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How Far Is Far Enough?

A Measure of Information Privacy in Terms of Interpersonal Distance

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Do average people have a sense of information privacy, and do they require others to understand and respect such privacy concerns? This research attempted to operationalize the measure of information privacy by using interpersonal distance as a unit of measurement. We collected data on the interpersonal distance among the automatic teller machine (ATM), add value machine (AVM; information privacy attached) and ticket vending machine (TVM; little information privacy attached) users. On-site observation revealed that the interpersonal distance between ATM users was larger than that between AVM users, and the interpersonal distance between AVM users was larger than that between TVM users, which suggested that the concept of information privacy (in terms of personal identification numbers, money, etc.) can be thus operationalized and measured. Moreover, on-site observation and interview revealed that desired distance was larger than the actual distance for both ATM and AVM users, which indicated that people's actual information privacy need is higher than that anticipated by others.

Keywords: *information privacy; interpersonal distance; automatic machine user*

Using an automatic machine (i.e., automatic teller machine: ATM; add value machine: AVM[1]; ticket vending machine: TVM) in a public place, people need to provide or disclose certain amount of personal information. Waiting to use an automatic machine in line involves a problem of interpersonal distance, which includes both the actual distance and the desired distance between users. The present research sought to investigate the effects of personal information on the interpersonal distance between users of automatic machines, the possibility of using interpersonal distance to measure the concerns of information privacy, and differences between

the actual and desired distance of users, so as to make a possible contribution to furthering our understanding of these matters.

The previous studies showed that there were many variables that had an influence on interpersonal distance, such as density (Kaya & Erkíp, 1999; Rüsteml, 1992; Sinha & Mukherjee, 1996), heat and noise (Bell & Barnard, 1984), culture (e.g., Barry, 2002; Beaulieu, 2004; Huff, 2001; Li, 2001), sex (Baxter, 1970; Evans & Howard, 1973; Fisher & Byrne, 1975; Gifford, 1982), attraction (Allgeier & Byrne, 1973; Michinov & Monteil, 2002), relationship (Aiello & Cooper, 1972), age (Naus & Eckenrode, 1974; Webb & Weber, 2003), mood states (Long, 1984; Yamaguchi & Suzuki, 1996), personality (Kaitz, Bar-Haim, Lehrer, & Grossman, 2004; Ray, 1984), etc.

Privacy also has an important role on interpersonal distance. People who have a low need for privacy are more likely to choose a closer interpersonal distance when interacting with a stranger than people who have a high need for privacy (Bowers, 1979; Kline & Bell, 1983; Pedersen, 1994). It is conceivable that the effect of privacy on interpersonal distance is not just a kind of individual difference. Worchel (1986) found that subjects expecting a long conversation to focus on a personal topic with a stranger had chosen greater distance than subjects who expected a short conversation over a personal topic and subjects who expected a conversation on a nonpersonal topic. Because the longer the conversation over a personal topic is, the more personal information might be disclosed, the higher the risk of losing control of personal information. Therefore, findings of Worchel's study suggest that the amount of personal information may have an influence on interpersonal distance. On the other hand, privacy is the selective control of access to the self or to one's group (Altman, 1975, 1976) and could be described through physical, psychological, social, and informational dimensions (Burgoon, 1982; Leino-Kilpi et al., 2001). The focus of the present study is on the informational dimension—that is, information privacy. Information privacy means the ability (i.e., capacity) of the individual to control personally (vis-à-vis other individuals, groups, organizations, etc.)

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information about oneself (Stone, Gueutal, Gardner, & McClure, 1983). Therefore, Worchel's results imply that interpersonal distance may increase as information privacy concerns increase in a face-to-face interaction.

The extant literature on information privacy can be differentiated by the focal parties engaged in information exchange; and these studies converge on the exchange between employees and an organization, consumers and corporations, and Internet users and Internet goods, services, and information providers (Dinev & Hart, 2004). The studies about information exchange between consumers and corporations showed that as information privacy concerns increased, a substantial number of individuals did not supply complete information about themselves, and 30% of individuals would not apply for something similar to credit or insurance because they did not want to provide specific information about themselves (*Harris-Equifax Consumer Privacy Survey*, 1990), and 51% of respondents in a direct marketing study said that they had refused to give information to a company because they thought it was either unnecessary or too personal (Nowak, Glen, & Phelps, 1992). The studies about the Internet found that many online users did not visit sites requiring registration, which generally involves a user providing numerous information items about him or herself to access the site (Pitkow & Kehoe, 1997; Sheehan & Hoy, 1999), and when information privacy concerns increased, online users were more likely to provide incomplete information to Web sites (Sheehan & Hoy, 1999). Dinev and Hart even developed an instrument, which used perceived vulnerability and perceived ability to control information to measure information privacy concerns. However, information exchange and information privacy do not exist only between individual and organization but also exist between individuals. There are few studies about this kind of information privacy, and there is far less consensus in terms of how to operate and measure these concepts.

Using automatic machines (i.e., ATM or AVM) in public places may bring with it risks of losing control of personal information and may involve various levels of information privacy because automatic machines such as ATMs and AVMs need users to provide their personal information, such as personal identification numbers (PINs), details of the transaction, the amount of money involving, etc. These machines are generally installed in places, where commuter flow is large and frequency in use is high. In an environment such as this, users' personal information is more likely consciously or unconsciously seen by a stranger, and the risk of losing control of personal information might be perceived high by users. Because privacy can be best understood as a protection against certain kinds of risks—risks of injustice through such things as unfair inference, risks of loss of

control of personal information, and risks of indignity through exposure and embarrassment (Perri, 1998), it is possible that using an automatic machine that needs personal information in a public place may facilitate information privacy concerns of a user. However, the scales that measure information privacy concerns, developed by Dinev and Hart (2004) are for information privacy of online user. There are a lot of items that are not suited to measure information privacy concerns in public places.

Previous studies have used interpersonal distance as a behavioral measure to examine personal space, which is the closest layer of the self or the invisible boundary surrounding the self (Hall, 1966; Sommer, 1969), and which serves as a mechanism of privacy (Altman, 1976). Namely, interpersonal distance has been used as an index of privacy including information privacy and privacy of other dimensions. In doing this, little attempt has been made to separate, operate, and measure information privacy. We, however, reasoned that the relationship of interpersonal distance and information privacy, while using an automatic machine in public places, can be described as:

$$\text{Total interpersonal distance} = \text{distance for information privacy} + \text{distance for other privacy} + \text{operating space}$$

where operating space, the space people need while operating an automatic machine, is relatively invariable. When the amount of other privacy is invariable, the distance used to regulate this amount of privacy would be invariable, too. If the total distance changed under this condition, it only would mean the amount of information privacy has changed. However, even if waiting to use an automatic machine that needs little personal information (e.g., TVM), people still will keep a certain amount of distance from the current user in addition to the operating space. It is quite possible that this certain amount of distance is used to regulate the other privacy. If the interpersonal distance isn't simply covariant with machine type, and only covariant with whether the machine needs personal information, it is conceivable that information privacy concerns affect the interpersonal distance. Therefore, in the first study of the present research, we investigated whether there is any difference in the interpersonal distance between users of different automatic machines that require different levels of information privacy disclosure; whether the interpersonal distance would increase with the level of information privacy disclosure; and whether there is a possibility of using interpersonal distance to measure the concerns of information privacy.

Study 1

To investigate whether there is any difference in the interpersonal distance between users of different automatic machines that require different level of information privacy disclosure, we collected data on the interpersonal distance among the ATM, AVM and TVM users. The rationale behind the data collection was that when using TVM for a single trip or TVM for a swimming pool, there involved almost no personal information that people want to control from others; when using AVMs, however, there are PINs; when using ATMs, in addition to PINs, there is a lot of personal information that people want to keep from others' eyes, such as how much money was withdrawn from their account, how much money is left in their account, etc. It appeared that the amount of personal information varies from ATM to AVM and to TVM but approximately remains the same between TVM for single-trip ($TVM_{single\text{-}trip}$) and TVM for swimming pool ($TVM_{swimming\ pool}$). Based on these insights, we hypothesized that there will be no interpersonal distance difference between ATM and AVM users and $TVM_{single\text{-}trip}$ and $TVM_{swimming\ pool}$ users, if those machine users do not have a sense of information privacy. Otherwise, the observed interpersonal distance difference between ATM and AVM users and $TVM_{single\text{-}trip}$ and $TVM_{swimming\ pool}$ users should be greater than zero and thus could be used as information privacy concerns. Hypotheses of the present study were as follows:

Hypothesis 1a: The distance between current user and the next user of ATM (distance between ATM users) is larger than the distance between current user and the next user of AVM (distance between AVM users).

Hypothesis 1b: The distance between ATM users is larger than the distance between current user and the next user of single-trip TVMs (distance between single-trip TVM users) or the distance between current user and the next user of swimming TVMs (distance between swimming TVM users).

Hypothesis 1c: The distance between AVM users is larger than that of either type of TVM users.

Method

Participants

Convenience sampling was used. Onsite observation was conducted where people who used ATM, AVM, TVM for single-trip, or TVM for swimming pool at five MRT (mass rapid transit) stations at the time the data collection

took place became our participants. A total of 934 local Singaporeans (Chinese, Malay, and Indian Singaporeans) were observed—that is, 379 ATM users, 408 AVM users, 95 single-trip TVM users, and 52 swimming pool TVM users became our participants.

Setting

Although many places in Singapore have one or two automatic machines, only MRT stations have many different machines (ATM, AVM, single-trip TVM) together. Bedok, Choa Chu Kang, Eunos, Orchard and Tiong Bahru MRT station were chosen because their locations cover east, west, and central regions of Singapore. In addition, a machine's layout in these stations leaves enough space for queues. For the same reason, a swimming complex in Jurong, where several swimming pool TVMs were available, also was chosen.

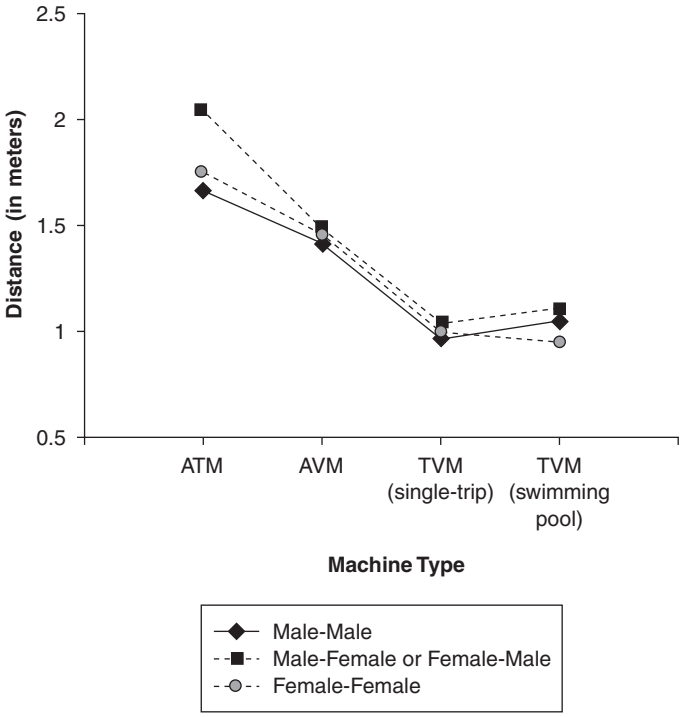
Procedure

To avoid the effects of crowdedness, the survey was conducted in the daytime of a weekday (excluding rushing hours and holidays). An onsite observation was conducted, where the actual interpersonal distance between the person who was using the target machine (current user) and the person behind the current user (next user) was observed and recorded. The actual distance was measured with the help of a marking tape with 10 centimeter intervals, which was laid on the ground in front of each target machine beforehand. Because the previous studies showed that gender and culture influenced interpersonal distance, gender and ethnic group of the participants also were recorded.

Results

The observed actual distance between the current user and the next user served as the interpersonal distance index. Mean interpersonal distance as a function of machine (ATM vs. AVM vs. $TVM_{single\text{-}trip}$ vs. $TVM_{swimming\ pool}$) and gender-dyad (male-male vs. male-female or female-male vs. female-female) were shown in Figure 1. A 4 (Machine: ATM vs. AVM vs. $TVM_{single\text{-}trip}$ vs. $TVM_{swimming\ pool}$) × 3 (Gender-dyad: male-male vs. male-female and female-male vs. female-female) × 3 (Ethnic group: Chinese vs. Malay vs. Indian) analysis of variance (ANOVA) conducted on the data revealed a significant effect of machine on mean interpersonal distance, $F(3, 904) = 94.33$, $p < .001$. As predicted, the observed distance of ATM users ($M = 1.86$) was

Figure 1
Mean Interpersonal Distance As a Function of Machine (ATM vs. AVM vs. $TVM_{single\text{-}trip}$ vs. $TVM_{swimming\ pool}$) and Gender-Dyad (Male-Male vs. Male-Female or Female-Male vs. Female-Female)



larger than that of AVM users ($M = 1.46$), $p < .0001$. The observed distance of ATM users was larger than that of either type of TVM users ($M_{single\text{-}trip} = 1.04$; $M_{swimming\ pool} = 1.08$), $p < .0001$, respectively. The observed distance of AVM users was larger than that of either type of TVM users, $p < .0001$, respectively. On the other hand, the observed distance of single-trip TVM users was not significantly different from that of TVM users ($M_{single\text{-}trip} = 1.05$; $M_{swimming\ pool} = 1.08$, *ns*.). Hypothesis 1a, 1b and 1c were supported.

The ANOVA revealed a significant effect of gender-dyad, $F(1, 904) = 4.60$, $p < .01$, a significant two-way interaction (machine by gender-dyad), $F(6, 904) = 4.99$, $p < .001$. Posthoc tests revealed that the interpersonal distance of male-female or female-male dyads ($M = 1.63$) was larger than that

of female-female dyads ($M = 1.58$, $p < .05$), and the interpersonal distance of female-female dyads was larger than that of male-male dyads ($M = 1.42$, $p < .000$). However, the ANOVA revealed no significant effect of ethnic group, $F(2, 904) = .66$, *ns*., and no significant three-way interaction (machine type by gender dyad by ethnic group), $F(1,904) = 1.89$, *ns*.

Study 2

Study 1 demonstrated that there was indeed such a thing as information privacy in the minds of average people in Singapore. A further question raised was "If Singaporeans do have a sense of information privacy, do they have a need to protect such privacy?" In other words, is it possible for us to use a similar method as used in Study 1 to measure such need?

It was found that interpersonal distances were smaller when people approached a target than the distances when people were approached by a target (Schiavo, Schiffenbauer, & Roberts, 1977). These results might be because of motivation differences and perspective-taking deficits. In the real world, one person approaches another when he or she wants to or needs to. However, when approached by another person, different needs, such as keeping a larger distance to protect self before he or she can understand the purpose of the approaching person, may arise. On the other hand, it is difficult for people to take another person's perspective because people do not use the self enough when trying to understand another person (Vorauer & Cameron, 2002). So it is difficult for them to understand how far is far enough for another person. This distance difference also may appear when people use or wait to use machines in public places. People who are waiting certainly want to use the machine sooner. This desire may bring them close to the machine, and thus to the current user. The same desire may bias them so that they cannot understand the information privacy needs of the current user sufficiently. Therefore, it is conceivable that the actual distance between the current user and the next user is smaller than the current user desires.

In Study 1, what we measured was other's respect toward information privacy but not one's own requirement. As the information privacy was deduced from the ATM and AVM users, as shown by results of study 1, we choose those who used these two machines to report the distance that they would prefer the next user left them when they became the current user. In particular, we hypothesize that

Hypothesis 2: The desired distance between the current users and the next users is larger than the actual distance.

Method

Participants

A convenience sample was used also—that is, 413 local residents who were simply using ATM (N = 208) and AVM (N = 205) at five MRT stations at the time the survey conducted were asked to participate as volunteers.

Setting

ATMs and AVMs located at Bedok, Choa Chu Kang, Eunos, Orchard, and Tiong Bahru MRT stations were selected for the same reason given in Study 1.

Procedure

An onsite observation followed by a brief interview was originated at the earlier-mentioned five MRT stations. First, as in Study 1, interpersonal distances at ATM and AVM were recorded. Second, the next user was asked to show how far he or she would prefer the person behind him or her to stand when he or she became the current user. Instead of a verbal response, we asked the user to indicate his or her desired distance on the marking tape.

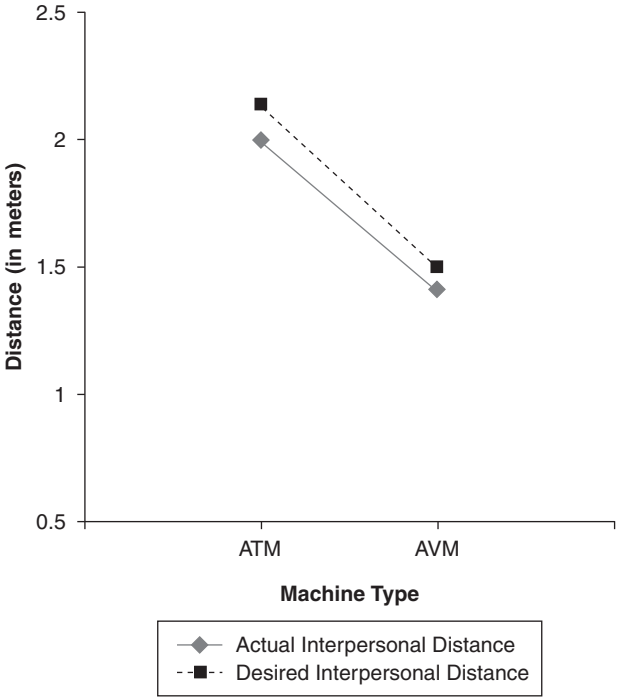
Results

Mean interpersonal distance as a function of machine (ATM vs. AVM) and response (actual interpersonal distance vs. desired interpersonal distance) was shown in Figure 2. To examine the difference between the actual distance and the desired distance of ATM and AVM users, a 2 (machine type—between subjects factor: ATM vs. AVM) × 2 (distance—within subjects factor: actual vs. desired) ANOVA was conducted. As predicted, the ANOVA revealed a distance effect, $F(1,411) = 57.76$, $p < .0001$. The desired distance ($M = 1.81$) was larger than actual distance ($M = 1.70$). Hypothesis 2 was supported.

The ANOVA also revealed a marginally significant interaction of machine type × distance, $F(1,411) = 3.58$, $p = .059$. The desired distance of ATM users ($M = 2.13$) was larger than the actual distance ($M = 1.99$), $F(1,411) = 45.05$, $p < .0001$, and the desired distance of AVM users ($M = 1.49$) was also larger than the actual distance ($M = 1.41$), $F(1,411) = 16.29$, $p < .01$.

The ANOVA also revealed a significant machine type effect, $F(1,411) = 407.23$, $p < .0001$. The distance of ATM users ($M = 2.06$) was larger than that of AVM users ($M = 1.45$). And the actual distance of ATM users was larger than that of AVM users, $F(1,411) = 300.62$, $p < .0001$, the desired

Figure 2
Mean Interpersonal Distance As a Function of Machine (ATM vs. AVM) and Response (Actual Interpersonal Distance vs. Desired Interpersonal Distance)



distance of ATM users was larger than that of AVM users, $F(1,411) = 360.51$, $p < .0001$.

General Discussion

This research investigated the effects of personal information on interpersonal distance, and the possibility of using interpersonal distance to measure the concerns of information privacy. Consistent with our hypotheses,

results showed that the average observed interpersonal distance between the current user and the next user of ATM was larger than that of AVM and the average observed interpersonal distance between the current user and the next user of AVM was larger than that of TVM user. Because risks or perceived risks of losing control of personal information may increase as the amount of personal information increases, these results imply that interpersonal distance may increase as information privacy concerns increase. Most importantly, such differences in terms of interpersonal distance can be taken as supporting evidence that even average people do have a sense of information privacy and that such information privacy concerns can be observed and measured. The deeper information privacy concerns grow, the greater the interpersonal distance difference between ATM and AVM users and $TVM_{single\text{-}trip}$ and $TVM_{swimming\ pool}$ users was to be measured.

Results of this research also showed that the desired distance was larger than the actual distance between the current user and the next user of ATM or AVM. These findings imply that average people do have a need to protect their information privacy. However, such need is generally not being met. When their desired privacy is not satisfied, people would feel discomfort, withdraw, become aggressive, etc. (e.g., Le Poire, Burgoon, & Parrott, 1992; Mazur & Hubbard, 2004). To solve this problem, there are two alternatives. One is to draw a stopping line according to the desired distance of users. The other is to set up a booth designed for only one user. Maybe for economical reasons, the number of stopping lines would increase much faster than one-user booths, although the study of Kaya and Erkip (1999) found that people preferred an ATM space designed for a single person. However, results of our study showed that the mean of the desired distance of ATM users was 2.13 meters. A one-user booth seems more economical in space than a stopping line. One-user booths may be more suitable for countries such as Singapore in which population density is high.

Meanwhile, results of the present research showed that the observed distance between a male and a female user was larger than the distance between male users or female users. The distance between female users was larger than the distance between male users. These results are different from the results of some previous studies. Some studies reported that male dyads use larger distances than female dyads (Aiello & Jones, 1971; Evans & Howard, 1973; Fisher & Byrne, 1975; Gifford, 1982) and mixed-sex dyads (Baxter, 1970; Cook, 1970; Evans & Howard, 1973) when they interact with each other. However, some studies indicate that the gender effects on interpersonal distance vary with the cultural context (Rusteml, 1986;

Remland, Jones & Brinkman, 1995; Shuter, 1977). Results of Shuter's (1977) study showed that in both Germany and America, males took larger distances than did male-female and female dyads. But this trend was almost reversed in Italy where males interacted closer than did male-female and female dyads. Our results showed that the gender effects on interpersonal distance in Singapore have a similar tendency to that in Italy. It would be very interesting to explore why Italians and Singaporeans share a similar trend in the gender effects on interpersonal distance.

Our results might be because all male Singapore citizens and permanent residents are liable for enlistment into full-time national service from 16.5 to 18 years old. The 2.5 years of national service training might foster a sense of camaraderie among Singapore males and thus shorten their interpersonal distance.

Inconsistent with results of the studies that found culture's effects on interpersonal distance (e.g., Beaulieu, 2004; Hewitt & Alqahtani, 2003; Huff, 2001), results of the present study showed the ethnic group of the next user did not influence the observed distance between the current user and the next user. One possibility is that Singapore is a multiracial but compact country, where Chinese, Malay, Indian, Caucasian, etc. have peacefully lived together for several decades. As a result of this long interaction, all ethnic groups relatively understand the conventions and norms of each other well. To avoid conflict, Singaporeans might have found a proper interpersonal distance that could be accepted by every ethnic group member while using public facilities. Further investigation is needed to examine this possibility.

The present study only investigated interpersonal distance and information privacy while using an automatic machine in a public place. There are other situations that may involve information privacy. For example, people need to fill their personal information (e.g., passport number, birth date, name, etc.) in the immigration card or declaration card in airports or railway stations. Whereas, desks for filling out these cards generally are not designed for protection of privacy, people beside you could see every thing on your card easily. However, people in airports or railway stations are always in a hurry, and they may not pay much attention to their information privacy. Under this condition, how far do people wish the others to stand? Do people have more tolerance for the invasion of their personal space or their information privacy? Will the ethnic group of people influence their interpersonal distance? How to protect people's information privacy? These questions remain interesting issues for future investigation.

Note

1. The add value machine (AVM) provides convenient and user-friendly services for commuters. It can be used to transfer the desired top-up amount from a user's bank account to revalue a TransitLink card. A TransitLink card is a stored-value magnetic fare card for use on both bus and rail in Singapore. People need to provide their personal identification numbers (PIN) of their bank and their automatic teller machine (ATM) card while revaluing their TransitLink card by an AVM.

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