect to consider is that during the interaction, the robot always exhibited the same behavior, no matter how many times the participants responded correctly. Consequently, the participants experienced repetitiveness. Two participants pointed out that the robot should have different gestures to avoid repetition. The following comment illustrates this point of view: *"Maybe he can change the encouragement or motivating words to be more variable so I can feel that it is natural and is not repeating.”* Additionally, one participant suggested that a thumbs up would be another appropriate gesture for the action of congratulation and to avoid repetition, for instance: "*I would be happy to see more gestures. Maybe it would be more expressive. We use thumbs (up-down)."*

- **Gesture to indicate mistake:** When a participant did not select the correct image, the robot crossed its arms and lowered its head as a sign of empathy with the failure. The interviewees' responses reflect the acceptance of this gesture as appropriate for indicating a mistake. Four out of five participants understood the sense of compassion that the robot transmitted; one informant reported, *"He was sorry for me; he was not blaming me."* From these results, it can be concluded that supportive and empathetic behavior should be included in the final design

implications; nonetheless, a different display of empathy should be developed to avoid repetitive behavior.

Attitude towards Robots

This subsection studies whether preconceptions towards robots affect participants' assessment of the usefulness of the robot's scenarios and behavior and possible ethical considerations that this work's final discussion should consider. We used the NARS Negative attitude toward robots' questionnaire (Nomura et al., 2006) to address this goal. The need to understand perception of robots responds to the relation of the anticipated use with the user experience, as the official definition of UX establishes: *"User Experience (UX) is defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service"*. (*Ergonomics of human-system interaction. part 210, human-centred design for interactive systems (ISO 9241-210:2010)*). Furthermore, scientific evidence in social robotics has demonstrated that users perceive robots based on attitudes towards technology, physiological state, and prior social experience (Turkle, 2011). This study did not aim to understand the differences between genders. The goal is to have a general perspective of the participants' attitudes.

NARS Negative attitude toward robots' scale

The data (Figure 20) shows that participants had a positive attitude toward robots. The results of the sub scale (S1) Negative Attitudes toward Situations of Interaction with Robots implies that they are open to interacting with robots without any difficulty. Additionally, feelings like nervousness are barely present, and it is possible that the introduction of robots in real-life settings with the proposed scenarios would not require a significant effort or a long adaptation process between the user and the robot. These results support the findings of the scenarios in which they were gathered.

Turning next to subscale (S2) Negative Attitudes toward the Social Influence of Robots, participants were slightly less favorable, compared to interaction with robots. These results are connected to one participant's concern with robots replacing humans. Participants are positive about interaction with robots but were slightly more negative when considering the social effect of the interaction. Finally, in terms of the last subscale (S3), Negative Attitudes toward Emotions in Interaction with Robots, participants had a strong positive attitude, which explains why they were positive regarding the robot's display of empathy during the scenarios.

The results of the NARS questionnaire suggest that previous assumptions or ideas about social robots did not affect the user experience in the scenarios evaluated. However, with a small sample size, caution must be used, as the findings might not be decisive.

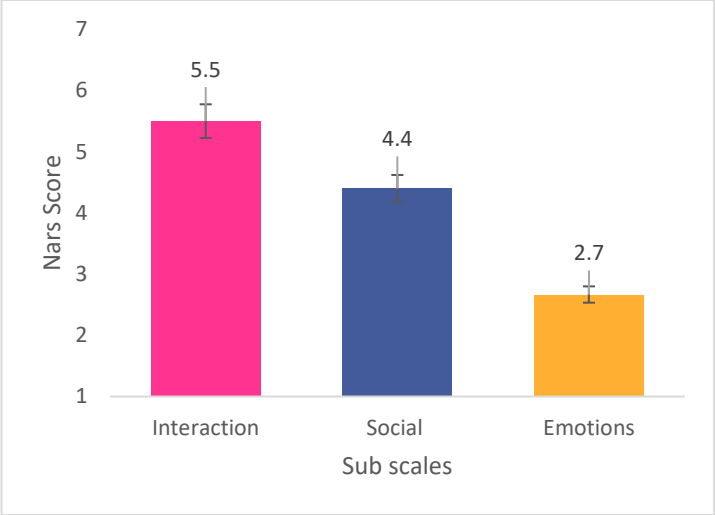

Figure 20. Results of NARS Negative attitude towards robots scale.

Lower values of interaction and social subscales reflect a more negative attitude towards the robots, while the emotion subscale is the opposite.

S1: Negative Attitudes toward Situations of Interaction with Robots

S2: Negative Attitudes toward the Social Influence of Robots

S3: Negative Attitudes toward Emotions in Interaction with Robots

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User's perception of the robot

The success of an interaction between humans and social robots goes beyond evaluating the robot's performance, which is traditionally done with industrial robots (Bartneck, Kulić, Croft, & Zoghbi, 2008); it involves the users' perceptions from different points of view. In this study, users' perceptions were evaluated using the Godspeed questionnaire (Bartneck et al., 2008) to examine anthropomorphism, animacy, likeability, perceived intelligence, and safety (pre- and post-interaction). In general terms, the Godspeed results (Figure 21) correspond with the semi-structured interviews; the figure shows an overview of the Godspeed subscale results, which display an overall positive perception of the robot. Once again, caution must be applied, since it was a small sample, and the results of this questionnaire are not decisive.

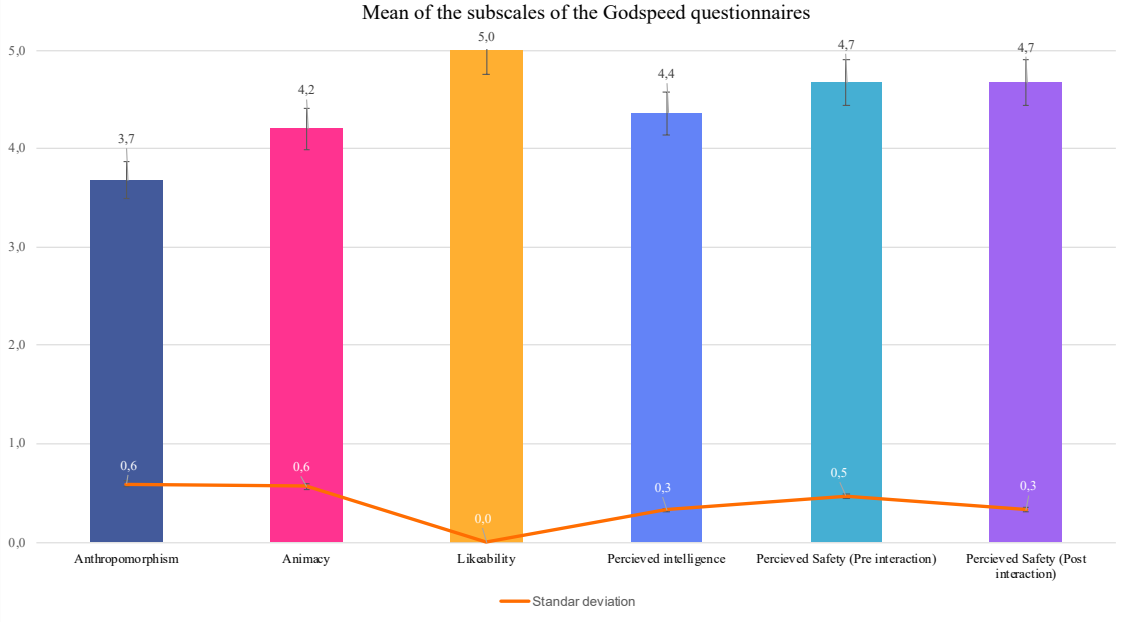

Figure 21. Results of the Godspeed questionnaires

A higher standard deviation (SD) means less consensus in the answers of the participants.

7.5 Summary of the design evaluations

Overall, the participants perceived the value of the scenarios as convenient and useful for them. However, they all agreed that these solutions are suitable for the first weeks to months after arrival, not after immigrants already understand the logic of the new culture or they have people to rely on.

The three scenarios proposed (“Hanging out,” “Supermarket,” and “Language friend”) were considered desirable for operation in a real-life context, as they address real pain points for immigrants. Interestingly, it was found that participants reported a preference for interacting with robots in the scenarios rather than humans. Aspects like participants' shyness, lack of a common language, and people’s changeable moods make interaction with a robot more suitable for them. However, this finding raises ethical considerations, which will be discussed later. Participants also highlighted the robot's social skills, addressing that, even though the solutions proposed in the scenarios can be fulfilled with other devices like a tablet or computer, it was better to interact with a robot due to the interaction's naturalness.

In terms of cultural adaptation, participants recognized a certain level of adaptation to Arabic culture. They agreed the robot was friendly, animated, easygoing, and helpful like a typical Arab. Some specific behaviors, such as dancing to congratulate a correct

answer in the “Language friend” scenario, were recognized as more international conduct. Participants indicated that it was a suitable way to react, but that other gestures, such as clapping, would be more appropriate for their culture.

The social role of "peer" performed by the robot was highly accepted as the most proper one, since it demonstrates empathy and friendly behavior.

The participants made two significant suggestions. The first was personalization in the interaction, for instance, addressing the user by name, referring to previous interactions, letting the user select the language of the interaction, and adjusting the difficulty of the lessons based on the participant’s level of knowledge. The second was non-repetitive behavior, especially for the scenario of “Language friend,” where the robot repeated the same behavior to congratulate or indicate a mistake. Thus, a wider variety of actions should be designed and implemented for the robot.

Regarding negative attitudes towards robots, the results showed that in terms of interaction, participants had positive feelings. Surprisingly, participants were highly positive about the presence of emotions during the interaction. Thus, display of emotions and empathy was included in the final design implications.

Finally, users' perceptions of the robot were overall positive, especially regarding the robot's likeability and first impression. The robot's animacy and liveliness were also highlighted, which is extremely relevant for this study, since it supports the robot's cultural adaptation.

8 Design implications for a culturally aware robot

This section presents the design implications and use cases for a culturally aware robot that helps Arab immigrants adapt to their new culture. The words “use case” and “scenario” are used interchangeably to describe the context, goals and actions, and events of the interaction in which the robot will be assisting immigrants. The goals of the design implications are, first, to help design the behaviors of a robot that is culturally aware of Arab culture, and, second, to be inspirationally and technologically actionable for future work in the cross-cultural robotics field. This section explains the methods used to develop the design implications, the dimensions and framework established to transmit the design knowledge, and the design implications and use cases.

8.1 Methods

Design implications translate fieldwork and scientific literature to actionable and applicable design knowledge (Sas, Whittaker, Dow, Forlizzi, & Zimmerman, 2014). The process of generating design implications started with Related work Section 2 and the development of Pre-study Section 4, where initial data was gathered to create scenarios following pre-developed design guidelines. Additionally, the method for creating or picking social robot for diverse assignments of (Deng, Mutlu, & Mataric, 2019) (Figure 22), was used as inspiration for the structure of the design implications (Figure 23). This framework guides the writing and explanation of the design implications for every scenario.

The design implications that will be presented here combine two types of design implications: abstract functionalities and prescription. These terms are adopted from the taxonomy developed by (Sas et al., 2014). Abstract functionalities are, for instance, the displays of affective behavior based on social rules of the culture and the moment of the interaction. Prescriptions are a more specific type of strategy, such as the robot’s hugging the user when it recognizes sadness.

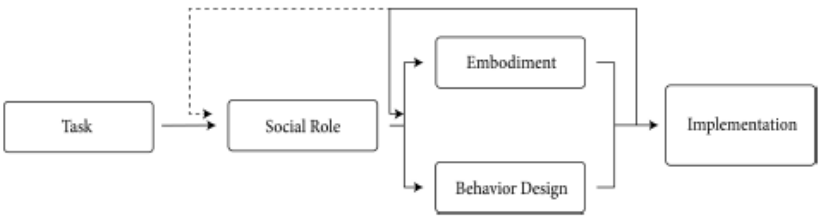

Figure 22. A characterization of the process of designing or selecting socially interactive robots for different tasks

(Deng et al., 2019, p.310)

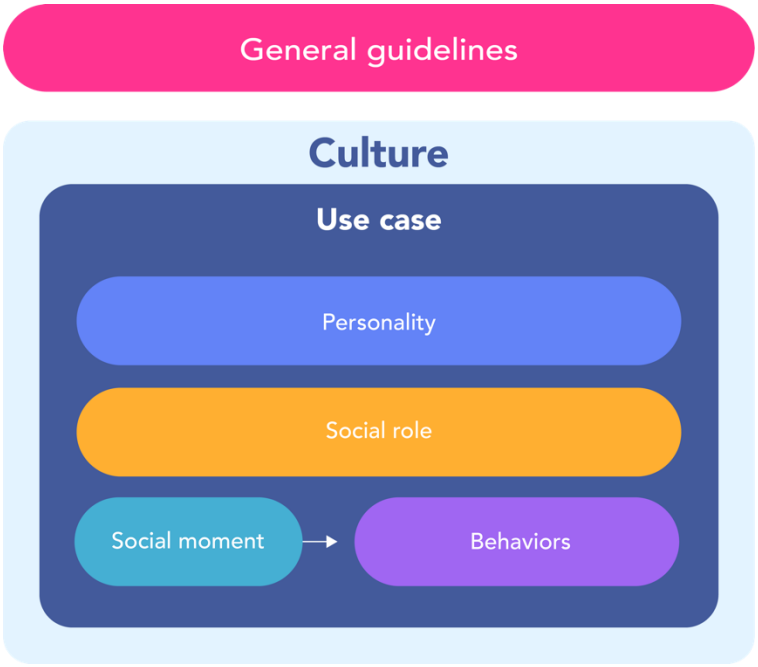

Figure 23. Design implications general framework for a culturally aware robot

8.2 Dimensions

The design guidelines consist of six dimensions that integrate multiple aspects of the human-robot interaction and create a culturally aware robot. The dimensions are general guidelines, use case (Deng et al., 2019), personality (Lacey & Caudwell, 2018), social role (Deng et al., 2019), social moment (Durantin, Heath, & Wiles, 2017), and behavior (Deng et al., 2019). These dimensions come from well-known concepts in the field; different sources use them in multiple ways. They are integrated to develop a framework (Figure 23) of design implications for further work with culturally aware robots. The framework starts by addressing the first dimension, general guidelines of HRI. These are a source of reference for achieving natural human-robot interaction. Afterwards, the users' culture needs to be established. The culture acts as a frame that encompasses the other dimensions and works as the primary dependent variable. Once the culture is established, the designers should select the use case or scenario where the robot is going to perform the interaction. The use case acts as a modifier of the social role, personality, social moments, and verbal and non-verbal cues. The verbal and non-verbal cues are the tangible and visible outcome of the robot's cultural adaptation and are organized by the interaction's social moments.

General guidelines: A large and growing body of literature has investigated human interaction with smart machines and interactive social agents. After multiple studies, researchers have compiled findings and insights from different perspectives of the interaction. For instance, (Amershi et al., 2019; Mavridis, 2015) developed a series of desirable strategies for guiding verbal and non-verbal human-robot interaction. Likewise,

(Amershi et al., 2019) created design guidelines for human-AI interaction. Even though neither of them considered culture as part of their recommendations, they generally strengthened the design implications that this research work proposes. Thus, in this section, we selected the most relevant and actionable guidelines from these different sources that match the findings and requests of the participants found in the empirical work.

Use case: Every type of interaction, human-to-human or human-to-robot, is influenced by context (Deng et al., 2019). All the circumstances that shape the settings of a situation influence the behavior of the robot as well.

The contextual factors of the interaction will be described here: first, the place or type of setting where the interaction will take place, such as a school, a supermarket, a library, or private or public space, and second, the functions or tasks the robot will perform, such as giving instructions, cheering up a user, or teaching new vocabulary.

Personality: Personality describes the perceptible and expressible qualities of an entity that are consistent, such as behaviors, displays of emotions, habitual patterns of thought, individual differences, and dispositions (Ruckert et al., 2013; Woods, Dautenhahn, Kaouri, Boekhorst, & Kheng, 2005). They support the interaction by *"providing consumers with clear mental models to help make sense of, and anticipate, the robot's behavior."* (Lacey & Caudwell, 2018, p. 27).

The development of robots' personalities in the field shows an inclination to import relational models and interaction templates from human-human interaction (Seibt, 2017). Personality is often described using imprecise terms that are comprehensible for people, for instance, "helpful," "friendly," and "talkative" (Lacey & Caudwell, 2018).
This dimension was not included in the initial reference model of (Deng et al., 2019) (Figure 22). However, previous research has demonstrated the value of considering this dimension in the design of HRI. This research will use the participants' preferences expressed in the design evaluation to establish the robot's personality in every use case.

Social role: The fourth dimension is the social role that the robot enacts in the interaction. *"Selecting the role is critical because it is closely tied to a robot's ability and approach to achieving its goals"* (Deng et al., 2019, p. 310). Generally, the designers choose the social role based on intuition following human social standards, and by reviewing literature and selecting roles that have been used in similar contexts and for

similar functionalities (Deng et al., 2019). This research work uses the organization theory of (Magee & Galinsky, 2008), which established three classes of social role: subordinate, peer, and superior. The selection is based on the findings of the design evaluation, the contextual factors, and functionalities of every scenario. Additionally, the social role includes the knowledge base of the robot, which allows it to fulfill its social role. For instance, if the robot has a role of peer/friend, it should have person-specific knowledge to demonstrate friendship.

Social Moment: This refers to the specific moment of the interaction in which the social interaction involves both human and robot and has pragmatic or semantic meaning. *"Social moments are brief events that occur during an interaction between two or more agents that have the potential to impact social dynamics"* (Durantin et al., 2017, p. 2)

Behavior: The last dimension of the framework is where cultural adaptation becomes visible and tangible. Behavior consists of verbal and non-verbal cues that are described based on the social moment of the interaction and includes a combination of factors such as dialogue, facial expressions, gaze, head and arm gestures, posture, proximity, and body postures, among others (Deng et al., 2019). The behavioral design of the robot is adapted to the social role, personality, and social norms of the user's culture.

8.3 General Guidelines

The following guidelines (Table 9) are a summary of recommendations that combine multiple scientific sources. They were established to create natural and pleasurable human-robot interaction. The guidelines presented here will be used in different scenarios to support the cultural adaptation of the robot.

Table 9. Summary of general design guidelines from the literature

General guideline	Description	Studies
1- Communicate with high-level dialogue	The type of utterances expressed by the robot should include multiple speech of act, for instance, informative utterances ("There is a box on the table"), directives ("Open the box"), expressiveness ("The box feels heavy"), and requests ("What is that box").	(Eric Deng, Bilge Mutlu, & Maja J. Mataric, 2019; Mavridis, 2015)
2- Mixed initiative dialogue	The dialogues should be initiated either by the robot or the user.	(Amershi et al., 2019; Mavridis, 2015)
3-Express emotion	The robot should perform affective interaction by recognizing the user's emotional states and displaying emotional behavior according to that.	(Eric Deng et al., 2019; Mavridis, 2015)
4-Multi-level learning.	The knowledge used by the robot to perform the interaction should be able to be updated after the code feeding information, by learning from user behavior, remembering recent interactions, and using online resources and services.	(Amershi et al., 2019; Eric Deng et al., 2019; Mavridis, 2015)
5- Multilingual capabilities	The robot should be able to support speech interaction in multiple languages as a basis of cultural adaptation.	(Mavridis, 2015)
6- Use natural cues.	To ensure a natural and smooth human-robot interaction, the robot ought to use the physical features of embodiment for the robot, for instance, gazes or gestures if the robot has arms, among others.	(Eric Deng et al., 2019; Mavridis, 2015)
7-Exhibit distinctive personality	The personality, as the demonstration of the perceptible qualities that reflect the essence of an entity, improves the human-robot interaction by giving users mental models of the robot and a clear sense of how to approach the robot.	(Eric Deng et al., 2019; Lacey & Caudwell, 2018; Seibt, 2017)
8-Develop social competencies	To develop social competence, the robot must match relevant social norms, considering the social and cultural context.	(Amershi et al., 2019)

8.4 Design implications for a Culturally aware robot supporting Arab immigrants

This section presents the specific design implications for a culturally aware robot that aims to support Arab immigrants in their first months of arrival to a new culture in three different use cases: “Hanging out,” “Shopping assistant,” and “Language friend.” Considering the supportive nature of the robot functionalities in these scenarios, the design guidelines use the social support taxonomy (Information, tangible, esteem, and emotional support) adopted by (Leite, Castellano, Pereira, Martinho, & Paiva, 2014). Furthermore, these design implications follow the general guidelines (Table 9) that were mentioned previously as a basis for creating a natural human-robot interaction.

Design implications for Hanging out scenario

The “Hanging out” scenario was designed to support the emotional needs of the user that are related to the social isolation and lack of socialization found in the studies. Here, the robot acts as a friend that cares about the emotional state of the user and reacts accordingly. This scenario can be applied in public libraries, common areas of universities, or spaces where immigrants may visit.

Table 10. Design implications for Hanging out scenario.

Use case: Hanging out		
Personality: The robot is talkative and loquacious; it is always saying something. It is expressive, and the use of gestures to support speech is frequent. Users must feel that it is easy to get along with the robot. It is humorous; the robot tells jokes to the user at appropriate moments. Most importantly, the robot is empathetic, supportive, and in tune with the user's emotional states (Leite et al., 2014).		
Social role: Peer-Friend (Magee & Galinsky, 2008). The robot has the same hierarchical status as the user, and its function is to emotionally support the user. With this social role, supportive emotional behavior is encouraged. A higher level of personalization is required with this social role. The knowledge base of the robot should be compounded by general and specific cultural information, and person-specific knowledge gathered from interactions with the user (Churamani et al., 2017). The robot should display memories of past interaction to demonstrate friendship-like behavior (Leite et al., 2014) .		
Social moments	**Behaviors**	**Example of implementations in the robot**
Greeting	Initiate the interaction by greeting the user with a welcoming attitude. If it is the first time the robot is interacting with the user, it should ask the name of the user; otherwise, it should greet the user by his/her name.	The robot offers a handshake to the user. (Intimate proxemic zone (Hall, 1966))
Recognize users emotional state	If the robot cannot read facial expressions, it should ask the user how they feel, showing interest. Staying in the intimate proxemic zone.	"How are you feeling today?"
Reaction towards negative emotions	Empathetic and supportive behavior, offering tangible and emotional support (Leite et al., 2014). A hug is culturally encouraged. As a non-functional touch-based interaction, a hug facilitates social connectivity and emotional support (Deng et al., 2019). After social touch, the robot should express goodwill.	The robot decreases the tone of voice, lowering head gesture. The robot should ask if the user wants a hug, and if the user accepts, the robot hugs the user. After, the robot says, "I hope you feel better soon."
React towards positive emotions	When the robot recognizes an expression of joy, it should attune to the emotional state of the user. Telling jokes is a normal attitude for Arab culture in this situation, and it will reflect the robot's joyful and humorous personality.	The robot says, "I am glad to hear (notice) you are feeling good". The tone of voice should increase and become more expressive, using more arm gestures. The robot utters a joke.
End the interaction	The robot lets the user know that it is the end of the interaction by expressing pleasurable and affective behavior.	"It was nice to see you today." Combine with affective and culturally accepted embodied cues like hugging, cheek kissing, or simply by waving hands.

Design implications for Supermarket Scenario

In the "Supermarket" scenario, the robot meets the need for guidance and assists users that have questions about products in a shop. The goal is to give the user autonomy in everyday life. As found in the studies, immigrants face many challenges by not knowing the local language; one of them is not being able to understand the differences between products (e.g., which is the box of milk without lactose). In this use case, the robot offers explanations for users' questions. This scenario can be applied in supermarkets, shopping centers, and retail stores.

Use case: Shopping assistant		
Personality: The robot is helpful, demonstrating care for the immigrant's needs. It is polite and respects the limits of its social role, and it recognizes the moment that it should end the interaction. It is confident with the information it is providing and empathetic by displaying understanding towards the doubts of the user (Leite et al., 2014).		
Social role: Peer-Assistance (Magee & Galinsky, 2008). Even though the robot has the same hierarchical status as the user, the relationship between the agent and the immigrant is less intimate, and the robot has more boundaries, which are reflected in the proxemic zones and allowance of social touch. The goal of the robot is to resolve users' doubts and guide the shopping activity. The robot's knowledge base should contain general and specific aspects of the culture and store's products' full data.		
Social moments	**Behaviors**	**Example of implementations in the robot**
Greeting and introduction	Initiate the interaction by greeting the user and introducing himself. The robot attitude is friendly and polite. Personalization factors like language are suggested. If the robot has a screen, it can show language choices for the user.	The robot waves its hand and says, "Hi, I am Nao." (Personal distance proxemic zones (Hall, 1966))
Recognize the needs of the user and offer support	If the robot is not able to recognize the state of doubt of the user, it should ask the user if s/he needs assistance, acting friendly and polite. Once the user has indicated their questions, the robot should display an empathetic and esteem-supporting attitude. (Leite et al., 2014)	"How can I help you?" After the user mentions their question to the robot: "Choosing milk is always confusing, but I am here to help."
Offers explanation	The robot should provide clear answers (information support (Leite et al., 2014)). At the end of the social moment, it should ask the user if they need more assistance.	Using indicative gesture to complement the speech. "Do you need help with something else?"
End the interaction	If the user does not have more questions, the robot should end the interaction. If the robot has mobility, it should leave the personal distance, allowing the user to continue with their shopping activities.	The robot utters a sentence of goodwill, "Have a good day," and does waving hand gestures.

Table 11. Design implications for Supermarket scenario

Design Implication Language Friend Scenario

The "Language friend" scenario was developed to help immigrants practice the local language and learn new vocabulary. The objective is to help people from other countries

to practice the local language of their new culture in their spare time or while they are not in an official language course. In this use case, the robot teaches new vocabulary according to the language level of the user. This scenario can be applied in public areas like libraries, where immigrants can go to learn new vocabulary of their own will.

Table 12. Design implications for Language friend scenario

Use case: Language friend		
Personality: The robot is friendly, making feel immigrants feel comfortable while learning a new language. It is empathetic; instead of focusing on the mistakes, it recognizes people's effort and sympathizes with the difficulty of learning a complex language. Nonetheless, it is also positive and encouraging, motivating people to try again, making sure they know it is ok to make mistakes. The robot is also joyful and dynamic. When it is time to acknowledge users' achievements, it will celebrate to make users feel motivated.		
Social role: Peer – friend (Magee & Galinsky, 2008). The robot has the same hierarchal status as the user, due to the positive effects of learning a language with a friend compared to a robot that behaves like a tutor (Zaga et al., 2015). In that sense, the robot's role is not to intimidate learners, but, rather, to encourage them and make learning new vocabulary a fun activity. The knowledge base of the user should be compounded with culture-generic and -specific information and constant data updates from the interaction, which would allow the robot to improve teaching cues by adapting to the user (Leyzberg, Spaulding, & Scassellati, 2014; Schodde, Bergmann, & Kopp, 2017). This adaptation will reflect the friendship of the social role.		
Social moments	**Behaviors**	**Example of implementations in the robot**
Greeting and introduction	Initiate the interaction by greeting the user with a positive and friendly attitude. The robot should mention the goal of the interaction and let the user select the level of difficulty of the words s/he is going to learn. The proxemic zone is social distance.	"Hello, let's practice some Finnish." Waving hand as gesture to support the speech.
Explanation	It is suggested that the robot supports the teaching of new vocabulary with a screen, to show visual content. Additionally, it is recommended that the embodiment of the robot is used as a learning feature.	If the users touch the hand of the robot, it will repeat the word, and touching its head will continue to the next word.
Reaction towards user's mistake	The attitude of the robot should be empathetic and encouraging, by uttering supportive sentences. The robot should have a wide set of gestures and sentences to perform in this social moment to avoid repetition, which would lead to a machine-like perception from the user. A cheerful attitude is a social norm in Arab culture. Using the user's name leads to potential learning gain (Leite et al., 2014).	"Sorry (Name of the user), that word is a bit hard, but let's try it again." Gestures like moving one finger from left to right to support the speech.
Reaction towards user's achievement	The robot should display a festive attitude towards the users' achievements. Arab culture is masculine, and recognition of success is socially encouraged (Hofstede, 2020) . The robot should have a wide set of gestures and sentences to perform in this social moment to avoid repetition, which would lead to a machine-like perception from the user.	Gestures like clapping, high five, or others that indicate celebration or success.
End the interaction	To end the interaction, the robot should congratulate the user for the job done.	"You did a great job today."And a final clap or display of effort recognition.

9 Discussion

This section discusses the findings on the design implications and use cases of a culturally aware robot helping Arab immigrants in their new culture in light of the scientific literature and previous work. Considering the sensitivity of the topic, here, we present ethical aspects found in the studies that should be considered when working with immigrants and culturally adapted robots. Furthermore, this section discusses the novelty, value, and limitations of this thesis work.

9.1 Design implications and use cases in light of the related work

In the last section, Design implications for a culturally aware robot, we presented three use cases with their design implications for a culturally aware robot. Here, we explain the most relevant findings of the design evaluation, which allowed us to develop the design implications and use cases.

Use case Hanging out

Many limitations arose when discussing the **validity and usefulness** of the "Hanging out" scenario. Firstly, the delicate nature of the use case, the need for socializing and belongingness, is recognized in psychology literature (Maslow, 1999) as one of the primary human needs and refers to the affective experience of social connectedness (Rettie, 2003). The ability of a robot to provide a sense of connectedness to immigrants requires more rigorous evaluation methods that evaluate related concepts of the experience, such as the sense of sharing and involvement (Bel, Smolders, K. C. H. J, IJsselsteijn, & Kort, January 2009). Furthermore, the interaction in this scenario was approximately one minute. Therefore, more extended interactions are required to validate the long-term value of the scenario, especially considering the novelty effect of interacting socially with a robot. As one participant explicitly noted, "*It's a new thing for us. It's not popular to have robots in our countries, so that will be very interesting*." Thus, the value of the scenario is not entirely validated.

In terms of **social touch**, which is presented in the "Hanging out" scenario with the "Handshake" embodiment cue, the literature describes the relevance of social touch in human-human interaction. For instance, (Gallace & Spence, 2010) explains that the sense of touch is an important channel of communication, and actions like handshakes can convey more information than language and prompt emotional experiences. Field (Field, 2010, p. 370) highlighted that *"touch is ten times stronger than verbal or emotional contact, and it affects damned near everything we do. No other sense can arouse*

you like touch". Hence, a handshake as an embodied cue should be part of the list of the design implications for this context of use.

Furthermore, one participant suggested a hug as part of the embodied cues for the robot. Despite its only being mentioned once, a hug is an essential type of physical contact in human-human interaction. (Forsell & Åström, 2012) explains that hugging displays empathy and can denote a psychological feeling of well-being; it is often a positive emotional experience. There is a large body of literature regarding this type of interaction in HRI (Yagi, Kang, Yu, & Mahzoon, 2019) and thus a hug was included as part of the design implications.

Use case Supermarket

The "Supermarket" scenario was validated by the participants. They found the support of a social robot in shopping activities valuable. Interestingly, one participant suggested that they should be able to select the language they want to use to interact with the robot. In this sense, the robot should have some level of personalization that allows the user to select the interaction's preferred language. Previous studies in human-robot interaction have proved the value of personalization in interaction. For instance, (Churamani et al., 2017) found that participants assessed a social robot as more intelligent and likable when the conversation was personalized.

In the speech interaction, participants highlighted the use of diectic gestures to support the speech as positive. This positive aspect can be explained by the list of desiderata for natural interaction between human and robots developed by (Mavridis, 2015), in which item (D6) *"Motor correlates and Non-Verbal Communication"* addresses robots' behavior where speech should be connected with embodiment cues. Therefore, the use of diectic gestures was included in the final design implications.

Use case Language friend

Participants were in consensus about the value provided by the "Language friend" scenario. The eagerness of participants towards a social robot as a language friend can be explained by the role the robot performed during the interaction. In this use case, the robot is a peer and learning companion. According to the literature (Belpaeme, Kennedy, Ramachandran, Scassellati, & Tanaka, 2018) this role has substantial advantages compared to the tutor-student role. Besides the less intimidating impression that a peer produces as opposed to a tutor, studies have found that practical benefits, such as longer periods of attention, and faster and more accurate responses, among others, can be found in learners who are exposed to peer robots compared to ones who in-

teract with teacher robots (Zaga et al., 2015). Furthermore, participants highlighted the social skills of the robot as a benefit compared to a computer or mobile application for learning language. This result is supported by the literature (Saerbeck, Schut, Bartneck, & Janse, 2010), which has demonstrated that the benefits of social interaction in learning between humans, in terms of cognitive and affective outcomes, are also translated to robot and humans.

Regarding the empathetic behavior of the robot in the "Language friend" scenario, the scientific literature supports this type of conduct for interactive social agents. (Leite et al., 2014) found that a social robot that can exhibit empathetic and pro-social behaviors is seen as equal, and users will, in due course, be enthusiastic about continuing to interact with it. Additionally, that type of action results in increased learning for the user.
Finally, the personalization factor, which also appeared in the "Language friend" scenario, was one of the suggested improvements. Several pieces of evidence showed an increase in cognitive learning advantages when robots customized content based on user performance during the interaction (Leyzberg et al., 2014; Schodde et al., 2017).

9.2 Contribution and novelty of the design implications

In this investigation, the aim was to assess use cases and design implications for a culturally aware social robot helping Arab immigrants adapt to their new home.

By conducting a pre-study with seven participants from Arab countries, we found that their most pressing needs are *socializing*, *support and guidance in everyday tasks,* and *practicing the local language*. That knowledge answered the first research question: **What are the needs of an Arab immigrant that could be supported by a culturally aware social robot?**

Additionally, the pre-study allowed us to develop three scenarios ("Hanging out," "Supermarket," and "Language friend") where the robot should support the target group. Furthermore, the findings of the pre-study combined with the literature in cross-cultural studies (Subsection 2.1) enabled the creation of a cultural persona (Figure 14), based on the method of (Lachner et al., 2015). Summarizing the most relevant Arab behaviors that the robot should adopt to demonstrate cultural awareness answered the second research question: **What behaviors from the Arab population are suitable for a culturally aware social robot?**

To answer the third research question: **What are the design implications and use cases for a culturally aware social robot that helps Arab immigrants adapt to their new culture?,** a design evaluation was conducted with five participants. That study found that participants validated the use of social robots to socialize, guide, and teach new languages to them. They also supported the affective and cultural behavior of the robot and made suggestions that contributed to the creation of the final design implications.

Additionally, this work contributed by creating **a design implications general framework (**Figure 23***)*** that serves a guide for developing culturally aware robots. This framework was based on the model of (Deng et al., 2019) (Figure 22), with an addition of a users' culture layer and a social robots' personality layer.

Designers and developers can select the culture they want to work with to create behavioral guidelines for specific use cases for specific cultures. Thus, this research's impact goes beyond the culture selected and can guide a wider work area in culturally aware social robots.

Previous design implications for culturally aware robots, like the ones created by (Šabanović, 2010), do not include any specific use cases or scenarios. Hence, this research work is the first comprehensive investigation of design implications and use cases for a culturally aware robot that helps immigrants; it combines use cases and behavioral settings beyond the typical specific behavioral experiments in cross-cultural design.

Moreover, before this study, social robots were used to provide support to vulnerable populations such as the elderly (Kolstad, 2019; Lane et al., 2016; Mcglynn, Kemple, Mitzner, King, & Rogers, 2014). However, very little work has researched immigrants as target users. Some studies (Carolis et al., 2019; Kim, 2016) use social robots to teach languages and communication skills. Nonetheless, socializing and being assisted by a culturally aware robot has not been documented before.

Finally, the adaptation of robots' behavior is mostly based on user behavior. However, the need to have emotional (Martins et al., 2019) and cultural (Šabanović, 2010) adaptation has received less attention, and the design implications of this work contribute to that field by developing specific guidelines to be culturally adapted and demonstrate affective behavior.

9.3 Ethical considerations

Overall, the findings of this work are encouraging for the creation of robots that are culturally aware and support immigrants. However, ethical concerns arose and are important to discuss and consider in future work.

First, the research itself presented significant challenges due to the sensitivity of the target group. Immigrants are outsiders who face challenges like discrimination. Consequently, the data gathering could potentially cause participants negative and unwanted experiences. Due to the sensitive nature of the study, we anonymized all the data, and stored it securely in servers of Tampere University.

Second, regarding the design implications, there are multiple ethical concerns to be addressed. For instance, when developing culturally aware robots, designers and developers should try to avoid creating robot behaviors that reinforce undesirable and unfair stereotypes, as indicated by (Amershi et al., 2019). Our work as cross-cultural designers is to create technology that improves people's lives and does not strengthen social biases.

Additionally, an issue that arose during the evaluations was the negative attitudes towards the social influence of robots and the replacement of human interaction. Even though participants were positive and demonstrated enjoyment during the interaction with the robot, in the NARS questionnaire and the interviews, they showed some worry about the consequences of implementing this type of solution. As stressed by Bekey, Lin and Abney (Bekey, Lin, & Abney, 2012, p.11), *"given the lack of research studies in these areas, it is unclear whether psychological harm might arise from replacing human's relationship with robotic ones."* As a result, the "Hanging out" scenario presents multiple risks, such as emotional dependence, which, at the moment, is not possible to calculate and should be considered if this scenario is implemented in real life settings.

9.4 Validity and limitations

The generalization of these results is subject to certain limitations. First, the lack of Arabic language in the robot's system limited the implementation of the scenarios, and thus, participants' assessment of the cultural adaptation of the robot could have been biased because of this factor.

Second, due to the target group's sensitivity, the study sample was small, seven participants for the pre-study, and five participants for the design evaluation; they all were

between 20-30 years old. More participants would have enriched the data, particularly a wider age range, and more comprehensive design implications could have been developed. However, it would have made the research process more complicated.

Notwithstanding these limitations, this study suggests the positive aspects of using a social robot to support Arab immigrants in their integration process. The validity of the findings is grounded in two ways. First**,** the findings were based on real target users, interacting with a working prototype, and second, the findings were supported by the literature in cross-cultural design and human-robot interaction fields.

It is acknowledged that the reliability of data analysis is always arguable. Qualitative analysis has a subjective nature, and the researcher's perception may affect the results, mostly when just one researcher conducts the analysis.

Finally, considering that this research work aims to produce generative instead of evaluative data (Höök & Löwgren, 2012), aspects like the effectiveness of using a robot to support immigrants instead of virtual agents or digital platforms were not assessed. There is a rich body of literature that has studied these aspects, and positive findings have been reported on the use of physically embodied agents. For instance, physically located agents are seen as "*independent agents pursuing their own goals, and seen as real-world, self-relevant stimuli. Proxemic relationships with these agents are dynamic and co-managed to follow human norms*" (Deng et al., 2019, p. 272). Likewise, in the education field, (Belpaeme et al., 2018) discovered that users who interact with physically embodied agents display learning gains.

9.5 Future work

The findings presented in this thesis create many questions in need of further investigations. First, long-term interaction between Arab immigrants and social robots is required to corroborate the value of the adaptation process to their new culture, the usefulness of the proposed solutions, and the novelty effect on the attitude towards the solutions.

Furthermore, specific studies that examine the cultural adaptation of the robot are required. The findings of the design evaluations indicated that some behaviors should be mimicked and others should be unique to the robot. Namely, a participant mentioned that a teacher in Arab culture could have a more aggressive way of teaching. However, she did not like that approach and preferred the robot's friendly way. Hence, examination to understand which robot behaviors should be mimicked and which should be de-

veloped as “robot culture” are needed. Likewise, future work should evaluate the design decisions to avoid cultural assumptions as addressed by (Šabanović, 2010).
Finally, a significant aspect in human-robot interaction, content and user personalization, requires more attention, as a way to improve the uniqueness of robot behavior (Grollman, 2018) and performance in the use case.

10 Conclusions

This study has identified four main results following a human-centered and constructive design research process. We conducted a pre-study with seven participants of the target group to gather data related to their needs as immigrants and the most relevant Arab behaviors that a culturally aware robot should consider. The pre-study contributed to the development of the first two outcomes of this research work.

First, the Arab cultural persona is a useful theoretical tool that includes the most relevant values, social norms, and cultural behaviors, and helps future interaction designers with developing or adapting existing solutions for users from Arab countries.

Second, the scenarios or use cases, where a social robot can support an immigrant's adaptation process to a new culture consisted of *Hanging out* (Socializing need), *Supermarket* (Shopping guidance need), and *Language friend* (Practice local language need). They represent the most relevant needs of an immigrant in their first months post-arrival.

After the scenarios were established, we conducted a design evaluation with five participants of the target group. These evaluations included working prototypes in live sessions with the participants. As a result, we developed the third and fourth outcomes of this work.

Hence, the third result is the design implications general framework, another theoretical tool that combines culture, use case, personality, social role, and behavior by social moment. This is a comprehensive framework that guides the practical development of design implication for specific cultures and specific contexts of use by indicating the most generally relevant aspects to consider when developing culturally aware robots. From that framework, the fourth outcome was created, the design implications for a culturally aware social robot helping Arab immigrants adapt to their new culture. Before this work, design guidelines that integrated culture did not combine use cases and behaviors or focus on specific areas of embodiment cues such as proximity. The presented guidelines are a unique combination of culture, use case, personality, and social role, delivering a more robust robotic platform that behaves according to the social moment of the interaction and responds to Arab social norms.

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12 Appendixes

12.1 Semi-structured interview pre- study

Questions for breaking the ice and Person-specific knowledge
1-What is your favorite food?
2-What do you do in your free time? What are your hobbies?

Questions for Culture-generic knowledge
3-Tell me a local tradition of your country that you wish you had here.
4-What is the most traditional food in your country?
5-What aspect characterizes your culture the most? Tell me what the people are like there.
For example, in Colombia, we are known for our love of dancing Salsa and we start dancing as children. (This comment is in case the participant does not understand the question)
(Does your country have special costumes, particular clothing, like a hat or traditional shoes?) (This is an extra question if the participant does not share many details in the previous one)

Questions for Culture-specific knowledge
6-How do people in your culture say hello to each other? Any specific gesture?
(For example, in Colombia, when we say hello to a person, we give them a kiss on the cheek)
7-Do you celebrate international traditions, for instance, Christmas?
8-What is the most important celebration in your culture and how is it celebrated? (Question about theit psychological needs)
Let's talk about the differences between your culture and Finnish culture.
9-Can you tell me about a difference between your culture and Finnish culture?
10-What cultural differences were or are still hard for you to understand?
11-What kind of difficulties did you face in language learning?
12-What about the problems in acculturation and adaptation?
13-During the first months in Finland, what you would have liked to have been different?
14-Do you feel you are treated differently here than in your culture?

Questions about technology
Let's talk about technology now.
15-What technological devices or apps did you use or still use for cultural adaptation?
16-Does your culture have any personal beliefs against robots?

Finally, let's see Nao the robot.
17-What is your general impression of Nao the robot?
18-Do you have any particular expectations about the future design of a robot that understands your culture?
19-How do you think a robot can be helpful in the adaptation process of an immigrant if it understands the culture of the person?

12.2 Semi-structured interview scenario 1

1: What do you think about the tasks the robot was performing to socialize? (Hand shaking, playing a song, offering candies, telling a joke)
2: Are those tasks suitable for the scenario? Would you add or remove any of them?
3-Do you feel the robot behaves according to your culture? Please explain.
4-What do you think of the behavior of the robot for the different emotional states?
5-Would this scenario be better for you if you could interact with more people and the robot? Explain why.
5-Is there something that you would like to add to improve the cultural and emotional adaptation skills?
6-Is there something that you would remove completely?
7-Do you think that a robot with social skills and cultural/emotional capabilities can help an immigrant adapt more easily to a new country?
9-Do you feel this scenario, socializing with a robot, makes you feel that the robot cares about you?
10-Would you feel less isolated in society if you could hang out with a robot?

12.3 Semi-structured interview scenario 2

1-Do you feel the robot behaves according to your culture? Explain why.
2-How relevant do you find the robot's offering help instead of waiting to be asked for help?
2-Is there something that you would like to add to improve the cultural adaptation skills?
3-Is there something that you would remove completely?
4-Do you think that a robot that can assist in the supermarket can help an immigrant to adapt more easily to a new country?
5 Would there be other tasks/roles like this for the robot in the future? Where could it help you?
6-Do you feel that a robot assistant in a market would give you more autonomy in daily life, which might be difficult when arriving in a new country?

12.4 Semi-structured interview scenario 3

1-Do you feel the robot behaves according to your culture? Please explain.
2-Do you feel that dancing was a way to congratulate you according to your culture?
3- Do you feel that the gesture made to tell you the answer was incorrect accords with your culture?
4-Is there something that you would like to add to improve the cultural adaptation skills?
5-Is there something that you would remove completely?
6-Do you think that a robot that can practice Finnish with you can help an immigrant adapt more easily to a new country?
7-What other ways to practice Finnish with a robot would you find relevant?
8-Do you feel that practicing language with a robot can help you learn and improve your skills?