Gender Differences in the Perception and Use of E-Mail: An Extension to the Technology Acceptance Model[1]

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Abstract

This study extends the TAM model (Davis 1989) and the SPIR addendum (Straub 1994) by adding gender to an IT diffusion model. The technology acceptance model (TAM) has been widely studied in IS research as an explanation of the use of information systems across IS types and nationalities. While this line of research has found significant cross-cultural differences, it has ignored the effects of gender, even though in socio-linguistic research, gender is a fundamental aspect of culture. Indeed, socio-linguistic research has shown that men tend to focus discourse on hierarchy and independence, while women focus on intimacy and solidarity. This literature provides a solid grounding for conceptual extensions to the IT diffusion research and the technology acceptance model.

Testing gender differences that might relate to beliefs and use of computer-based media, this study sampled 392 female and male responses via a cross-sectional survey instrument. The sample drew from comparable groups of knowledge workers using e-mail systems in the airline industry in North America, Asia, and Europe.

Study findings indicate that women and men differ in their perceptions but not use of e-mail. These findings suggest that researchers should include gender in IT diffusion models along with other cultural effects. Managers and co-workers, moreover, need to realize that the same mode of communication may be perceived differently by the sexes, suggesting that more favorable communications environments might be created, environments that take into account not only organizational contextual factors, but also the gender of users. The creation of these environments involves not only the actual deployment of communication media, but also organizational training on communications media.

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[1]Robert Zmud was the accepting senior editor for this paper.

"Why can't a woman be more like a man?"

—George Bernard Shaw

Introduction

Researchers have studied IT outcomes and IT diffusion processes since the inception of the information systems field. A summation of the implementation literature (Swanson 1988) highlights independent variables such as management commitment and user involvement. Another study cites factors such as job tenure, uncertainty, competition, and feedback (Kwon and Zmud 1987). Reviews of the IT innovation-diffusion literature (Prescott and Conger 1995; Karahanna 1993), which focus on factors such as relative advantage, complexity, ease of use, and results demonstrability, examine the overall impact of these variables on adoption of technological innovations. The current study extends this work on IT implementation and diffusion by considering gender effects in the context of the technology acceptance model (TAM) (Davis 1989) and a later addendum to the model (Straub 1994).

The TAM research (Davis 1986, 1989) is an influential contribution to the enduring line of IT implementation and diffusion research. This model posits that both perceived ease of use (PEOU) and perceived usefulness (PU) correlate with system use, a relationship that seems to explain fairly well why people accept or reject an IT. Known as TAM, the causal model hypothesizes that actual system use is affected by behavioral intentions which are themselves affected by attitudes toward use. Finally, beliefs about the system, PU and PEOU in TAM, directly affect attitudes toward use.

TAM has attracted a growing body of research. Originally dealing with e-mail and graphics (Davis 1986, 1989), TAM has since been extended to voice-mail and word processors (Adams et al. 1992; Chin and Todd 1995), spreadsheets (Mathieson 1991), DBMS (Szajna 1994), GSS (Chin and Gopal 1995), and adaptive technology for the physically-challenged (Goette 1995). Overall, PU and PEOU have shown significant associations with IT outcomes.[2]

An exogenous social presence/information richness factor[3] deriving from Hofstede's (1980) seminal work on dimensions of cultural differences among countries was added to TAM by Straub (1994). In this model, presented in Figure 1, perceived social presence (SP), i.e., the sense of human contact embodied in a medium, was combined with the information richness of the medium (IR) to become the first construct of the diffusion model: SPIR. Straub looked at bivariate relationships that suggested why there are differences in e-mail usage and choice among knowledge workers in different cultures.

Lack of gender-based work in TAM and other IT diffusion research

As active as these streams of research have been, none has dealt with the possible impact of gender on IT diffusion. The original TAM work (Davis 1986, 1989) makes no reference to gender differences nor does subsequent research (Adams et al. 1992; Chin and Gopal 1995; Moore and Benbasat 1991; Straub 1994). Gender, moreover, is not examined in IT acceptance models (Markus 1983; Szajna and Scamell 1993). In fact, gender has been generally missing from IT behavioral research (Kwon and Zmud 1987; Swanson 1988), one prominent exception being a study of women in the IS workplace (Truman and Baroudi 1994).

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[2] It should be noted that Straub, et al. (1995) found that PU and PEOU may be related to perceived or self-reported use rather than actual system use. Rather than questioning the overall validity of TAM, they suggest that a new conceptualization of the dependent variable may be in order.

[3] The social presence of e-mail has also been examined by Zack (1993). Studying the use of face-to-face (FTF) and e-mail communications in two daily newspapers, Zack concluded that social presence of the medium played a significant role in the use and effectiveness of the communication media.
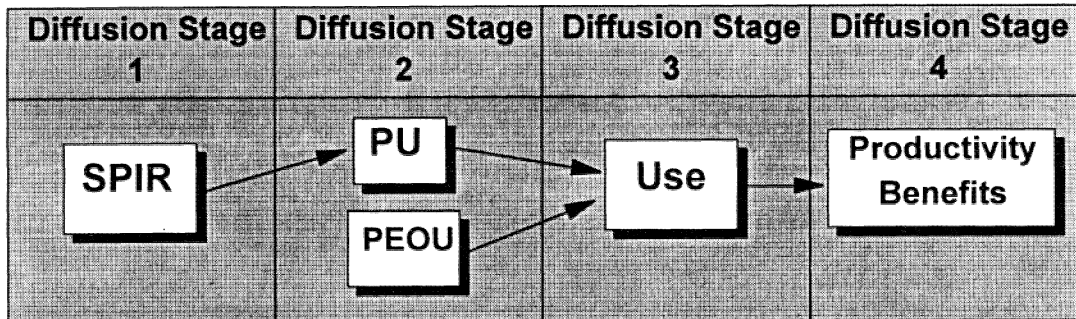
Figure 1. IT Diffusion Process Model (Straub 1994; Reprinted with permission)

Is such an omission important? Is there value to be added by extensions to the literature that consider the effect of gender on IT diffusion? The contention presented in this paper is that diversity in the workplace needs to be actualized as much as advocated and that knowledge about the ways in which men and women respond during the IT diffusion process could be essential for competitiveness in the emerging organizational environment (Galen 1995). The need for a better understanding of diversity in the international business environment is stressed, for example, by some of the leading researchers in IS (Cash et al. 1988; Ives and Jarvenpaa 1991).

Gender Effects in IT— Analogous Circumstances

A good case for why women and men would respond in different ways to IT can be built via the literature that studies circumstances analogous to those involved in IT perception and use. The extensive work on cultural dimensions (Hofstede 1980), for example, offers insight into how sex differences in thinking and behavior arise, which suggests, in turn, why there might be underlying *IT* gender differences. Through analysis of 116,000 questionnaires gathered in 40 countries, the study posits that cultural differences manifest themselves through four dimensions of national cul-

ture. These dimensions, measured and combined into indices, are (1) acceptance of unequal power distance distribution (PDI), (2) uncertainty avoidance (UAI), (3) acceptance of individualism (IDV), and (4) disposition toward masculine attitudes and behavior (MAS). Cultural indices of three selected countries are shown in Table 1.

The concept of MAS and its opposite—femininity—represent the different ways in which societies deal with implications of sex differences (Hofstede 1980). In his review of the relevant literature in psychology, sociology and political science, Hofstede found a nearly consistent pattern of men rating advancement and earning power more highly and women rating interpersonal aspects, service, and physical environment more highly. The MAS dimension affects whether the organization will be people-oriented, emphasizing the quality of life and the environment (low MAS), or task-oriented (high MAS). Low MAS is related to sympathy for the weak and to social leveling. According to Hofstede, gender roles, as reflected in MAS, are transferred through socialization. Men are taught to be assertive and women to be nurturing.

What is important to note in this argument is that gender differences are one aspect of the overall cultural differences that exist between human beings. Thus, both national/ethnic *and* gender differences constitute the socio-cultural factors that influence perceptions and behaviors.

Table 1. Selected Cultural Dimension Indices (adapted from Hofstede 1980)

Country	PDI	UAI	IDV	MAS
Japan	54	92	46	95
Switzerland	34	58	68	70
USA	40	46	91	62
40 Country Statistics				
Mean	52	64	50	50
Standard Deviation	20	24	25	20

Other research has found that men and women tend to use and understand language in different ways, a finding that can help to explain specific gender differences in computer-based communications media choice. Socio-linguistic researchers argue that men and women have different social norms for conversational interaction, to such an extent that they even form "distinct speech communities" (Coates 1986, p. 117). Discourse is characterized by patterns of speech that are sex-specific (Preisler 1987). Such gender discrepancies, which relate mainly to spoken language, suggest that discourse between genders tends to be, by and large, a cross-cultural communication that affects the meaning and content of discourse. Male patterns of communication tend to be based on the notion of a social hierarchy. Female patterns, on the other hand, tend to be network-oriented (Tannen 1990). In general, although intimacy and independence are shared needs of both genders, women focus more on creating intimacy while men focus more on asserting independence and seeking respect.

In view of this gender difference, it is not surprising that women's discourse tends to be more tentative and socially oriented in contrast to men, who tend to be more categorical (Preisler 1987). Furthermore, women show a proclivity to highlight cooperation in their discourse while men tend to be competitive (Coates 1986). As a result, men's conversation often has a hidden agenda of achieving and maintaining social standing. For men, discourse tends to be a struggle to preserve independence. By contrast, women's communication is inclined toward seeking and confirming intimacy, support, and consensus. These differences are also evident in problem solving communications where men tend to use discourse to solve the problem while women use it to show empathy (Tannen 1990), solidarity, and mutual support (Coates 1986). Such gender-based distinctions have been supported by many case studies (Johnson 1993; Tannen 1994).

While there is a debate about whether oral differences are biological in origin (Tannen 1994), there is little doubt that girls learn to speak sooner than boys. Current research relates gender variation in language development to linguistic environments that socialize children into gender roles (Coates 1986). Indeed, many languages force a gender distinction that socializes gender roles (Adler 1978). Even in languages where there is no gender distinction, boys and girls grow up in different uni-sex cultures, usually playing in same-sex groups. This directly affects learned discourse patterns because boys tend to play hierarchically-structured outside games with rules, boasts, and winners and losers while girls tend to play indoor games, without orders or winners and losers (Tannen 1990).

Finally, research on social stereotypes has shown that feminine behavior is often stereotyped as being tactful, gentle, loquacious, and aware of the feelings of others. While masculine behavior is stereotyped as aggressive, independent, unemotional, logical, and competitive (Doyle 1985), feminine stereotypes, it is claimed, are associated with "a people-centered approach" (Rigg and Sparrow 1994, p. 9). Similarly, gender traits are attributed by

Hofstede to his MAS cultural dimension, where men are "assertive" and women "nurturing" (p. 261). Other social-psychological research on stereotypes tends to support these notions. For example, it was found that the probability of a trait being attributed to a man or woman is significantly different (Deaux 1984). Table 2 presents that study's findings of the probability that a trait will be attributed to a person of either sex.

Table 2. Probability of a Trait Being Gender-Related (adapted from Deaux 1984)

Trait	Men	Women
Independent	.78	.58
Competitive	.82	.64
Warm	.66	.77
Emotional	.56	.84

In sum, many gender-based differences in oral discourse patterns and attributed meanings bespeak a fundamental difference between the sexes. Adopting this intellectual stance, the present research looks at whether these gender differences in oral discourse might not appear in other types of communication, specifically e-mail. It is hypothesized that women and men exhibit significantly different perceptual and usage patterns in adapting their respective discourse patterns and tendencies to an electronic form of discourse, namely e-mail.

The Role of Gender in Related IT Research

While some prior IT research has considered gender differences, these differences were examined outside of the specific context of IT diffusion. Tellingly, studies have found dramatic differences between the sexes. In a study of 270 undergraduates and 56 masters students, approximately half women and half men, it was found, for instance, that female college students had significantly higher computer anxiety than male students (Gilroy and Desai 1986).

These results suggest that differences between the sexes occur in computer-related circumstances which, by logical extension, could affect the diffusion of IT use in the workplace.

"Striking" gender differences in computer skills and usage between male and female students in a country not considered in the previous research (Canada) were uncovered, thereby raising the possibility that gender differences in an IT context could hold across cultures (Lowe and Krahn 1989, p. 175). Additional evidence for such differences, which also underscores the overall importance of the research question, may be seen in the designation of a special issue on gender in academic computing in *Communications of the ACM* (November, 1990). In this issue, Frankel (1990) quotes participants in a workshop on this topic who state that "the computer culture is uncomfortable for girls and women" (p. 38).

Research Hypotheses

The objective of this research was to examine the effect of gender on TAM and previous cultural extensions, specifically on the perceived attributes of SPIR (Straub 1994), PEOU and PU, and self-reported use of e-mail. The research model for this set of relationships is shown in Figure 2. While the effects of *gender* have been overlooked in TAM and other IT diffusion research, *culture* has been found to be important (Straub 1994). Furthermore, the effects of gender differences on the use and perceptions of other forms of human discourse are well established. For this reason, it was hypothesized that gender could be a crucial element in the case of e-mail, too.

H1: Women will perceive the social presence of e-mail to be higher than will men.

With respect to H1, while men tend to adopt a pattern of oral communication that is based on social hierarchy (Tannen 1990) and competition (Coates 1986), women have a proclivity to adopt a networking approach, using discourse
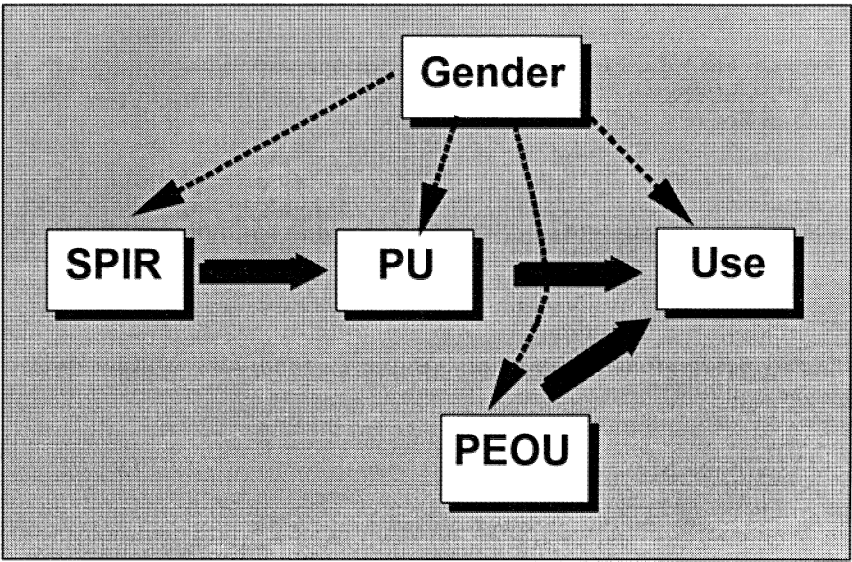
Figure 2. Research Model

to achieve intimacy, support, consensus, rap-port (Tannen 1990), and cooperative behavior (Coates 1986). These two communication pat-terns imply very different values for the need for social presence. If, as hypothesized, these differences are extended to e-mail SPIR per-ceptions, then gender should be a significant factor.

A plausible case can be made that women will perceive SPIR to be higher. *In oral discourse,* women's inclinations are associated with a strong sense of social presence and human contact while men's inclinations are associated with low SPIR. A logical extension of these tendencies to e-mail, might suggest that women would perceive a higher degree of social presence.

Moreover, one study suggests that context, to some extent even more than content, is a cru-cial factor in choosing a communication mode (Zack 1993). Following this line of thinking fur-ther, that argument can be extended to infer that women would use e-mail for more interac-tive exchanges and more context building exchanges than men would because of femi-nine discourse tendencies to use communica-

tion for rapport and cooperative behavior (con-text) and men's tendencies to focus on con-tent. Again, this logic would then suggest that women, compared to men, would see e-mail as relatively higher in SPIR.

H2: Women will rate the perceived useful-ness of e-mail higher than men will.

Regarding H2, it has been reported that women adopt a discourse pattern that, on the whole, lets all participants speak (Coates 1986). Furthermore, it was found that women, general-ly, disapprove of having the conversation domi-nated by one person (Coates 1986). Men, on the other hand, use discourse to establish a hierarchy of domination that directly affects the amount of time granted to each group member. If indeed, as has been concluded (Coates 1986), these oral discourse differences are the product of cultural differences, then differences should apply to *electronic media* as well. In such a case, the fit between discourse patterns and media characteristics should influence the way individuals perceive media effectiveness. Increased media effectiveness should highly correlate with an increase in PU (Davis 1986, 1989). Along this vein, hypothesis H2 posits

that e-mail will be perceived as more useful by women than by men in that the way e-mail is used fits better with feminine discourse patterns.

H3: Women's rating of perceived ease of use of e-mail will be higher than men's.

While it has been found that women experience higher anxiety than men in using computers in general (Frankel 1990; Lowe and Krahn 1989), we expect they will not experience more discomfort with e-mail systems. As argued in H1 and H2, women should respond positively to the kind of discourse offered by e-mail, and this should, in turn, promote a feeling of comfort with the medium.

H4: Women's use of e-mail will be greater than that of men.

Given the truth of previous hypotheses H1 through H3, a logical derivation of the TAM model is that gender will affect usage.

Research Method

Knowledge workers in three similar organizations on three continents—North America, Asia and Europe—were surveyed in order to test the effects of gender on IT perceptions and use. Thus, with this research design, we were able to treat culture as a covariate and to account for the confounding effect of culture in the variation of the dependent variable.

The research questionnaire measured self-reported e-mail use, perceived ease of use, usefulness, and social presence. E-mail use was measured by the number of sent and received messages and social presence by four items validated by Short et al. (1976) plus one additional measure. Measures for PU and PEOU were based on Davis' (1989) construct definitions.

Questionnaires were internally distributed to users of the e-mail system in one U.S., one Swiss, and one Japanese airline. All firms had had one or another e-mail system for many

years. The sample included workers across managerial, professional, and technical ranks. Computer networks were used in all three organizations to coordinate business processes and managers in all three firms were experienced e-mail users. Response rates were 55% for the American airline, 60% for the Japanese, and 61% for the Swiss. In all, 392 questionnaires were analyzed in the present study. Cronbach alphas for all study variables were well above the threshold for exploratory research (Nunnally 1967)

Results

To test H1 through H4, a partial least squares (PLS) analysis using PLS-Graph (Chin 1994) was performed, in keeping with other TAM studies (Chin and Gopal 1995). Like LISREL and related structural equation approaches, PLS offers the advantage of allowing the entire research model to be tested at once. In addition to the variables in the research model, country, the surrogate for culture, was modeled as a covariate. Similar to setting up dummy variables in linear regression, two of the three possible pairings between cultures were entered into the structural equations. We felt justified in accounting for variations in culture in that Straub found that culture did impact bivariate relationships in his diffusion process model. Figure 3 shows the research model with culture modeled as a covariate; the path coefficients and the R^2 levels are calculated including this covariate.[4]

As shown in Figure 3, the research model was supported at the .05 level in the effect of gender on SPIR (β_1 = -.1429, T = -3.0898), on PU (β_2 = -.1088, T = -2.9111), and on PEOU (β_3 = .1306, T = 3.4369)—albeit not in the hypothesized direction. The effect of gender on use, however, was insignificant (β_4 = -.0081, T = -.1494). These results suggest that the impact

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[4]When the Jackknife Technique was used to generate the T-values for the betas, the output suggested that two outliers should be discarded. In accordance with the procedure recommended by Pedhazur (1982, p. 38), these outliers were removed.
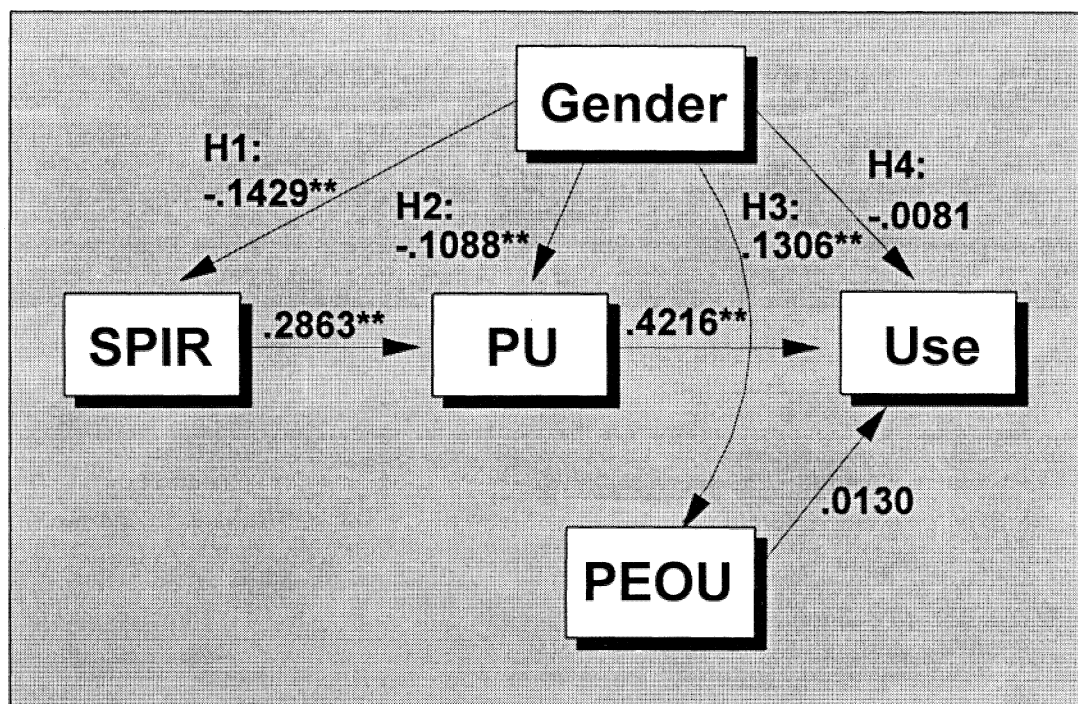
	SPIR	PU	PEOU	Use
Covariate Culture₁ on ...	.5464 **	.3073 **	.9606 **	.4381 **
Covariate Culture₂ on ...	.1475 **	.0546	.3145 **	.3322 **
Overall R² (Including the effects of culture)	.37	.59	.53	.34

Note: ** = significant at the .05 level
     * = significant at the .10 level
     Culture₁ = Dummy variable comparing U.S. to Switzerland and Japan
     Culture₂ = Dummy variable comparing Switzerland to U.S. and Japan

Figure 3. PLS Results of Testing Gender Effects on TAM Variables

of culture on IT diffusion needs to be pursued in further research. Gender and the covariate culture account for 37% of the variance in SPIR and 53% of the variance in PEOU. This result suggests that gender does, indeed, have an impact on the IT diffusion process. The effect of gender, SPIR, and the covariate culture on PU is also a respectable R^2 of .59. The R^2 of use was .34. This result also corroborates Straub, who posited SPIR and culture as antecedents to PU in the case of e-mail. Overall explained variances for the TAM con-

structs are not at variance with what has been reported in prior work (see Straub et al. 1995).

Discussion

This study extends the TAM model (Davis 1989) and the SPIR addendum (Straub 1994) by adding gender to the IT diffusion model. This seems a natural addition in the light of

Hofstede's seminal work and socio-linguistic theory. Findings in this exploratory study show some support for the proposition that perceived attributes of e-mail can differ between genders. The first hypothesis, H1, posited that gender differences in discourse, in general, would be reflected in gender differences in perceived social presence of e-mail. This effect was supported in the PLS run with women viewing e-mail as being higher in social presence than men. The second hypothesis about the TAM attribute of PU, H2, was also supported. Women did perceive a higher value for PU than men, and at a significant level. H3, the effect of gender on PEOU, proved to be significant yet in the opposite direction than hypothesized. The effects of gender on PEOU do, however, support previous observations that noted men's relative tendency to feel more at ease with computers (e.g., Frankel 1990; Gilroy and Desai 1986; Lowe and Krahn 1986).

H4 predicted that because women perceive a higher social presence and usefulness of e-mail, there would be a direct effect of gender on e-mail use. This hypothesis was not confirmed. (However, because hypotheses H1 and H2 were confirmed, gender does have a measureable, albeit indirect, effect on e-mail usage through the paths of Gender → PU → Use and Gender → SPIR → PU → use.) These results support the observation made by Deaux that, with regard to gender differences, the only difference lies in "the initial expectations for performance" (p. 106). Indeed, in the present research, women's perceptions, as evidenced by their perceptions of SPIR and PU, are different from male co-workers. Yet these gender differences do not affect actual use.

Limitations

Intriguing as the findings are, the limitations of the study need to be noted. From the standpoint of external validity, the study gathered data from three firms in one industry across three countries, which, *per force*, limits the generality of the results. It may well be, for instance, that there is a systematic bias in the airline industry that restricts our ability to generalize to other industries. Moreover, knowledge workers in managerial, professional, or technical positions in Japan tend to be overwhelmingly male, which very likely explains a relatively smaller number of Japanese women in our sample. Given the inaugural and exploratory nature of the study, this was perhaps inevitable.

There are several measurement issues to be considered by future researchers. First, our adoption of Straub's conceptualization of SPIR limits the ability to generalize. While SPIR has two components, information richness (IR) and social presence (SP), the present research focused on the latter because socio-linguistics suggests that women have a higher sense of SP. The study did not measure IR although there is some evidence (Zack 1993) that IR, too, may be a valid way of measuring perceptions of IT. Second, organizational culture was not directly measured, a fact which may have confounded differences among national cultures.

Acknowledging these limitations, the results should be viewed as more tentative than definitive. They do, however, more than justify future research into gender effects on IT perceptions and outcomes. As mentioned earlier, they also suggest the need for further work on the influence of culture on IT. Additional research might include trying to capture a measure of exactly how males and females differ in their actual usage content along the network versus hierarchy continuum that forms the core of the hypotheses here. This might be done by content analyzing the contents of e-mail interchanges and examining differences in the content and style of e-mail messages when the e-mail users are all female, all male, or both male and female. Differences of this nature, including adopting a masculine style by women in mixed gender groups, have been found in oral discourse (e.g., Edelsky 1993; Tannen 1990) and, thus, might apply to e-mail too. Finally, future, confirmatory research should measure Hofstede's cultural dimensions directly, rather than assuming that study participants do not differ significantly from Hofstede's national norms.

Implications

The implications of this study are noteworthy for academics and practitioners alike. Results indicate a genuine gender effect in some aspects of IT diffusion. One intriguing explanation for the overall results is that social conformity in later phases of the diffusion process might cause women to adopt the characteristic masculine usage patterns. From an academic researcher's perspective, the findings suggest that IT theories should attempt to account for gender and other cultural effects on IT constructs. Culture has long been proposed as a cornerstone for international organizational research by Hofstede (1980), and, with the growing global economy (Cash et. al. 1988; Ives and Jarvenpaa 1991), has also been touted as a critical element in IT studies.

From a practitioner perspective, the academic implications just discussed are instructive and should not be overlooked. When marketing IT and when considering its effects, managers should consider the gender of their users, no less than their ethnicity. To the extent that socio-cultural differences affect marketing, management, and IT policies, so too should gender. In training users on particular IT such as e-mail systems, a prudent posture at this point would be to address groups composed primarily of women in a different manner than mixed or mainly masculine groups. For mostly female groups, the ability of the medium to convey the "presence" of the communicator— her feelings and thoughts—might be stressed, for example. The user-friendliness of the medium is also a feature to which women may be particularly sensitive.

The implications for coordinating and other communication-intensive tasks are also significant. Typically, there are many alternative media to choose from for such tasks. Managers and co-workers should realize that the *same mode of communication may be perceived differently by the sexes.* This overall finding suggests that managers and co-workers should recognize that women and men attribute different social presence to the same mode of communication and they may also have different perceptions of the usefulness of a medium. Research on oral discourse shows that these differences are prevalent and cause many misunderstandings between the sexes (Tannen 1990), some of which are, possibly, no less important than cross-cultural ones. Misunderstandings of this nature might be avoided if gender-affected social meanings relevant to e-mail become better understood in the work place (Zack 1993).

If, indeed, gender differences found across a wide variety of disciplines apply equally well to emerging computer-based technologies, then the contribution of the present research will be clear. As the socio-linguistic literature indicates, gender differences show that, to some extent, women and men mean and understand similar messages quite differently. Managers who are aware of this difference can better align the IT with user's culture, an alignment that could improve IS implementation success (Davenport 1994). In addition, to the extent that gender has a bearing on the effectiveness of communication patterns, managers also need to be informed about how to create a more favorable communications environment, one that depends not only on organizational contextual factors, but also on the gender of its users. Such a consideration might have not only an impact on actual deployment of communication media, but also, as Gilroy and Desai found with respect to computer anxiety, a decided impact on organizational training and implementation programs.

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