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Research Report

Cross-cultural comparison of hand gestures of Japanese and Germans for tabletop systems

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ABSTRACT

Goal was to study cultural differences between Japanese and Germans gesture use when interacting with a map and a video walkthrough application for a table top system. Japanese and Germans' choice of gestures was compared in a quasi-experimental design. Gestures had to be generated for two different scenarios, an electronic map and a video walkthrough. Data revealed that physical aspects of hand gestures such as hand shape, focus on motion pattern, and preference of simple, one-hand gestures are similar between Japanese and Germans. However, Japanese and Germans differed in the choice of symbolic and metaphorical gestures and in the frame of reference and perspective taken for performing gestures. Furthermore, differences between Germans and Japanese were larger for the map application than for the video walkthrough. Culture partly affects the choice of hand gestures for table top systems. Designers of gesture vocabularies for tabletop systems have to carefully consider which referents are carried out by hand gestures alone. Gesture input appears to be appropriate for the direct manipulation of objects or real world applications. However, abstract functions or artificial realities should not be handled by gestures alone. Also, designers should consider the development of culture-centered interfaces.

1. Introduction

The way we interact with the technical devices that surround us in everyday life has changed tremendously over the decades. In order for users to work with these devices smoothly, effortlessly and effectively, the user interface – the communication gateway between user and technical device – has to be natural, intuitive and self-explanatory. Recent research has focused on the development of user interfaces (UI) that provide a natural human input experience through hand gestures (e.g., Buchinger, Hotop, Hlavacs, Simone, & Ebrahimi, 2010; Derboven, De Roeck, & Verstraete, 2012; Koike, Nishikawa, & Fukuchi, 2009). This so-called Gesture Interface (GI) is able to recognize and interpret a specific set of gestures performed by a human user. Gesture recognition systems use mathematical algorithms to analyze the shape and movement of the user's hand and match the performed gesture with a predefined set of gestures, the so-called gesture vocabulary.

Gesture input is seen as a "natural way of communication" because humans use gestures in everyday face-to-face communication as well (Karam & Schrafel, 2005; Widgor & Wixon, 2011). However, gestures are not natural per se. The first steps towards creating guidelines have been made; however, a lack of well-known standards for the design of GI makes research in this area very valuable. Previous studies have shown that participants' choice of gesture is affected by personal characteristics such as expertise, general knowledge, cultural background (Mauney, Howarth, Wirtanen, & Capra, 2010; Wobbrock, Morris, & Wilson, 2009) and characteristics of the referent such as task complexity, context, and size of the manipulated object (Kühnel, Westermann, Hemmert, Kraty, Müller, & Möller, 2011; Urakami, 2012). Even though it is widely accepted that cultural background has an effect on the use of gestures, not many studies have been conducted in this regard. In order to make gesture interaction with technical systems natural and intuitive, gestures have to be consistent with and be compatible to their conventional meaning and use in everyday life settings. By studying the use of gestures of participants from two different cultures, Japan and Germany, the current study intends to improve our understanding of cultural differences in gesture-based communication between humans and technical devices. Furthermore, participants' choice of gestures was analyzed for two different settings, a map with basic navigation functions and a video application, for navigating in a specific environment.

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1.1. Cultural differences in human–computer interaction

Technology is a product of a specific culture and therefore should be studied in connection with a culture's value orientation, moral, world view, self-perception, and communication practice (Inkster & Satofuka, 2000). For that reason some authors have argued in favor of culture-centered design (e.g. Barber & Badre, 1998; Choi, Lee, & Kim, 2006; Xie, Rau, Tseng, Su, & Zhao, 2009). Cultured-centered interfaces make use of the shared knowledge of a target culture and incorporate culture specific symbols, metaphors and conventions into interface design. A general guideline for choosing gestures for a GI is "semantic intuitiveness". Gestures must have a clear cognitive association with the semantic function they perform (Stern, Wachs, & Edan, 2008). However "intuitiveness" is strongly associated with the cultural background and general knowledge of the user. Therefore, cultural differences in choice of gestures for a GI are very likely expected.

So far, research in this area has generated varying results. Previous research has shown culture specific preferences in interface design (Evers & Day, 1997; Xie et al., 2009). Cultures differ in color associations, preferred text layouts, and the use of icons or metaphors. For example, van der Sluis, Luz, Breitfuß, Ishizuka, and Prendinger (2012) found differences in the perception of "human likeness" of a virtual agent between Japanese and Irish participants. Shen, Woolley, and Prior (2009) tested a "Chinese Garden" metaphor as alternative interface to a "desktop" metaphor and received a positive feedback from Chinese users.

However, Pappachan and Ziefle (2008) studied the comprehensibility of icons and found that independently from culture, the detailed nature and concreteness of the icon was responsible for its comprehensibility. Mauney et al. (2010) conducted a cross-cultural comparison of user-defined gestures for touchscreen interfaces. Overall a high level of agreement in the choice of gestures across cultures was observed. The only difference found was that Chinese participants generated more symbolic gestures than participants from other countries such as Finland, France, Germany, India, Spain, the UK and the US.

Since previous research has shown that cultures differ in preferences and technology usage, I will focus in the following on cross-culture research in psychology that might explain why those differences occur.

1.2. Effect of culture on gesture communication

Gestures are a natural form of expression (Kendon, 2004) and are partly universal, and partly culture-specific (Streeck, 2009). The environmental and cultural setting affects what gestures are drawn from our physical experience. Gestures are acquired in interpersonal discourse during the course of daily lives. Thus, gestures are deep-seated upon knowledge of personal, physical and cultural interrelations. Resent research in cross-cultural psychology implies that people from the East (e.g., Japan, China, Korea) and people from the West (people of European decent, e.g., German, U.S. American, Canadian) perceive and process the world differently (see an overview in Heine, 2012). In our current study we compare gestures between Japanese and German users. These two countries are comparable in living standard, education level and technological advancement, but differ in the way of thinking, self-concept, and communication practice.

1.2.1. Way of thinking

Nisbett (2003) distinguishes two different ways of thinking, the analytic approach and the holistic approach. Analytic thinking focuses on the application of abstract rules and is a theoretical way of thinking. The world is perceived as consisting of concrete objects that exist independently from their context. On the other hand holistic thinking focuses on the relationship between objects and is an associative way of thinking. Objects are seen in their relationship to their context. In a study by Ji, Zhang, and Nisbett (2004) participants were given three words like "monkey" "panda" and "banana", and were ask to choose two words that were most closely related. Westerners tended to choose "monkey" and "panda". This answer is a typical taxonomic categorization since both words belong to the category "animal". Easterners on the other hand choose more likely "monkey" and "banana". This answer is a typical thematic categorization based on the relationship among them, because monkeys like bananas. Numerous similar kinds of studies (e.g., Nisbett, Peng, Choi, & Norenzayan, 2001; Norenzayan, Smith, Kim, & Nisbett, 2002) revealed the same answering pattern showing that Westerners apply more likely the analytic way of thinking whereas Easterners more likely apply the holistic way of thinking.

The way of thinking can have an impact on participants' gestures in the current study. Participants might choose different gestures if they belief that the object that has to be manipulated by a gesture exists independently from the context or is related to the context.

1.2.2. Self-concept

Cross-cultural assessments of peoples' self-concept suggest that people see themselves in at least two different ways, being "independent" or "interdependent" (Markus & Kitayama, 1991). The *independent self* believes in its own uniqueness, and autonomy. The *independent self* looks at the world from an "I" perspective putting oneself in the focus of attention and describing oneself in terms of individual attributes. The *interdependent self* sees itself in relationship to others and describes itself in roles and relations to others. The *interdependent self* takes the "me" perspective believing that the own behavior is determined by the perception of what others think, feel or how they behave in a relationship. A widely used self-assessment is the Twenty-Statement Test (Kuhn & McPartland, 1954) in which participants describe themselves in twenty statements. Westerners (e.g., Canadians, Swede, Australians, U.S. Americans) focus more strongly on the *independent self* by describing themselves in single attributes such as "I am creative", "I like ethnic music" or "I am humorous" (Bochner, 1994; Ma & Schoeneman, 1997), whereas East Asians (e.g., Chinese, Koreans, Japanese) focus more strongly on the *interdependent self* by describing themselves in terms of roles and relationships to others such as "I am an older brother", or "I am a member of the tennis team" (Bond & Cheung, 1983; Rhee, Uleman, Lee, & Roman, 1995). The nature of self affects the way how we communicate with each other and is therefore relevant for the information exchange with technical devices. Different views of the self can affect participants' perspective and the role they assume when generating gestures for a table top system.

1.2.3. Communication

Hall (1976) distinguishes between low context and high context cultures. In a low context culture (e.g., Germany) the speaker has to express explicitly what he/she means. The topic is handled in a straight forward manner and needs and wants are verbalized. The goal of communication is exchanging information. In contrast, in a high context culture (e.g., Japan) information lies in the context and does not need to be spelled out explicitly. The speaker does not say what he/she assumes the receiver already knows. It is also necessary to understand what has not been said, to "read the air" (Ishii, Reyes, & Kitayama, 2003). The goal of communication is building relationships to others. It is difficult for the speaker to speak without receiving feedback (Miyamoto & Schwarz, 2006). Consequently it is believed that communication in a computer mediated space might be more problematic for Japanese since it requires stating one's own position explicitly and often lacks appropriate feedback (Nojima, 1994).