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Exploring the relative impact of biological sex and masculinity–femininity values on information technology use

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ABSTRACT

Previous studies in an e-commerce context suggest that there are biological differences (i.e. whether one is a man or a woman) with respect to perceptions of websites. In other research, there is evidence that psychological gender (i.e. values such as masculinity or femininity) likewise influences website perceptions. It is the aim of the current investigation to explore the possibility that both biological sex and psychological gender influence user perceptions, and to examine the predictive power of each on our model. To test these assumptions, we use an augmented technology acceptance model (TAM). To maximise variance in our sample, participants are selected from two countries that are significantly different in masculinity–femininity. As expected, psychological gender better predicted trust and TAM than biological sex. Moreover, this study validates that the masculinity–femininity dimension as originally developed by Hofstede [1980. *Culture's Consequences: International Differences in Work-Related Values*. Beverly Hills, CA: Sage] can be separated into two scales – one each for masculinity and femininity. The results suggest the need for additional research into the differentiation between psychological gender and sex.

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Biological sex; masculinity–femininity; perceived social presence; online trust; perceived usefulness; perceived ease of use

1. Introduction

Previous researchers have explored the role of biological sex concerning information technology (IT) usage and found differences between men and women with respect to perception and use of technology (Amin, Rezaei, and Firouzeh 2015; Chen et al. 2015; Chou, Chen, and Lin 2015; Cyr et al. 2007; Gefen 2003; Gefen and Ridings 2005; Sanchez-Franco 2006). However, it is possible that user perceptions of technology are not related to biological sex alone, but may relate instead to psychological perceptions that are determined by the biological sex of the person, as well as by socially and culturally determined factors. For instance, in studies investigating online and conventional shopping, researchers found that when shopping in a conventional store, women were more motivated by social and emotional factors, while men were more motivated by functional factors (Dittmar and Drury 2000; Dittmar, Long, and Meek 2004). But when shopping online, both men and women placed more value on functionality. This implies that attitudes towards IT and online shopping are not only necessarily rooted in biological sex, but also in the interpreted and value-laden response to the given situation. In this case, women shifted their values related to the type of shopping experience.

In this vein, others have examined the impact of values such as masculinity or femininity in an IT context (Cyr and Head 2013; Srite and Karahanna 2006). Generally described, masculinity refers to personality traits such as seeking competitiveness and independence, while femininity refers to traits such as being gentle and compassionate (Srite and Karahanna 2006). These values are not predetermined by the person being a man or a woman, and in fact, it is possible for a person of either sex to espouse both masculine and feminine values (Bem 1981). To further support the separation of masculine and feminine values from biological sex, Venkatesh et al. (2004) found that although the results of masculine value-oriented individuals were aligned to the values and perceptions of men, feminine value-oriented individuals exhibited a different pattern of results from women based on previous research.

Venkatesh et al. (2004) suggested that values such as masculinity–femininity – which they termed 'psychological gender' – are distinct from biological sex, and

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proposed the need to examine masculinity and femininity separately from biological sex. However, to date there are only a few studies in which masculinity–femininity is the focus in an IT context. An exception to this is a study by Srite and Karahanna (2006) that tested the moderating effect of masculinity–femininity on technology use and found differences between participants having either masculine or feminine value orientations. Another exception is McCoy, Galletta, and King (2007) who examined the technology acceptance model (TAM) in countries divergent for masculinity–femininity, and likewise found differences in user perceptions. In line with those previous studies, in the current paper we also use the term psychological gender to refer to an individual's masculine or feminine value orientation as developed through a process of socialisation. Despite the suggestion to distinguish between psychological gender and biological sex as suggested by Venkatesh et al. (2004) almost a decade ago, the majority of studies have not tackled this issue.

Building on the preceding, it is the aim of the current study to test the relative importance of biological sex and psychological gender in the context of IT usage. To do this, we employ TAM as developed by Davis (1989), and add to the model trust and perceived social presence (PSP). Previous researchers demonstrated that the degree to which a website has social presence – and hence is seen as warm and personable (Cyr et al. 2007; Gefen and Straub 2003) – results in differing perceptions between men and women towards the website. Likewise, previous studies indicated men and women exhibit different propensities to trust a website (Cyr and Bonanni 2005; Murphy and Tocher 2011; Rodgers and Harris 2003). It is not our intention to revalidate the augmented TAM, but to use the model as a vehicle to determine the relative importance of biological sex or psychological gender for predicting user perceptions. The model is tested in an e-commerce setting. To ensure maximum variance for masculinity and femininity, we test participants in two countries which are known to be widely divergent on these two dimensions.

A secondary goal of the current study is to examine Hofstede's (1980) single bipolar scale for masculinity–femininity. Although a bipolar approach has been used in most IS research to date, there is evidence to suggest that in research into psychological gender, masculinity and femininity are two separate dimensions (Powell, Butterfield, and Parent 2002). Jung (1953) introduced the terms anima (the feminine part of the psyche) and animus (the masculine part of the psyche), as two of five important archetypes determining the psyche of each individual person. Also, in the Bem Sex Role Inventory (Bem 1981) and Personal Attributes Questionnaire (Spence and Helmrich 1987), the dimensions of masculinity and femininity are empirically and logically independent. Using these inventories, it is possible for individuals to demonstrate 'psychological androgyny', a term introduced by Bem (1981), wherein individuals may possess characteristics of both masculinity and femininity. As a methodological goal of the current study, this leads us to investigate whether masculinity–femininity is a singular bipolar dimension as currently applied in the IS literature, or two separate scales as suggested in some psychology literature.

In sum, the goals for this study are the following:

(1) From a theoretical perspective, to explore the possibility that both psychological gender and biological sex influence user perceptions in an e-commerce setting using an augmented TAM, and to examine the predictive power of each scale.
(2) From a methodological perspective, to separate scales for masculinity and femininity, and test their independence as opposed to assuming that masculinity and femininity are bipolar items of the same scale.

The primary contribution of this research is to determine, as some have suggested, that both biological sex and psychological gender play a role in determining user perceptions to IT, and in particular in online shopping. While the majority of the research has investigated differences related to biological sex, depending on our findings, there might be an impetus to more carefully investigate the role of values such as masculinity or femininity as they affect user perceptions. A secondary contribution of this study is the separation of the masculinity–femininity dimensions into two separate scales. Once validated, these scales can be used by others in future research.

In the following sections, we provide the background for this study, including research in an online shopping context for biological sex and psychological gender. The augmented TAM is presented as the theoretical underpinning for the investigation, followed by the literature review and hypotheses, research methodology, results, and a discussion including directions for future research.

2. Biological sex and online shopping

Men and women are known to process information differently and this influences areas of IT communications (Gefen and Ridings 2005; Gefen, Geri, and Paravastu 2007), including online shopping. Relevant to the current investigation in which comparisons between men and women are made with respect to website design, in

other research concerning gender and website design both Simon (2001) and Sanchez-Franco (2006) refer to the Meyers-Levy (1989) selectivity model as a theoretical framework for comparisons. Based on the selectivity model, women are generally seen as comprehensive processors who assimilate all available information before arriving at a conclusion, while men are generally selective processors who rely on highly available and salient cues. In an online shopping experience, it would be expected that women spend considerably more time gathering information about products and comparing the merits of each prior to making the purchase decision. Men, on the other hand, tend to pursue a minimising approach, whereby they make a selection as quickly as possible. This dichotomous approach is supported in a study of shopping in which men take a more utilitarian approach and women seek a more interpersonal experience (Knowledge at Wharton 2007). Simon (2001) suggested that given the comprehensive information-processing strategy preferred by women, women using the Internet may exhibit lower levels of favourable perception and satisfaction if websites fail to provide sufficient detail and information.

Related to the preceding, differences have been observed with respect to how men and women perceive the online shopping experience, including website design characteristics that underlie that experience (Amin, Rezaei, and Firouzeh 2015; Cyr et al. 2007; Dittmar, Long, and Meek 2004; Maltby, Chudry, and Wedande 2003; Murphy and Tocher 2011; Pascual-Miguel, Agudo-Peregrina, and Chaparro-Pelaez 2015). Generally speaking, women tend to be less satisfied with online shopping websites than men (Parsa et al. 2011; Rodgers and Harris 2003). In a study of information design, navigation design, and visual design, significant differences were found between men and women for the same shopping website regarding satisfaction (Cyr and Bonanni 2005). In particular, men found the website more visually appealing and better able to fulfil personal needs and expectations. These results are supported indirectly by another study that examined user brain activity while on eBay using functional magnetic resonance imaging; differences were found between men and women concerning brain areas that encode trustworthiness (Reidl, Hubert, and Kennedy 2010). Men and women also differ in their 'web acceptance and usage processes' (Sanchez-Franco 2006, 19), with men being more driven than women by instrumental factors such as perceptions of usefulness. Moreover, in that study perceived ease of use (PEOU) impacted attitudes towards web usage more strongly for women than for men.

Also related to web acceptance, Moss, Gunn, and Heller (2006) tested 30 male-produced and 30 female-produced websites and found significant differences between the two sets of websites on 13 of 23 factors with respect to navigation and visual content. Websites designed by women had links to a larger number of topics than those designed by men, used language differently, and manifested different elements of visual design such as using rounded versus straight shapes, applied more colours, a horizontal layout, and informal images. In another study, differences between men and women were observed for colour preferences and language usage (Mahzari and Ahmadzadeh 2013). Simon (2001) examined differences in website perceptions between men and women concerning information richness, communication effectiveness, and the communication interface, and found that women preferred websites with less clutter and fewer graphics. In other studies, accurate product descriptions and fair pricing are important for men (Chen and Hu 2012; Ulbrich, Christensen, and Stankus 2011), while the ability to return items is important for women (Ulbrich, Christensen, and Stankus 2011). Website characteristics such as colour, shapes, and use of expert language also differ between men and women (Ozdemir and Kilic 2011).

In an e-service shopping environment, research has found that women more than men experience higher levels of enjoyment related to the presence of social elements on the website (Cyr et al. 2007). Further, Cyr and Bonanni (2005) uncovered differences on selected items between men and women for information design, navigation design, and visual design. In total, five of 11 design items as perceived by men or women were statistically different. Based on these results as well as interview data, men more than women felt that information on the website is better organised and presented, and men were more satisfied with navigation.

In sum, men and women perceive the online shopping experience differently, and have differing preferences for how shopping websites are designed and presented.

3. Psychological gender and online shopping

The assumption guiding this study is this: rather than whether one is a man or a woman, differences in perception and use of IT may be tempered by psychological gender which includes values of masculinity or femininity. As noted in the introduction, masculinity values are generally typified by assertiveness, toughness, and a focus on material success; femininity values, in contrast, are typified by modesty, tenderness, and concern for the quality of life (Hofstede 1980). This seems to be supported by previous research testing male and female web usage as it related to TAM. It was found that women mostly had a high level of femininity, which the authors termed 'socio-emotional,

expressive and interpersonally oriented' traits; whereas men mostly clustered on masculinity, which was referred to as 'task-oriented, instrumental and agentic' traits (Sanchez-Franco 2006, 22). Relevant to this study, Srite and Karahanna (2006) examined TAM using individual and espoused (rather than predetermined) value dimensions including masculinity and femininity. They wrote: 'Masculinity/femininity, a measure of psychological gender, refers to whether a society or an individual espouses masculine values (e.g. being aggressive) versus feminine values (e.g. being nurturing)' (683).

In other research, Zahedi, Van Pelt, and Srite (2006) investigated the use of language signifiers in websites and found differences in masculine and feminine communication actions on the web. For example, beliefs expressed on female-oriented websites emphasise relationships, success focused on others, and concern for quality of life. In contrast, beliefs on male-oriented websites related to performance, success, and accumulation of wealth. This result suggests there may be differences in how websites are created based on differences anchored in masculine or feminine value sets.

To summarise, it appears that beyond biological forces, there are indications that psychological gender impacts the user experience of websites, and that these differences are manifest in values that align to masculinity and to femininity. Men and women may exhibit values of both masculinity and femininity. Following this premise, it may be possible that some men may be more feminine in value orientation than some women, and some women may be more masculine in value orientation than some men.

4. Research model

An augmented TAM (as per Gefen, Karahanna, and Straub 2003; Gefen and Straub 1997) is used to explore the relative impact of biological sex and psychological gender based on user perceptions of an e-commerce website. An outline of our model is presented in Figure 1. The TAM as originally developed by Davis (1989) has been used extensively in research in the information systems field (Moon and Kim 2001). Further, the TAM has been used by previous researchers to separately examine biological sex (e.g. Sanchez-Franco 2006) and psychological gender (Srite and Karahanna 2006).

The original TAM includes PEOU, perceived usefulness (PU), and behavioural intention to use. Related to the e-business context of the current investigation, we have replaced behavioural intention to use with e-loyalty as the final dependent variable, which is in alignment with prior research (e.g. Cyr 2008; Flavián, Guinalíu, and Gurrea 2005). E-loyalty refers to a user's intention to revisit a website or to purchase from it in the future. Also consistent with earlier studies in e-business (e.g. Cyr et al. 2007; Hassanein and Head 2006), our model includes PSP as an antecedent of PU. Trust is important in e-business and has likewise been added in alignment with previous research (e.g. Cyr 2008; Gefen, Karahanna, and Straub 2003; Hsu, Chuang, and Hsu 2014; Koksal and Penez 2015; Samuel, Balaji, and Wei 2015). As already noted, it is not our intention to retest the model, but rather, our contribution is to selectively examine the effects that biological sex and psychological gender have on this model. The elements of the model are elaborated further in the following sections, along with the hypotheses.

5. TAM, biological sex, masculinity–femininity, and associated hypotheses

Men and women perceive IT differently. Venkatesh and Morris (2000) found that men's technology usage decisions are strongly influenced by PU, while women are more influenced by PEOU. PU has a positive effect on trust for men more than for women, while PEOU

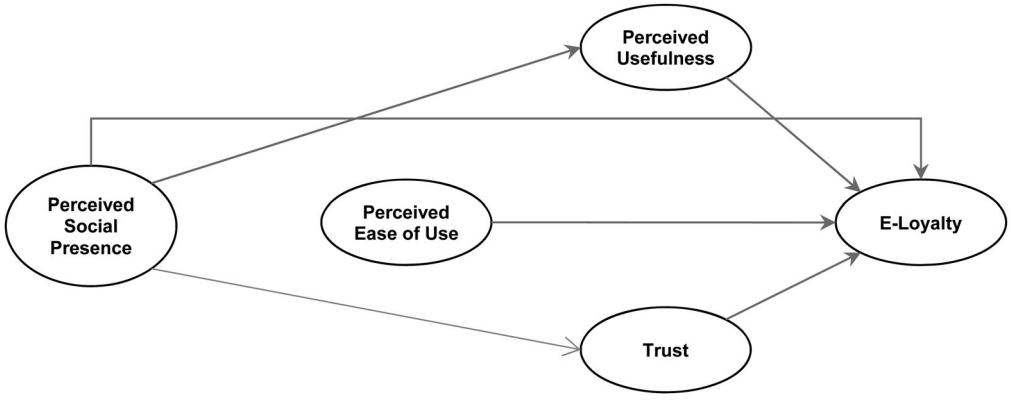

Figure 1. Research model.

has a more positive effect for women over men (Awad and Rogowsky 2008). Sanchez-Franco (2006) used TAM to test differences between men and women for web use and acceptance. He found that men more than women are driven by instrumental factors resulting in higher PU, and in turn higher PU had a stronger positive influence on men's behavioural intention. In an investigation of intention to use instant messaging as one form of communication technology, among women PEOU was a significant predictor of use intentions, while among men PU was more important (Ilie et al. 2005). Further, in a mobile commerce context, PEOU was more important to women when intending to use m-commerce (Lu and Rastrick 2014). In an e-services context PU to e-loyalty was stronger among men than among women (Cyr et al. 2007).

Rather than examining biological sex and TAM as in the previous studies, Sanchez-Franco (2006) advocated the importance of understanding behavioural differences based on other characteristics besides being male or female. As Sanchez-Franco (2006, 19–20) outlined,

> Evidence has proved that behavioural differences, due to gender and other social indicators – as individual differences – may be currently more stressed in the online environments as users become representatives of these social categories … Accordingly, research thus suggests the need for incorporating intrinsic motives that influence web acceptance and usage by males and females.

Others (e.g. Davis, Bagozzi, and Warsaw 1992; Venkatesh 2000) support the notion of examining intrinsic values and motives related to computer use and technology acceptance. Masculinity and femininity represent such values.

Srite and Karahanna (2006) tested the moderating effect of espoused masculinity–femininity on the paths from subjective norms, PEOU, and PU to behavioural intention. Participants in that study were students representing 30 countries at an American university. Individual data for masculinity–femininity was collected. The researchers found that masculinity–femininity, as a single construct, had a significant effect on the relationship between subjective norms and behavioural intent to use a technology. This relationship was stronger for those with a more feminine orientation. In addition, masculinity–femininity influences the path between PEOU and behavioural intention, with the relationship stronger for those with a masculine orientation. Of note, this relationship is opposite to that found in the preceding section on biological sex – when the relationship from PEOU to behavioural intention was stronger among women. Masculinity–femininity did not affect the relationship between PU and behavioural intention in that study. Further, in a study testing masculinity and femininity, McCoy, Galletta, and King (2007) found direct effects of PU on behavioural intention among users with either a masculine or a feminine value orientation. However, regarding the effect of PEOU on behavioural intention, the relationship was significant only for those with a feminine value orientation.

Based on the preceding studies, there is support for the notion that whether one has masculine or feminine values does influence the path relationships in TAM. A number of researchers (e.g. Davis, Bagozzi, and Warsaw 1992; McCoy, Galletta, and King 2007; Srite and Karahanna 2006; Venkatesh 2000) have also indicated the importance of further research to better understand the impact of values such as masculinity and femininity on the TAM. However, to date there is no investigation in which both biological sex and psychological gender (such as masculinity and femininity) are examined in the same study for their relative impact on TAM. To this end, we propose our first set of exploratory hypotheses, arguing that psychological gender may have a stronger effect on PU and PEOU than biological sex.

> H1a. PU is explained by femininity significantly better than by biological sex.
>
> H1b. PU is explained by masculinity significantly better than by biological sex.
>
> H2a. PEOU is explained by femininity significantly better than by biological sex.
>
> H2b. PEOU is explained by masculinity significantly better than by biological sex.

Consistent with previous research we do not expect a direct effect of biological sex, masculinity, or femininity on e-loyalty. Further, we expect that biological sex, masculinity, and femininity will mediate the effect of PEOU and PU on e-loyalty. In other words, biological sex, masculinity, and/or femininity should have an effect on PEOU, PU, and other antecedents, which in turn affects e-loyalty.

6. PSP, biological sex, masculinity–femininity, and associated hypotheses

PSP is defined as 'the extent to which a medium allows users to experience others as being psychologically present' (Gefen and Straub 2003, 11). PSP implies a psychological connection of the user to the website, with the user perceiving the website as socially warm, personal, and sociable – therefore creating a feeling of human contact (Yoo and Alavi 2001). This definition is adopted in the current study. Examples of website features that encourage PSP include socially rich and emotive text

(Hassanein and Head 2006), personalised greetings (Gefen and Straub 2003), or human pictures (Hassanein and Head 2006).

In one study in which PSP was tested comparing men and women, both sexes were found to appreciate social elements of a website – although this was especially important for women (Cyr et al. 2007). That study found that for both sexes PSP increased PU. However, women experienced statistically higher levels of enjoyment compared to men related to the presence of social elements on the website. Also, in an online shopping context, differences in perceptions were found based on biological sex to such as extent that 'in general, women view some forms of shopping as more of a social activity than do men' (Van Slyke, Comunale, and Belanger 2002, 85). PSP fosters trust in online shopping contexts (Gefen and Straub 2003; Hassanein and Head 2006). Women, more than men, include images in their web design (Moss, Gunn, and Heller 2006; Tedesco, Chadwick-Dias, and Tullis 2004), which may contribute a sense of PSP to the website. In a study in which gender differences were examined regarding online visual representation of products, women valued the quality of a picture, which in turn influenced the intention to purchase the product (Flavián, GurreaSarasa, and Sanclemente 2011).

Based on in-depth interviews, Dittmar and Drury (2000) documented that conventional shopping is a more psychologically and emotionally encompassing experience for women than for men. Generally, women were found to be more motivated by emotional and social factors in shopping, while men were more motivated by functional factors. However, in follow-up research concerning online shopping, men's attitudes remained much the same in both conventional and online shopping environments, while women placed greater value on functionality online than in a conventional setting (Dittmar, Long, and Meek 2004). This difference between group responses in the two studies suggests that attitudes towards shopping may not depend only on biological sex, but may also depend on the interpreted response to particular circumstances. More specifically, rather than based on whether one is a man or a woman, women's attitudes in that study changed depending on the shopping context.

While previous research suggests that social presence has different effects on men than on women, the studies by Dittmar, Long, and Meek (2004) suggest that socio-psychological differences may occur with respect to PSP that are not tied to biological sex. Although not previously tested, we explore this possibility in the following hypotheses, assuming a parallel with the previous set of hypotheses where psychological gender was hypothesised to have a stronger effect than biological sex.

H3a. PSP is explained by femininity significantly better than by biological sex.

H3b. PSP is explained by masculinity significantly better than by biological sex.

7. Trust, biological sex, masculinity–femininity, and associated hypotheses

PSP affects trust in online contexts (Cyr et al. 2007). Similar to traditional shopping, trust is about consumer confidence in the vendor operating the website as part of a buyer–seller transactional exchange. Trust concerns the consumer's willingness to depend on the seller to take appropriate actions in circumstances where such action makes the consumer vulnerable to the seller (Jarvenpaa, Tractinsky, and Saarinen 1999). In the current study, we adopt a definition of online trust based on Corritore, Kracher, and Wiedenbeck (2003), wherein trust is an attitude of confident expectation that one's vulnerabilities will not be exploited by the vendor.

Rodgers and Harris (2003) found that women do not trust e-commerce to the same extent as men do. Furthermore, Cyr and Bonanni (2005) showed significant differences concerning the degree men and women trust information as presented on a website – with women being less likely to trust. Correspondingly, women also perceived a higher level of risk in online purchasing than men do (Garbarino and Strahilevitz 2004). The effect of trust on intention to shop online is stronger among women than among men (Awad and Rogowsky 2008). Trust is more significantly related to e-loyalty among women than among men (Cyr et al. 2007).

Trust and societal values are interconnected, and trust levels vary based on country affiliation (Doney, Cannon, and Mullen 1998; Gefen and Heart 2006). Research into trust and e-commerce across societies and cultures is rare, although a few studies examined values such as individualism–collectivism (Cyr 2008; Jarvenpaa, Tractinsky, and Saarinen 1999) or uncertainty avoidance (Vance, Elie-Dit-Cosaque, and Straub 2008). To our knowledge, no prior research examines the relationship of femininity or masculinity to trust. However, masculinity and femininity as a set of values could be related to levels of trust. The reason for this is that biological sex does affect trusting levels in online contexts (Reidl, Hubert, and Kennedy 2010), and by extension so should the psychological gender representation of biological sex. As in the previous hypotheses, it is assumed that psychological gender has a stronger effect than biological sex.

H4a. Trust is explained significantly better by femininity than by biological sex.

H4b. Trust is explained significantly better by masculinity than by biological sex.

8. Research methodology

8.1. Participants

A total of 336 participants successfully completed the experimental online questionnaire. Participants were recruited from major universities in Canada and the Netherlands. To maximise variance in our sample, these two countries were chosen as Canada is relatively high in masculinity (scoring 52) and the Netherlands is very feminine (scoring 14) on Hofstede's (1980) scale for masculinity–femininity. Nationality was added to the model as a control variable.

Participants were mostly graduate and undergraduate students, although some faculty and staff were also represented. As in Walczuch and Lundgren (2004) and Gefen, Karahanna, and Straub (2003), we used students for e-retailing research as they are Internet savvy. Average participant age was 20 (male – 20.3; female – 19.7) years with 3.4 years shopping experience (male – 3.4; female 3.2); 38% (110) were female and 62% (177) were male; and 54.3% were from the Netherlands and 45.7% from Canada. All respondents were recruited by email, and were entered in two lottery draws for a US$250 gift certificate at Amazon.com in exchange for their participation.

8.2. Website design and experimental task

The experimental task consisted of browsing an e-services website to buy concert tickets (for one of five concerts: U2, Eagles, Diana Krall, Gwen Stefani, or Elton John). Condition types were adapted from Burke (2002) who determined consumer values regarding online shopping features such as product information (i.e. text), product photographs, brand comparisons, and expert ratings.

Two diverse conditions for social presence were used to increase variance in the experimental conditions –with two different website designs used for each of the five concert sites. In the low social presence condition, the websites include only text and logos. In the high social presence condition, the following additional elements are included: (1) photo of the entertainer(s); (2) interactive elements that allow for discussion and reviews/ratings; (3) opportunity for users to open a blank window and send a live chat message to other users assumed to be concurrently browsing that web page; (4) a 'presence indicator' consisting of a static image of several 'smiley face' icons to represent the number of users browsing the current page; and (5) opportunity to view reviews from other users and to write their own review for the performer/band. Hence, in the high social presence condition, both synchronous chat and asynchronous reviews are offered to the user. The conditions were previously tested by Cyr et al. (2007). The difference in PSP between the two conditions was significant ($p < .01$). In each country, participants are randomly assigned to a condition of high social presence or low social presence.

The experiment was conducted entirely online, and participants could complete the study from any computer with an Internet connection, thus increasing online shopping task realism. Following completion of the task of buying a concert ticket, participants completed an online questionnaire (using a 7-point Likert scale) about their experiences on the e-services website (refer to Appendix 1).

8.3. Instrument validity and reliability

Content validity ensures that construct questions (items) are representative and drawn from a universal pool (Cronbach 1971). In this research, the items for PSP, PEOU, PU, trust, and loyalty come from the existing literature, where they have been shown to exhibit strong content validity.

Items for masculinity–femininity were developed expressly for this research. Hofstede (1980) defined masculinity–femininity as a single bipolar dimension at the nation level. Although this bipolar dimension has been used in most IS research to date, in individual-level research masculinity and femininity are sometimes portrayed as two separate dimensions (Powell, Butterfield, and Parent 2002), and have been found to be two independent constructs (Bem 1981; Spence and Helmrich 1987). As indicated in Appendix 1, masculinity items M-1 and M-3 are taken from Hofstede and two new items were created. For femininity, items F-1 and F-2 are from Hofstede and two items were created. The 8 items were piloted with 21 Canadian and 12 Dutch participants, and tested for content validity. From the 8 items, two independent scales emerged.

The model was analysed with LISREL 8.71. The correlation of a construct with other constructs is shown in Table 1. The scales demonstrate appropriate reliability (Nunnally 1978).

9. Results

9.1. Hypothesis testing

As is the norm when using survey data, we tested our data for common method bias using Harman's one

Table 1. Construct properties.

	Cronbach's alpha	PSP	PU	PEOU	Trust	Loyalty	MAS	FEM	Biological sex
PSP	.883	1.00							
PU	.882	0.22	1.00						
PEOU	.825	0.10	0.37	1.00					
Trust	.816	0.19	0.22	0.20	1.00				
Loyalty	.956	0.31	0.47	0.34	0.50	1.00			
MAS	.686	0.16	0.23	0.13	0.19	0.15	1.00		
FEM	.686	0.13	0.13	0.36	0.34	0.15	−0.09	1.00	
Biological sex		−0.10	−0.05	−0.20	−0.09	−0.11	0.11	−0.10	1.00

Notes: PSP, perceived social presence; PU, perceived usefulness; PEOU, perceived ease of use; MAS, masculinity; FEM, femininity.

factor method. When entered in an exploratory factor analysis, the first factor had an eigenvalue of 27%, less than half the explained variance at 68%. This is typically taken as indicative of low common method variance. To better verify the extent of common method variance, we applied the methodology suggested by Podsakoff et al. (2003). We added a new latent variable to the LISREL analysis so that in addition to the research model there would be one latent variable connected reflectively to all the measurement items. Adding this latent variable resulted in a chi-square of 635.14 with 342 degrees of freedom. This results in a change in chi-square of 84.72 with 30 degrees of freedom, compared to the original model we reported with a chi-square of 719.86 with 372 degrees of freedom. The change in chi-square is insignificant. Even attaching this common method variance latent variable only to the TAM, PSP, and trust items showed insignificant change in the model. The resulting chi-square of 613.38 with 350 degrees of freedom shows insignificant change to the reported overall fit, with a change in chi-square of 106.48 with 22 degrees of freedom. In sum, while there should be a common method bias in our data because it comes from a survey, the common method bias has an insignificant effect on the model.

To adjust for this common method variance, the technique as outlined by Malhotra, Kim, and Patil (2006) was used. We identified the second lowest correlation among the measurement items and used it as an upper bound estimate of common method variance. There was no external marker variable. The second lowest correlation was .067. Next, we adjusted the correlations to account for this estimation using the formula provided by Malhotra et al.

$$r_A = (r_u - r_m)/(1 - r_m), \tag{1}$$

where r_A is the adjusted correlation used in the LISREL analysis, r_m is the second smallest correlation coefficient, and r_u is the original correlation. In this case r_m is .067. Malhotra et al. had shown that accounting for common method in this manner produces slightly lower betas and R^2, but shows the same overall pattern of significant paths.

Having adjusted the correlation matrix, we ran the analysis in LISREL 8.71. The overall fit indexes were mostly within accepted values in management information systems research (Gefen, Rigdon, and Straub 2011): $\chi^2_{371} = 719.00$, GFI = .88, RMSEA = .052, NFI = .89., CFI = .94. The fit indices could have been improved further by dropping items in order that they are all above suggested thresholds. But in accordance with the recommendation by Gefen, Rigdon, and Straub (2011) in such circumstances, and since this did not change the pattern of significant paths, we decided to retain the original scales with the exception of dropping PSP5.

Path estimates are shown in Table 2 and Figure 2. Loadings are shown in Table 3. Table 4 shows the standard deviation of these paths which is necessary for comparing path coefficients based on Duxbury and Higgins (1991), with biological sex arbitrarily chosen as 1 for men and 2 for women.[1] To increase readability, paths that are not directly relevant for our hypotheses are shown in grey in Table 2 and in Figure 2.[2] We also examined whether the interaction terms of Masculinity by

Table 2. LISREL path coefficients.

		From							
To	SMC (R^2)	PSP	PU	PEOU	Trust	MAS	FEM	Biological sex	Nationality
PSP	.07			0.00		0.21**	0.14	−0.12	−0.12*
PU	.21	0.16*		0.33**	0.12	0.13	−0.02	0.02	0.03
PEOU	.19					0.19**	0.36**	−0.19**	−0.06
Trust	.20	0.08		0.02		0.24**	0.33**	−0.08	−0.15**
E-Loyalty	.44	0.18**	0.30**	0.19**	0.42**	−0.08	−0.13	0.00	0.03

*Significant at the .05 level.
**Significant at the .01 level.

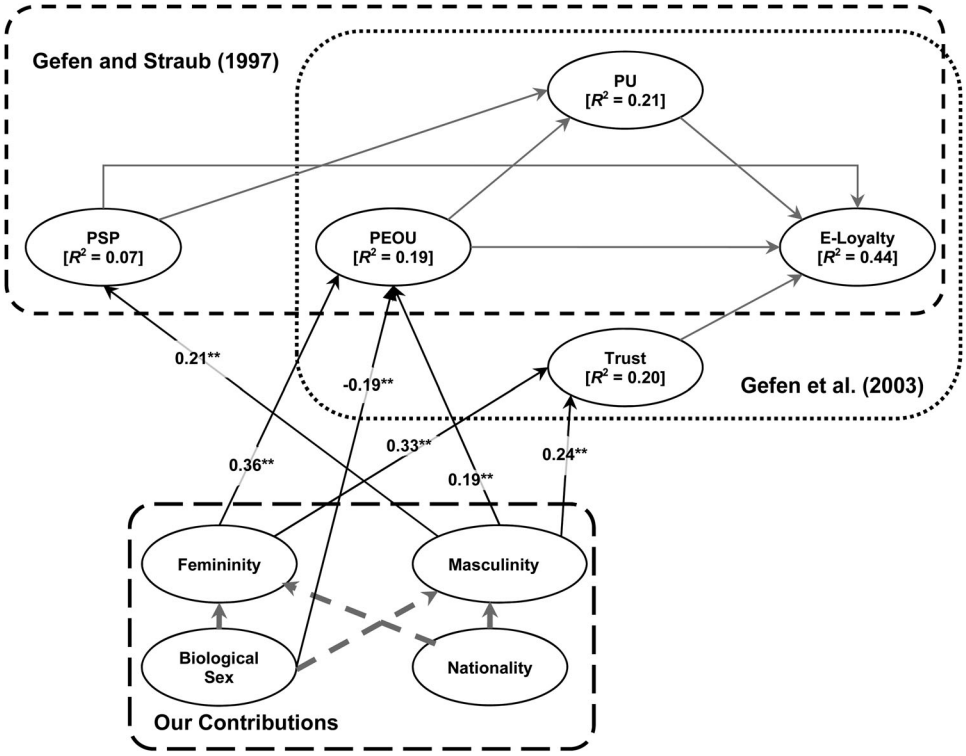

Figure 2. Result of the LISREL analysis.
Note: Only significant paths are represented in the model.

Biological Sex and the interaction of Femininity by Biological Sex have a significant effect on Trust, PEOU, PU, and PSP. None of these six interactions was significant.

Table 3. LISREL loadings.

	Use	PU	PEOU	Trust	PSP	MAS	FEM
Use1	1.47						
Use2	1.47						
Use3	1.48						
PU1		0.89					
PU2		1.28					
PU3		1.29					
PU4		1.20					
PEOU1			0.76				
PEOU2			0.81				
PEOU3			1.01				
PEOU4			0.86				
Trust1				0.86			
Trust2				0.71			
Trust3				0.40			
Trust5				0.48			
Trust6				0.88			
PSP1					1.34		
PSP2					1.14		
PSP3					1.32		
PSP4					1.04		
MAS1						0.79	
MAS2						0.62	
MAS3						0.80	
MAS4						0.87	
FEM1							0.63
FEM2							0.64
FEM3							0.70
FEM4							0.98

Note: All the paths are significant at the .01 level.

Overall, the data support our replication of two previous studies from which our baseline model was developed. PSP affected PU and e-loyalty; PEOU affected PU and e-loyalty; and Trust affected e-loyalty (Gefen, Karahanna, and Straub 2003; Gefen and Straub 1997). With respect to new additions based on the current investigation, Masculinity had a significant effect on PEOU, Trust, and PSP, while Femininity had a significant effect on PEOU and on Trust. Biological sex only had a significant effect on PEOU. Summarised results are shown in Table 4. The hypotheses, suggesting that Masculinity and Femininity have a stronger influence than Biological Sex, received mixed support (refer to Table 4). Of interest, if the hypotheses when both paths for biological sex and psychological gender are insignificant are excluded, for the remaining five hypotheses, four of these (H2a, H3b, H4a, and H4b) are supported in favour of psychological gender over biological sex, therefore having greater predictive power for the model.

9.2. Additional analyses

An interesting and unexpected finding of the analysis is that neither Masculinity nor Femininity was significantly affected by biological sex. Hence, on average, neither Femininity nor Masculinity was different between men and women in the sample, and both men and women

Table 4. Summary of results from hypothesis testing.

Hypotheses	*T*-test	Biological sex beta (std)	Psychological gender beta (std)	*T*-value (*p*-value) comparing the paths	Replication with stepwise linear regression showing order of entry by the stepwise procedure	Conclusion
H1a. Variance in PU is explained significantly better by femininity than by biological sex	Compare beta of biological sex on PU with beta of femininity on PU	0.04 (0.10)	−0.03 (0.11)	Both paths insignificant	Femininity alone ($\beta = .12$, $t = 2.15$)	Not supported
H1b. Variance in PU is explained significantly better by masculinity than by biological sex	Compare beta of biological sex on PU with beta of masculinity on PU	0.04 (0.10)	0.15 (0.09)	Both paths insignificant	Masculinity alone ($\beta = .19$, $t = 3.51$)	Not supported
H2a. Variance in PEOU is explained significantly better by femininity than by biological sex	Compare beta of biological sex on PEOU with beta of femininity on PEOU	−0.29** (0.09)	0.43** (0.10)	19.16**	Femininity ($\beta = .21$, $t = 3.99$) Biological sex ($\beta = .15$,$t = 2.77$)	Supported
H2b. Variance in PEOU is explained significantly better by masculinity than by biological sex	Compare beta of biological sex on PEOU with beta of masculinity on PEOU	−0.29** (0.09)	0.19** (0.07)	16.15**	Biological sex ($\beta = .18$, $t = -3.26$) Masculinity ($\beta = .12$, $t = 2.13$) biological sex is prominent	Not supported
H3a. Variance in perceived PSP is explained significantly better by femininity than by biological sex.	Compare beta of biological sex on PSP with beta of femininity on SP	−0.32 (0.16)	0.30 (0.17)	Both paths insignificant	Neither included in the stepwise procedure	Not supported
H3b. Variance in perceived SP is explained significantly better by masculinity than by biological sex	Compare beta of biological sex on PSP with beta of masculinity on SP	−0.32 (0.16)	0.35** (0.13)	2.68**	Masculinity alone ($\beta = .14$, $t = 2.52$)	Supported
H4a. Variance in trust is explained significantly better by femininity than by biological sex	Compare beta of biological sex on trust with beta of femininity on trust	−0.14 (0.10)	0.46** (0.12)	37.72**	Femininity alone ($\beta = .25$, $t = 4.68$)	Supported
H4b. Variance in trust is explained significantly better by masculinity than by biological sex	Compare beta of biological sex on trust with beta of masculinity on trust	−0.14 (0.10)	0.26** (0.09)	16.42**	Masculinity alone ($\beta = .16$, $t = 2.88$)	Supported

**Significant at the .01 level.

exhibit feminine as well as masculine values. Based on this result, we were interested to explore the data with respect to nationality, biological sex, and possible interaction effects as outlined below. To do this, an ANOVA analysis was conducted on the effects of nationality and biological sex on Masculinity, and the data were plotted. The results show that Masculinity is only marginally related to biological sex, but significantly affected by nationality in our sample. The interaction effect was insignificant, suggesting that these two effects are independent. Of interest, both men and women in the Canadian sample were more masculine in their values than their Dutch counterparts, with some Canadian women asserting more masculine values than Dutch males. A parallel analysis was conducted for Femininity with quite different results. Direct effects were insignificant, but there was a significant interaction effect. Women had a higher and approximately equal level of Femininity in both Canada and the Netherlands. However, Dutch men had a significantly higher value of femininity compared to Canadian men. Results for both sets of analyses appear in Appendix 2. Overall, this analysis suggests that biological sex is not strongly related to Masculinity or to Femininity. Rather, Masculinity is mainly related to nationality, whereas biological sex seems to have a moderating influence for the effect of nationality on Femininity so that while in the Canadian sample women are more feminine than men, this is not so in the Dutch sample.

10. Discussion and conclusions

An important contribution of this study is the observation that psychological gender (i.e. values of masculinity and femininity) had a more robust impact on the TAM than biological sex. Biological sex had a relatively weak overall effect in the model. In fact, for biological sex the only significant path was to PEOU. In contrast, the influence of both masculinity and femininity was positive on PEOU. In addition, femininity more than biological sex affected trust, and masculinity more so than biological sex affected both trust and PSP.

In sum, biological sex, when analysed in our model with psychological gender, seems to have a limited significant impact, while masculinity and femininity significantly influence four paths of the model. This supports the underlying premise that biological sex, but more so psychological gender, contributes to a user's experience of technology. Therefore, while there are some biological differences in information processing as proposed in the selectivity model (e.g. Meyers-Levy 1989) and in other research (Cyr and Bonanni 2005; Reidl, Hubert, and Kennedy 2010), when shopping online one's psychological gender is likewise important, if not more important, in determining user perceptions. Hence, the current research supports and extends earlier work in which values in organisational and other settings were found to be significant predictors of behaviours or perceptions (Brewer, Mitchell, and Weber 2002; Santos et al. 2006; Wu 2009). Tentatively, this outcome is now extended to the domain of IT acceptance and the TAM.

With respect to previous research, it is known that biological sex influences TAM (e.g. Gefen and Straub 1997). More specifically, in earlier studies women were more influenced by PEOU and men by PU. In the current investigation when biological sex, masculinity, and femininity are simultaneously considered, it is interesting that the effect on PU is not significant in any category, while PEOU is significantly affected by all three. While a tentative conclusion, it may be that those individuals with values more oriented to instrumentality (as is masculinity) are less concerned with PEOU. As predicted, there was no direct effect of biological sex, masculinity, or femininity on e-loyalty. Instead, e-loyalty was mediated by PU and PEOU. This represents an interesting extension of Sanchez-Franco (2006) who suggested that web acceptance and TAM may be affected by levels of masculinity or femininity. Other research by McCoy, Galletta, and King (2007) similarly suggested that TAM does not apply the same way in all cultures or societies when societal values differ. Our results show the need to take psychological gender into consideration – and not only biological sex.

In this study, trust was affected by psychological gender values of masculinity and femininity. This is in alignment with earlier studies (Flavián, Guinalíu, and Gurrea 2005; McKnight, Kacmar, and Coudhury 2004) in which the ability to trust was shown to be crucial for both men and women when shopping online. It may be that this should now be extended to include masculine or feminine values, regardless of gender.

In previous research women, more than men, were found to value the perceived social elements of the online experience (Cyr et al. 2007; Van Slyke et al. 2004), although masculinity and femininity were not tested in those studies. In this investigation, it is puzzling that only masculinity was significantly related to PSP. Given that femininity is related to espoused values that emphasise social concerns, one might expect femininity to have a significant relationship to PSP as well, and more so than masculinity.

Based on additional analyses, we found that neither masculinity nor femininity was affected by biological sex. On average, neither masculinity nor femininity differs between men and women, and both men and women exhibit feminine and masculine values. This

finding supports the notion of psychological androgyny as first introduced by Bem (1981). While the exact reason for this result is the subject of future research, it may be that social evolutions in Western countries may account for this merging of values between the sexes. More now than ever, women have increasingly similar opportunities and roles in society as exist for men. For example, women are now more representative in the workplace than in previous times, and men are more active in the child-rearing process. It is worth noting that such role changes have primarily occurred in the last 35 years since the original data for the studies by Hofstede (1980) were collected.

Another important contribution of this study is the separation and validation of two constructs for each of masculinity and femininity. Building on the psychological literature for masculinity and femininity, we developed and tested items to measure masculinity and femininity as two separate constructs in an IS context. The factor analysis confirmed that our items measure two distinct constructs in support of earlier work by Bem (1981). Further, the validation of separate scales permits future research to explore the possibility of androgyny, wherein men and women can be tested concerning masculinity or femininity. In previous studies in which masculinity–femininity was investigated as a single construct, the forced nature of merging both value sets may be the cause for erroneous or inconclusive results.

Concerning the separation of masculinity and femininity into two scales, there are implications for cross-cultural research. More specifically, and aligned to cultural indices as defined by Hofstede (1980, 1998), the possession of masculine traits suggests one is generally assertive and focused on material success, while possession of feminine traits suggests modesty and concern for quality for life. Based on the current results, cultural androgyny is possible wherein members of a certain culture can possess both masculine and feminine traits. This more individual-based perspective of cultural values avoids the 'ecological fallacy' trap –whereby all members of a certain culture are expected to possess the same traits. In alignment with this, Srite and Karahanna (2006) pointed out the importance of assessing cultural traits at the individual level of analysis.

Further, our data show that both masculinity and femininity are influenced by nationality. Nationality has a direct effect on masculinity, and femininity is influenced by an interaction of nationality and biological sex. For masculinity, an interesting finding is that Canadian men and women both exhibit higher levels of masculinity than Dutch men and women – with some Canadian women being more masculine in value orientation than Dutch men. This may be explained by the overall higher levels of masculinity in Canada compared to the Netherlands as first identified by Hofstede (1980). For femininity, while direct effects are insignificant, there is a significant interaction effect. That is, Canadian and Dutch women were both similarly high in femininity. In this case, biological sex had a moderating effect on femininity in that Canadian women are more feminine than Canadian men, but Dutch men and women are very similar. This, too, may be explained related to Hofstede's indices. One would expect in more masculine societies that there would be greater discrepancy in values between men and women, while in more feminine societies this value differential will be substantially diminished.

There are some limitations in this research. First, only one type of e-Services website (purchasing concert tickets) was used in the study. It may be that other types of websites will offer differing results. Second, the research was conducted on an experimental website where values and behaviours may differ from an actual and natural website. Third, a single survey-based methodology was used. While this methodology permitted sampling a wide range of participants, it is known to lack depth in terms of uncovering qualitative insights. In future work, it would be useful to use additional data collection methods such as interviews to obtain insights into the divergence of biological sex with values such as masculinity and femininity.

The outcome that masculinity and femininity, more than biological sex, influence user perceptions of an online e-service environment suggests that the same website will be viewed and appreciated differently by individuals with different levels of masculinity and femininity. Based on this, website managers may wish to adapt website content related to values of masculinity or femininity in addition to considerations of biological sex. For instance, based on previous research on web documents aimed at men or women, Zahedi, Van Pelt, and Srite (2006) found differences in beliefs, attitudes, rhetoric, and syntactic 'signifiers' based on masculinity–femininity. As one example, a rhetoric signifier for masculinity would be a website with an emphasis on numerical facts, use of irony, and brief and assertive commentary; websites with more feminine rhetoric signifiers might be more feeling oriented, defer to expertise, and be more explanatory in nature. In the context of the countries included in the current research, this would imply that users in the Netherlands might respond better to feminine rhetoric signifiers, while in Canada more masculine rhetoric signifiers may be appropriate. Given the novelty of examining website documents or websites using a value-based approach, there is much scope for further investigations into this area, including how this approach can be incorporated into the design of

websites. Similar research could be extended to examine other values such as individualism-collectivism or uncertainty avoidance.

Since this study is one of the first of its kind in the IS domain, it is partly exploratory in nature. However, the results suggest a need to study biological sex separately from masculinity and femininity and to place greater emphasis on the latter. There are interesting implications for TAM, trust, and the e-commerce user experience – which require a more nuanced approach to such investigations. The same applies on a practical level regarding website design that is sensitive to value orientations – in this case for masculinity and femininity – rather than expecting clients to be either men or women. A salient finding is that psychological androgyny exists. The data support that values such as masculinity and femininity are more relevant predictors of our model than biological sex. A methodological contribution of the current research is that masculinity and femininity are separate dimensions that afford new avenues for future research. Based on the preceding, there are numerous opportunities to explore how psychological gender shapes social perceptions – as well as the way in which we perceive and use technology.

Notes

1. The test itself is based on a standard independent two sample t test of means. The *t*-statistic is calculated as:

$$t = (\beta_1 - \beta_2)/\text{SQRT}\,[(\text{Std_of_}\beta_1 \wedge 2 + \text{Std_of_}\beta_2 \wedge 2)/N].$$

2. Adding a control of the treatment group to which the subject belongs increases the R^2 of PSP to .33. ($\beta = .49$, $t = 12.70$, $p < .001$). The addition of this path did not change the significance of the other paths. This control does not significantly affect any other construct.

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Appendix 1. Questionnaire items and sources

Note: The questionnaire includes the following statements that were ranked on a 7-point Likert scale: from 'very strongly disagree' to 'very strongly agree'.

Perceived social presence (Source: Gefen and Straub 2003)
PSP-1: There is a sense of human contact in the website.
PSP-2: There is a sense of personalness in the website.
PSP-3: There is a sense of sociability in the website.
PSP-4: There is a sense of human warmth in the website.
PSP-5: There is a sense of human sensitivity in the website. (Dropped)

Perceived usefulness (Source: Hassanein and Head 2006 with some adaptation for context)
PU-1: The website provides good quality information.
PU-2: This website improves my performance in assessing entertainment choices.
PU-3: This website increases my effectiveness for entertainment choices online.
PU-4: This website is useful for assessing entertainment choices online.

Perceived ease of use (Source: Hassanein and Head 2006 with some adaptation for context)
PEOU-1: This website is easy to use for concert assessment.
PEOU-2: I can quickly find the information I need on this website.
PEOU-3: This is a user-friendly website.
PEOU-4: My interaction with this website is clear and understandable.

Perceived trust (Source: adapted from Gefen, Karahanna, and Straub 2003)
T-1: I believe this company is honest.
T-2: I believe the company cares about its customers.
T-3: I believe the company is not opportunistic with its customers.

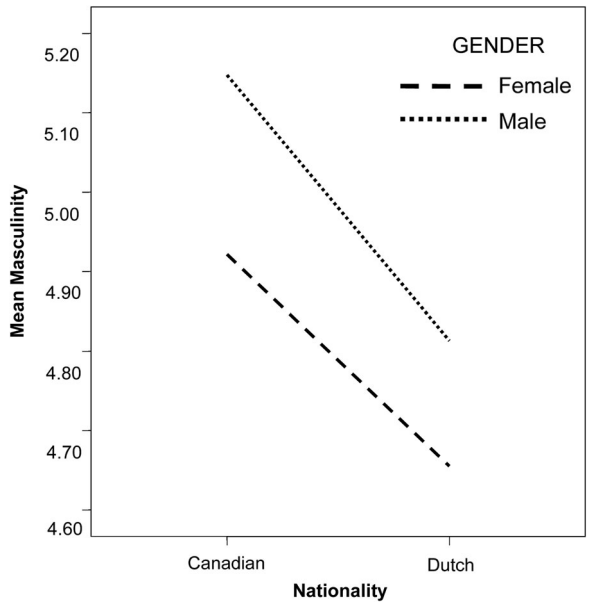

Figure A1. Graphical representation of the effect of nationality and biological sex on masculinity.

T-4: I believe the company is able to provide good service to its customers.
T-5: I believe the company is predictable.
T-6: I believe the company is trustworthy.
T-7: I believe the company knows its market.

Perceived loyalty (Sources: Cyr et al. 2005, 2007)
L-1: I would use this website again.
L-2: I would consider purchasing from this website in the future.
L-3: I would consider using this website in the future.

Masculinity (Source: own design, with items from Hofstede as indicated)
In my culture …
MAS-1: Money and material things are important. (Hofstede)
MAS-2: It is important to achieve in life even if personal sacrifices are made as a result.
MAS-3: Men are supposed to be assertive, ambitious and tough. (Hofstede)
MAS-4: Advancing one's career goal is important more than having a friendly work environment.
Femininity (Source: own design, with items from Hofstede as indicated)
In my culture …
FEM-1: The dominant values in society are caring for others. (Hofstede)
FEM-2: Both men and women are allowed to be tender and concerned with relationships. (Hofstede)
FEM-3: Creating a comfortable work environment is very important, even at the expense of getting ahead at work.
FEM-4: Quality of life is important in society more than focusing on financial outcomes.

Table A1. The influence of biological sex and nationality on masculinity.

Source	Type III sum of squares	df	Mean square	*F*	Sig.
Corrected model	10.347	3	3.449	3.946	.009
Intercept	7728.468	1	7728.468	8843.086	.000
Nationality	7.310	1	7.310	8.365	.004
Biological sex	2.982	1	2.982	3.412	.066
Nationality * Biological sex	.093	1	0.093	0.107	.744
Error	293.649	336	0.874		
Total	8504.188	340			
Corrected total	303.996	339			

Appendix 2. Results of the influence of biological sex and nationality on masculinity and femininity

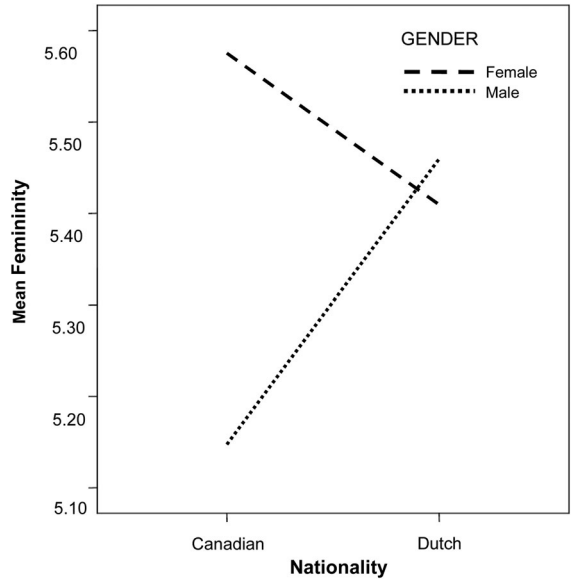

Figure A2. Graphical representation of the effect of nationality and biological sex on femininity.

Table A2. The influence of biological sex and nationality on femininity.

Source	Type III sum of squares	df	Mean square	*F*	Sig.
Corrected model	9.230	3	3.077	3.705	.012
Intercept	9439.234	1	9439.234	11,366.482	.000
Nationality	0.433	1	0.433	0.522	.471
biological sex	2.888	1	2.888	3.478	.063
nationality * Biological sex	4.624	1	4.624	5.569	.019
Error	279.029	336	0.830		
Total	10,156.813	340			
Corrected total	288.259	339			