Computers in Human Behavior 29 (2013) 1091–1101

Contents lists available at SciVerse ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

# Am I acceptable to you? Effect of a robot's verbal language forms on people's social distance from robots

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ARTICLE INFO

*Article history:*
Available online 6 November 2012

*Keywords:*
Social distance
Human–robot interaction
Robots' verbal language
User acceptance

ABSTRACT

This study is to examine the effect of robots' language forms on people's acceptance of robots. We applied a concept of social distance to measure people's acceptance of robots. In an experiment, calling participants by name vs. not calling by name as well as the robot's speech styles (familiar vs. honorific), were used to impose a verticality and horizontality of social relationships between participants and robots. After the conversation with a robot, participants rated the robot's interpersonal traits and their comfortable approach distance to the robot, and their response to the robot during the experiment were analyzed. As a result, participants whom the robot called by their name perceived the robot as friendlier. They introduced themselves more actively, and were more intently focused on what the robot said. They asked the robot questions more frequently. Participants called by their names consequently approached the robot more closely than participants who were not called. An interaction effect was found between speech styles and whether names were used in regard to the perceived friendliness of robots, negative response to robots, and comfortable approach distance to robots. We discuss verbal interaction design for increasing people's acceptance of robots.



## 1. Introduction

As the role of robots for providing diverse types of support in our daily life increases, appropriate ways to establish user acceptance of robots should be examined. Robots as appliances or products can be experienced by multiple aspects, such as its pragmatic and hedonic attributes (Hassenzahl, 2004), and aesthetic, meaning, and emotions (Desmet & Hekkert, 2007). Fong, Nourbakhsh, and Dautenhahn (2003) argued that the primary function of socially interactive robots is to interact socially with people. Computer as Social Actors (CASAs) paradigm, in particular, suggests that people tend to perceive robots as social actors with identities separate from other persons' identities (Nass & Moon, 2000; Nass, Steuer, & Tauber, 1994). Research has argued that the major reason of CASA is that people unconsciously tend to find cues which are socially interpretable and autonomously react to those cues in social manners (Reeves & Nass, 1996). This phenomenon has suggested pros of applying social cues based on customs, social structures, and shared knowledge in a pragmatic perspective such as reducing people's cognitive load of understanding complex manuals for technology usage.

In this study, we investigated how to increase people's acceptance of a social robot by considering the concept of social distance. Social distance has been used as a way to estimate the social relationship between two persons (Bogardus, 1947; Poole, 1927), because social distance is defined as a condition produced by a social relationship (von Weise & Becker, 1932). Social distance is affected by each individual's social identity, relative status, affectivity, cultural similarity, and so on (Karakayali, 2009). Among these factors, intimacy and status, which represent the horizontal and vertical axes of social relationship, affect interpersonal attraction, which is related to how much we like, love, dislike, or hate someone (Berscheid, Walster, & Hatfield, 1969). Intimacy is a key factor in terms of developing and maintaining interpersonal relationships (Bordens & Horowitz, 2009). It describes the emotional closeness of interpersonal relations and the valence of feelings and behavior (see Hall, Coats, & LeBeau, 2005). In the case of relative status, the vertical dimension of social distance, people become involved with others who have a status that is closely matched to their own (Bordens & Horowitz, 2009). How, then, can those factors be applied to the relationship between humans and robots? Will those factors work in similar ways in the relationship between humans and robots? Furthermore, the ways of representing intimacy and relative status are various: interpersonal affectivity (Bogardus, 1941; Karakayali, 2009), social roles (Bochner, 1982; Kadushin, 1962; Schmitt, 1972), interpersonal

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http://dx.doi.org/10.1016/j.chb.2012.10.001

similarity (Heider, 1958; Miller, Downs, & Prentice, 1998; Tesser, 1988), belongingness (Heider, 1958; Sumner, 1906), etc. What is the most appropriate and effective way to express intimacy and relative status between humans and robots? Research in human–robot interaction shows that dialog has a greater effect than the robot's appearance on people's perception of robots (Kiesler & Goetz, 2002). With a development of robotic technology, human–robot interaction through natural language is expected. Therefore, an optimum combination of language forms need to be investigated in order for robots as social robots in our daily live to be socially accepted by people. This study explored two factors of language forms: whether or not robots call people's name (intimacy) and whether robots speak with familiar or honorific speech style (relative status).

We defined social distance between people and robots as people's psychological boundary in a social relationship with a robot. Three phases of social distance were measured to identify how well people accept a robot: people's perception of the robot's interpersonal traits (perceived social distance), people's verbal responses to the robot (expressed social distance), and people's comfortable approach distance to the robot (undergone social distance).

## 2. Social distance between humans and robots

### 2.1. Definition of social distance

The term "social distance" was first used by Tarde (1903) in sociology. He treated the concept of social distance as the distance that exists between social classes, and stated that it is measurable by the degree of imitation existing between them. Social distance cannot be defined as one clear concept, because it includes too much, such as the relationships between individuals within groups, between individuals and others, their behavior towards others, or their social acts, group prejudice, cultural difference and group interaction (Poole, 1927). Nevertheless, many researchers in sociology have finally come close to concluding that social distance captures consciousness-of-kind among people's sociological attributes (Giddings, 1911; Rummel, 1976).

Bogardus (1947) provided another point of view on social distance, which focused on people's subjective attitudes, such as warmth, intimacy, indifference, and hostility in interpersonal relationships, measuring social distance, in a range extending from exclusion to a very close relationship. Hall (1966), who suggested the concept of proxemics, argued that people have a personal space where they feel discomfort, anger, or anxiety when that space is invaded. The size of an individual's personal space is subjective, and depends on the relationship between the two persons who are interacting.

In this sense social distance can be understood as an indicator of a balanced tension between personal intimacy and boundaries between people. The definition of social distance between humans and robots that we define and implement in our research is the following: *social distance is the individual's psychological boundary between self and a robot.* It is the result of a dynamic interaction between factors based on a person's prior experience with the robot, gender and age, and the robots' attributes (e.g., physical appearance and interaction cues). The social context of the interaction (e.g., frequency of interaction, type of task, and physical environment), also contributes to social distance between humans and robots. Because social distance borrows the concept of physical distance, which represents spatial relations, it can be used to visualize and compare the grades of understanding and intimacy which characterize personal and social relations generally (Park, 1924).

### 2.2. Three dimensions of social distance between humans and robots

As mentioned above, the concept of social distance has various aspects to consider. According to Bichi (2008), subjective social distance refers to an individual's perception of others, and is generated in the processes of social interaction. Objective social distance is identified both by the knowledge that society socializes its members, such as the social stock of knowledge (Berger & Luckmann, 1966), and by the physical organization of the space in which their relationships are built. On this premise, he suggested three modalities of the construction/reproduction process of subjective social distance as follows: a perceived social distance (pSD), which is distinct and recognized as such by one who experiences it; an expressed social distance (eSD), intentionally put in practice as an action of distancing oneself; and undergone social distance (uSD), the result of the distancing action.

Those three concepts of social distance relate to the three levels of the cognitive process by which humans respond to their environment (Card, Moran, & Newell, 1983; Norman, 2004): visceral, behavioral, and reflective. Based on this, Kim and Kim (2005) schematized the PCA model for human–robot interaction: in the model, they suggested that both humans and robots possess the ability for P (perception), C (cognition), and A (action), and follow the PCA cycle as they alternate between independent and interdependent action. From Bichi's three dimensions of social distance, pSD corresponds to perception, eSD to action, and uSD to cognition. In this sense, pSD is on the basic level of information processing which involves direct sensory gratification, while uSD involves higher level cognitive elaboration, linking the individual experience to surrounding contexts such as societal, cultural, and historical context (Schifferstein & Zwartkruis-Pelgrim, 2008).

#### 2.2.1. Perceived social distance

Hassenzahl (2004) argued that when individuals first come into contact with a product, each individual perceives the product's features such as content, presentation, functionality, and interaction, and then constructs a personal version of the product character. This phase bears resemblance to the visceral level of information processing which indicates human perception. Perceived social distance, on the other hand, may depend on the robot's characteristics as perceived by humans.

#### 2.2.2. Expressed social distance

Expressed social distance is likely to be revealed by an individual's behavior toward others. Hess (2000) focused on people's distancing behaviors and listed distancing tactics which refer to the specific behaviors used to accomplish distancing strategies such as avoidance, disengagement, and cognitive dissociation. Avoidance has five tactics, one of which is ignoring the other person when in her or his presence. Seven ways of disengagement include avoiding intimate topics of conversation, deceiving the other, etc. There are three tactics that refer to cognitive dissociation, such as mentally derogating the other.

#### 2.2.3. Undergone social distance

In a specific usage/interaction situation, people may judge a robot's appeal, their satisfaction, and their social relationship with the robot. To measure social relationship between two people, the concept of Hall's proxemics (1966) has been used. Regarding the use of physical space between two people in interpersonal communication, he divided physical distance into four types: intimate, personal, social, and public distance. Intimate distance is for embracing, touching, or whispering. Personal distance is for interactions among friends or family members, and social distance for interactions among acquaintances. Public distance is used for