

# Equality and Hierarchy in Human-Robot Interaction

## ABSTRACT

Advancements in artificial intelligence and robotics have created opportunities for robots to evolve into more socially-oriented agents. Because of this many relationships between robots and humans have shifted towards partnership. In order to create these partnerships and have them be accepted by the human partners the robotic system must interact in a way that is synonymous with the human's relationship with other humans. In order to create these kinds of partnerships factors such as culture, personality, and cognition need to be addressed. This discussion focuses on cultural challenges, specifically regarding equality and hierarchy in human-robot relationships.

## INTRODUCTION

In recent years, it has become increasingly clear that certain cultural constructs affect humans' perception and interaction with robots. For example, it has been found that national culture relates to attitudes toward robots (Bartneck, Suzuki, Kanda, and Nomura 2007). This connection may also be extended to humans' satisfaction and trust in their robot counterparts (Li, Rau, and Li 2010). Despite their usefulness in defining human-robot relationships, these findings are limited in that they treat each cultural construct as a separate entity. Humans' perception and interaction with robots may be more completely understood if explored at the intersection of multiple cultural constructs.

In the literature surrounding culture and its measurement, the joining of two common concepts, individualism/collectivism and power distance, has been explored in order to establish more intricate dimensions of culture. We seek to examine these dimensions and propose ways in which they may apply to human-robot interaction. In order to do so, we will first define national culture and explore how it affects human-robot interaction. We will then explore individualism/collectivism and power distance and their respective effects on human-robot interaction. Finally, we will explore the merging of these two concepts how the resulting dimensions may impact human-robot interaction.

## NATIONAL CULTURE IN HUMAN-ROBOT INTERACTION

National culture is defined as the cultural norms and average levels of cultural dimensions for a nation (Wang et al. 2010).

Cultural norms include social norms such as values and customs that a society adheres to (Sherif 1936). Cultural dimensions can be seen as measures of culture that group people into categories based on similarities. Scholars such as Geert Hofstede popularized the use of cultural dimensions by establishing them according to theoretical relevance and statistical relationships, thus finding an easy way to group nations into categories (Hofstede 1983).

National culture has been historically explored in social psychology and sociology as a way to examine how humans' behaviors vary from nation to nation (Sapir 1924). With the advent of robotics, examination of national culture shifted to include how human-robot interaction varies internationally. Humans are generally expected to interact with robots in ways that correspond to their national culture norms (Wang et al. 2010). As such, attempts have been made to differentiate between various human-robot interactions across nations and categorize these interactions with the same dimensions used to describe cultural differences in interactions between humans.

Several dimensions of culture have been examined in human-robot relationships, the most thoroughly-explored dimension being individualism-collectivism, also known as the "tightness" of a nation, or the extent to which members are concerned about their nation versus themselves (Li, Rau, and Li 2010). Other dimensions explored include power distance, uncertainty avoidance, masculinity-femininity and long-term orientation. While each of these cultural dimensions may have the potential to provide insight to human-robot relationships, the scope of this paper is only concerned with individualism-collectivism and power distance, where power distance is the distribution of power between members of a society (Hofstede 2005).

Specifically for this paper, the intersection between individualism-collectivism and power distance is where the hierarchy and equality lie. It is because of this intersection, and the lack of research in this area, that this paper was written. The reason for this focus is that the causes of the hierarchy and equality in cultures have been attributed to these two measures, though it is not known exactly why. Finding this why, and applying these measures to the human factors field, is necessary to develop the information and to make systems that are more user friendly, which is a necessity in this day and age.

## **Individualism and Collectivism in Human-Robot Interaction**

As we stated previously, individualism-collectivism refers to the “tightness” of a nation, or whether or not the nation and its people are more focused on themselves or their collective group (Triandis 2004). People from nations high in individualism (e.g. USA and Germany) do not identify with fellow citizens as strongly as people from nations high in collectivism (e.g. Korea and China). Collectivistic nations are thus more group-oriented and tight-fitting. If individualism-collectivism was considered in a human-robot relationship, a person from a nation high in individualism may treat the robot less inclusively, while a person from a nation high in collectivism may treat the robot more inclusively.

It has been suggested that individualism-collectivism contributes to attitudes toward robots (Wang et al. 2010), though individualism has not been isolated in studies of culture and human-robot interaction. One study has found that people from nations higher in collectivism (e.g. Korea and China) found robots more likeable and trustable than people from a nation higher in individualism (Germany). Whether or not this variation in attitude is due to individualism-collectivism is unclear. Future research is needed to determine how individualism-collectivism specifically impacts human-robot interaction.

## **Power Distance in Human-Robot Interaction**

Power distance refers to the distribution of power in a society; specifically the extent to which the less powerful members of a society accept and expect that power is not distributed equally (Hofstede 2005). For a nation with high power distance, the hierarchy of power is strictly enforced, and there is a clear difference in level of authority. For one with low power distance, there is more of a focus on equality in all persons. If this cultural dimension was considered in a human-robot relationship, we would expect the following: if a robot is programmed to be hierarchically equal to a human and is placed with a person that has a national background with high power distance, the person will not be able to utilize the robot to the full extent of its ability due to the fact they will not view themselves equal to the robot. Conversely, if a person with a national background with low power distance tries to interact with a robot that isn't built to be in equal standing, they may not find their interaction with the robot completely fulfilling.

The effect of power distance on human-robot interaction is unclear. While human-robot interaction in cultures of varying degrees of power distance have been explored, whether power distance itself affects these interactions hasn't been said. For example, one study found that people from Germany are less trusting of robots than people from China (Li, Rau, and Li 2010). While Germany is considered to have lower power distance than China (Hofstede 2004), it is unclear if this matters in the context of human-robot relationships or if we can attribute a person's trust of a robot to the power distance of his or her nation. More research is needed to understand if and how power distance may impact human-robot interaction.

## **THE INTERSECTION OF INDIVIDUALISM AND COLLECTIVISM**

While it is unclear whether the individual dimensions of individualism-collectivism and power distance impact human-robot relationships, we posit the two dimensions may jointly impact human-robot interaction. These dimensions have been examined together in social psychology, and it has been shown that the intersection of individualism-collectivism with power distance results in a multi-dimensional measurement of culture that explains more variance across nations. Thus, there is reason to believe they may explain more variance in human-robot relationships.

The work of Singelis, Triandis, Bhawuk and Gelfand (Singelis et al. 1995) serves to merge individualism/collectivism and power distance into a multi-dimensional construct with four independent categories: horizontal individualism (HI), vertical individualism (VI), horizontal collectivism (HC), and vertical collectivism (VC). While similar to traditional power distance which explains the distribution of power within a system, horizontal/vertical cultures refer to the perception of equality amongst individuals (Fiske 1992). In a dyadic setting, citizens of a country which displays HI (e.g. Denmark) are more likely to strive for personal gain without interfering with equality. In VI countries (e.g. USA), individuals are interested in gaining status and do not take the desires of the group into consideration. In HC countries (e.g. China), individuals feel a shared similarity among those in the group and are willing to work together, however, they are not afraid to question those of a higher status. Finally, VC countries (e.g. India) exhibit a shared similarity to the in-group and are willing to surrender their desires if it means that the group benefits.

These distinctions raise specific implications, particularly for knowledge sharing and acquisition. For instance, HIs are more receptive and likely to transfer knowledge which is independent of context, explicit and logical, VIs prefer information which is linear and explicitly logical, HCs prefer knowledge which is implicit, systemic, and historically grounded, and VCs prefer knowledge to come from individuals of high status (Bhagat, Kedia, Harveston, and Triandis 2002). These different tendencies toward knowledge sharing may affect humans' acceptance of robots, particularly if the robots communication style differs from that of the person interacting with it.

In fact, it has been found that knowledge sharing preference matters in human-robot interaction. A study exploring individualism-collectivism and communication (as implicit vs. explicit knowledge sharing) found that people of cultures who value implicit communication are more likely to heed the advice of robots who communicate implicitly, while people of cultures who value explicit communication are more likely to heed the advice of robots who communicate explicitly (Wang et al. 2010). The very same study indicated that individualism-collectivism alone did not explain why some people chose to heed the advice of the robot and others didn't. It was the more complex dimension of communication type (which, in our context, can be represented by the intersection of individual-

ism-collectivism and power distance) that predicted the interactions between humans and robots.

While individualism-collectivism has gained much traction in research, its connection with power distance has not. And neither of these measures has gained a large amount of research in the human-robot interaction field. This could be due to the fact that the human-robot interaction field has only begun to connect itself with human-human interaction cultural research and information. While we cannot directly connect the human-human interaction research with human-robot interactions, there is not enough human-robot interaction research done with cultural measures to make conclusions using purely human-robot interactions.

## CONCLUSION

The exploration of individualism-collectivism as horizontal and vertical dimensions hasn't gained as much traction as the exploration of other cultural dimensions. Furthermore, literature on culture in human-robot interaction hasn't expanded to include such complex dimensions as horizontal and vertical individualism-collectivism. However, this area promises to be an informative path of research. It has already been shown that individualism-collectivism and power distance affect humans' perceptions of robots. It has also been shown that knowledge sharing preference, a characteristic that emerges at the intersection of individualism-collectivism and power distance, affects humans' willingness to heed a robot's advice. What remains to be shown are the many other implications that horizontal and vertical individualism-collectivism may highlight in human-robot interaction. Further research of these cultural constructs is needed to allow the field to gain a better understanding of the complex cultural constructs that affect human-robot interaction.

This kind of research could greatly increase our knowledge of human-robot interaction. By analyzing the interaction using human-human interaction measures we will be able to draw more long term conclusions and create systems that allow for more effective human-robot interaction.

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