

Perceptions of web knowledge and usability: When sex and experience matter[☆]

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Abstract

Web users are now a mixture of consumer and web designer. As such, the context within which we are socialized about the web – as both male and female users – moderates the relationship between what we think we know about it and its usability to complete tasks. With online survey data from 2077 web users, we empirically examine the relationship between user perceptions of web knowledge (our confidence in what we think we know) and user beliefs about usability of the web (how easy and useful we believe it to be). We include a user's sex and their website design experience as important moderators on this relationship. Results show a positive relationship between perceived web knowledge and web usability, and under the context of website design experience, more value is placed on the utility of the web, rather than on its ease of use. This moderation effect is stronger for female than it is for male web users. In summary, users with more confidence in their knowledge are more oriented towards the utility of the web than how easy it is to harvest that utility. Our work contributes to an understanding of the influence of the usage context within which the knowledge and beliefs of male and female users are socialized about web technology.

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1. Introduction

With the rise of social web technology, issues surrounding web usability are of increasing importance to designers and consumers alike. Technological developments are altering user expectations of their interaction with web sites and services, and are placing extra demands on what a user thinks they need to know to use the web effectively (Vollmer and Precourt, 2008). With past research demonstrating that a user's technical expertise influences technology use, user awareness and confidence in their own knowledge of web technology are important for web

management and design. Without the requisite confidence in this knowledge, user participation often does not occur as expected, and design objectives such as site satisfaction and stickiness are not met (Danaher et al., 2006; Danaher, 2007). In this study we argue that the context within which a person uses and therefore learns about the web, and their biological sex, moderates the relationship between what a user thinks they know about web technology (perceived web knowledge) and how useful and easy they perceive the web to be (perceived web usability).

It is often assumed that a user with greater experience of a domain is more knowledgeable or even deserves to be labeled an expert (Park et al., 1994). Similarly, studies of the web refer to length of usage experience as a substitute for knowledge (Bhat et al., 2002; Taylor, 2004). But equating greater usage experience to more knowledge or expertise is akin to suggesting that car drivers are necessarily mechanics. The idea that length of usage experience is a substitute for knowledge is based on the assumption that

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users learn similar content, at similar rates, and with similar learning styles (Park et al., 1994). We disagree with this assumption and focus our study on how the context within which usage (and therefore learning) of web technologies occurs moderates the relationship between a user's confidence in their web knowledge and their beliefs about how easy or useful the web is.

We also argue that a user's sex¹ plays an important role in this moderation effect. Many usability studies include sex as a simple sample descriptor variable. Despite reports of similarity in terms of overall web adoption statistics, differences remain in how, why, and what influences male and female web use. Females are reported as less frequent and less intense users than males, as well as being less frequent online purchasers and driven by different motives (i.e., women by social motives and men by search and enjoyment) (Garbarino and Strahilevitz, 2003; Simon and Peppas, 2005; Gefen and Ridings, 2005). However, despite differences between male and female users in how they behave in a networked economy (Taylor, 2004; Wilson, 2004) and participate in its development (Robertson et al., 2001), it is surprising that researchers have only recently started to treat sex as a boundary condition moderating web use (Hasan, 2010; Hwang, 2010; Muscanell and Guadagno, 2012). In this paper, we consider sex as a boundary condition, moderating the effect usage context of website design has on the relationship between user confidence in their web knowledge and their beliefs about the usability of the web.

The study makes three main contributions. First, previous work on web usability has focused on its outcomes. We introduce perceived user knowledge, that is, user confidence in what they think they know about a technology, as a driver of user beliefs of its usability. This relationship is examined in the context of the web. Despite past research on web experience (Comber et al., 1997; Rodgers et al., 2005), there is no prior work examining relationships between confidence in web knowledge and user beliefs of the usability of the web. The question remains—how does my confidence in what I think I know about the web affect my beliefs on how useful or easy I think the web is to use? The present study addresses this question.

Second, prior usability research has neglected to consider the influence of the context within which we use a technology on our confidence in what we know and our beliefs about its usefulness or ease of use. Past research has mainly considered the use context to describe the sample used to test a usability model; and, in this, has mainly contributed to our understanding of usability within

organizational and educational contexts (Davis et al., 1992; Venkatesh and Morris, 2000; Trauth, 2002; Turner et al., 2010). Such an approach ignores the wider usage context of personal consumption. It also disregards how the usage context may condition whether confidence in what we think we know influences our usability perceptions. In response, we examine the potential moderating role of website design experience.

Third, this work contributes to our understanding of user sex as an important moderator of relationships examined in usability research. Empirical research shows that males and females may differ across a number of criteria when it comes to IT/digital media literacy (Harrison and Rainer, 1992; Sachs and Bellissimo, 1993), web usage (Garbarino and Strahilevitz, 2003; Simon and Peppas, 2005; Gefen and Ridings, 2005), site design experience (Robertson et al., 2001; Simon and Peppas, 2005; Cyr and Bonanni, 2005), and self-report knowledge of web services (Goldsmith and Goldsmith, 1997; Kamis and Stohr, 2006). Unlike previous work, this study tests the complex interplay between a user's sex and their website design experience as moderators conditioning the relationship between a user's confidence in their knowledge about the web and their beliefs in how useful and easy the web is to use.

2. Conceptual background

2.1. Usability

The technology acceptance model (TAM) (Davis, 1989; Davis et al., 1992) is a theoretical backdrop to the development of most models in this field, including Kim and Malhotra's (2005) integrative model of technology adoption. TAM implies that web usability comprises two beliefs – perceived ease of web use (PEOU) and perceived web usefulness (PU) – that are salient in leading to usage. PEOU is the degree to which a person believes that using the web would be easy and free of effort, whereas PU is the degree to which a person believes that the web is useful and, therefore, would enhance his/her performance of specific tasks (Porter and Donthu, 2006). While many usability studies have validated positive relationships between PEOU, PU, and self-report usage (e.g., Moon and Kim, 2001; Turner et al., 2010), far less is known about antecedents to PEOU and PU. This paper contributes to technology acceptance research by drawing from the literature on cognitive psychology and proposing that a user's confidence in what they know about the web (i.e., their perceived web knowledge) is an important determinant of their usability beliefs.

2.2. User knowledge

Knowledge is a body of facts, principles, and procedures (information or understanding) accumulated by people and social groups about a domain or area of interest. It is organized in memory in certain formats (called knowledge

¹In usability and technology adoption research the dominant use of the term gender is as a synonym for sex, referring to the biological condition of being male or female. However, gender studies focused on the socialization of technology adoption increasingly use the term gender to refer to socio-psychological masculinity or femininity (Wood and Dindia, 1998; Trauth, 2002; Zahedi et al., 2006). The focus of this research is the biological condition of being male or female and, as such, the term sex or 'being male or female' is used.

structures or networks), shared between social actors (through socialization), and can differ in its type of content (procedural or declarative) and scope (from general to more specialized) (Page and Uncles, 2004; Pillai and Hofacker, 2007). The terms familiarity, expertise, knowledge, and experience tend to be used interchangeably in the cognitive knowledge literature, but they are not one of the same. For example, much past consumer research has used length of usage experience as a proxy to infer knowledge (e.g., Johnson and Russo, 1984; Park et al., 1994). Indeed, usage experience has received significant attention in technology acceptance work, assuming that the longer you use something the more knowledgeable you must be about it (Legris et al., 2003). Usage experience ignores the fact that people learn at differing rates and learn different information from different usage contexts (Pillai and Hofacker, 2007).

Other approaches in considering knowledge focus on the subjective (self-report) and objective (testing) measurement of knowledge; that is, measurement of ‘what an individual thinks they know’ (confidence in my knowledge) and ‘what an individual actually knows’ (what knowledge is stored in my memory) (Carlson et al., 2007). These two approaches are conceptually distinct (Alba and Hutchinson, 1987; Park et al., 1994). While not representing actual knowledge, the self-report measurement of perceived knowledge is seen as an indicator of a user’s confidence in their knowledge about a domain (Brucks, 1985) and as having a significant impact on their motivation to conduct various behaviors (Selnes and Gronhaug, 1986). Perceived web knowledge is different to self-efficacy, often discussed in technology research, in that perceived web knowledge denotes confidence in one’s knowledge about a technology; whereas self-efficacy is confidence in one’s ability or skill to use the technology. For these reasons, perceived web knowledge is the focus here and is tested as a key determinant of usability beliefs (see Fig. 1).

2.3. Perceived web knowledge and usability

The web is increasingly multi-functional, social, and complex. In parallel, web users are more active, engaged,

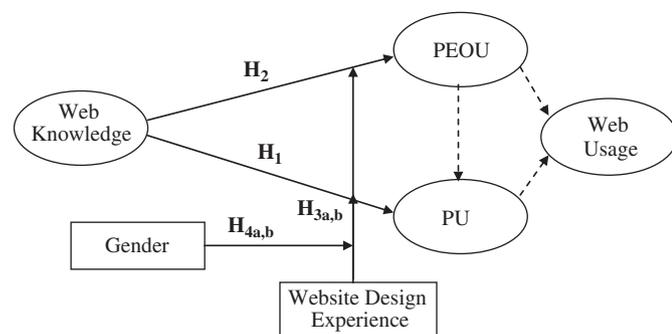


Fig. 1. Conceptual Model. Note. Dashed paths have been studied previously (e.g., Pearson and Pearson, 2008; Porter and Donthu, 2006) and serve as control links; PEOU = perceived ease of web use; PU = perceived web usefulness.

and self-directed in their usage than ever before (deValck et al., 2009; Mangold and Faulds, 2009). With past research demonstrating that a user’s technical expertise or computer-mediated communication (CMC) competency as defined by Ross et al. (2009) influences technology use, an understanding of the general effect that a person’s belief in their web knowledge may have on their perceptions of web usability, is of importance. We believe that the more confident a user is in their knowledge and understanding of the web, the less they will experience anxiety with using the web effectively to perform online activities (Bunz et al., 2007). That the confident user will be more focused in terms of both their time and effort in using the web should influence how easy and useful they perceive it to be. This is our rationale for examining the relationship between what a user thinks they know about the web and how useful and easy to use they believe the web to be.

Past research has identified that users with higher perceived computer knowledge are more open to learning about computing technology (Geissler and Horridge, 1993), and with higher levels of perceived Internet knowledge are more likely to be Internet opinion leaders and have a positive attitude toward the medium (Eastman et al., 2002; Ross et al., 2009). The logic that confidence in one’s knowledge about the web is a precursor to web service attitudes has been supported in the specific context of search engine use. Kamis and Stohr (2006) identified that the more knowledgeable users believe they are about using search engines, the more positive their attitude towards search engines. In addition Hsin (2010) reported that consumer familiarity with the agent functionality in online auctions was positively associated with perceived usefulness. As such, we posit that the more confident a user is in their knowledge about the web, the more useful they will believe it to be. Hence:

H₁. Perceived web knowledge is positively associated with PU.

Previous research has reported that users who are unfamiliar or have less computer and email fluency (as compared to those with higher fluency), experience higher levels of computer anxiety (Durndell and Haag, 2002; Bunz et al., 2007), suffer from more system disorientation (Hammond, 1989), demonstrate navigational problems in usage (McDonald and Stevenson, 1998), and are unsure of how or where to find the information they need for effective use (Kim and Hirtle, 1995; Last et al., 2001). All these factors can influence user perceptions on how easy the system is to use (Legris et al., 2003; Turner et al., 2010). Therefore, the more confident a user is in their knowledge about the web, the less anxiety and disorientation they should feel when using the web and the easier to use they will perceive the web to be. Hence:

H₂. Perceived web knowledge is positively associated with PEOU.

2.4. Site design experience, perceived web knowledge, and perceived web usability

A user's ability to understand and represent web-based information is structured and constrained according to their existing experience (Moreau et al., 2001). In this, many studies talk about experience in terms of cumulative usage experience such as frequency, length, and duration of technology use (e.g., Rodgers et al., 2005). The dominant discourse in these studies is that the length of prior experience shapes perceptions and adoption of technology (Moore and Benbasat, 1991; Taylor and Todd, 1995). Those who have used the technology for a long time, who use it frequently, and who do so for long periods exhibit more confidence in their ability to master and use the technology (DeLone, 1988). They also perceive IT as substantially more useful and easier to use when compared to the less experienced (Karahanna and Straub, 1999). With respect to the web, frequency of use has been found to be an important driver of attitude toward the web and the success of the web-activities undertaken (Torkzadeh and Van Dyke, 2002).

Although this focus on cumulative usage experience tells us something about behavior, it tends to discount the context within which this experience occurs. For example, is it part of one's work experience as a web designer, a high school teacher or perhaps for personal use? In studies where the context is considered, it is often used as a sample descriptor and restricted to generic conditions of mandated system usage (Venkatesh and Morris, 2000); such as 'for work' or 'in education' where users are driven to adopt the technology primarily because it is expected of them (Tarafdar and Zhang, 2005; Venkatesh et al., 2003). However, with current developments in web-based networked digital media, users and designers alike are more involved and active in the design, structure, and use of web-based information and services (Acar and Polonsky, 2007; Gangadharbatla, 2008). This gives importance to the argument raised long ago by Moore and Benbasat (1991) and Adams et al. (1992), and mentioned again by Hornbaek (2006) and Turner et al. (2010), that the context within which usage experience takes place influences usability perceptions and usage and has been neglected in the usability literature. We bring the context into the study as a moderator, proposing that the usage context of website design experience will condition the link between a user's confidence in their knowledge and their beliefs about usability of the web.

Whereas perceived web knowledge conveys self-confidence in one's knowledge, site design experience conveys the user's mastery of the technology and an awareness of its technical potential. How a designer sees, thinks, and uses web technology will be different to users without web design experience, such as consumers. Research shows that designers visit fewer hyperlinks, analyze websites more critically, are driven by both intrinsic and extrinsic motives, and achieve better performance outcomes (Chevalier and Kicka, 2006). They also suffer less from web anxiety, cognitive overload, disorientation, and navigation problems than non-designers do (Kim and Hirtle, 1995; Last et al., 2001). Users with

website design experience therefore would be expected to have acquired advanced technical skill (Bunz et al., 2007), be more involved with the technology (Eastman et al., 2002), and also be realistic about their own knowledge and performance outcomes (Pillai and Hofacker, 2007).

Possession of technical knowledge will influence how designers see and use web-based services and sites to achieve their goals. Their usability perceptions will be more focused on web productivity outcomes (i.e., how useful it is for the task they need to complete), than users not conditioned by this usage context (i.e., non-designers) (Chevalier and Kicka, 2006). Self-confidence in one's knowledge about a technology, coupled with technical design mastery, enables the designer to structure tasks and concentrate directly on productivity enhancement via perceived usefulness (Chevalier and Kicka, 2006). The confidence of the site designer in their knowledge would weaken intrinsic motivations pivotal to ease of use. In effect, site design mastery switches the focus of their knowledge from intrinsic to extrinsic problems. Therefore:

H_{3a}. The positive relationship between perceived web knowledge and PU becomes stronger when the user has site design experience.

H_{3b}. The positive relationship between perceived web knowledge and PEOU becomes weaker when the user has site design experience.

2.5. Sex, site design experience, perceived web knowledge, and perceived web usability

We further examine the complex interplay of a user's sex together with their experience designing websites in conditioning the relationship between a user's confidence in their web knowledge and one's beliefs about usability of the web. In terms of web/Internet penetration, studies have widely reported no significant differences between males and females in Internet adoption (Bimber, 2000), usage (Teo and Lim, 2000; Tsai and Lin, 2004), and use perceptions (Zhang, 2005). These findings have been attributed to the growing adoption and use of computers and the web amongst females, effectively decreasing the gender digital divide (Shaw and Gant, 2002).

However, research also does report differences in terms of web/Internet participation and usability indicators. For example, as well as being less intensive users of web technologies (Jackson et al., 2001; Ono and Zavodny, 2003), females report lower Internet skill levels (Schumacher and Morahan-Martin, 2001; Hargittai, 2007), and exhibit higher levels of anxiety, incompetence, and discomfort in their online activities (Zhang, 2005); they differ in online shopping satisfaction (Garbarino and Strahilevitz, 2003; Rodgers and Harris, 2003); and, with the exception of email and social media, females perceive the web as less useful than male web users (Gefen and Straub, 1997; Tsai and Lin, 2004; Muscanell and Guadagno, 2012). Nonetheless, in these studies the interplay between sex and a user's experience with web site design is unknown, but may explain differences in findings reported.

The present study compares male and female users both with and without website design experience. We argue that site design experience enables a user to switch the effect of confidence in their web knowledge toward influencing task-related usability perceptions and that this moderation is likely to be more pronounced for females than males. In this, a female with website design experience will self-report more confidence in her knowledge about the web than a female without such experience, and like male users focus more on the utility of the web to achieve tasks, than its ease of use. As such, differences between male and female web users are moderated by the use context within which they develop their confidence in what they know about the web and their beliefs as to its usability.

The moderation is more pronounced for females than males given how females yield more to social pressures (Crawford et al., 1995) and look more to the opinions of others as opportunities to learn about their own abilities (Roberts, 1991). The effect of social influence on the behavioral intent to use technology is stronger for females than males (Venkatesh et al., 2003; Cyr et al., 2007) and intertwined with historical differences in design experiences (Cyr, and Bonanni, 2005; Moss and Gunn, 2006) and web skill perceptions. For example, Bunz et al. (2007) identified that females perceive themselves to have technology-related skills, but that these skills are relationship and communication focused abilities that occur via computer-mediated communication. Males perceive themselves as having skills in more ‘technical’ aspects of technology (akin to the self report knowledge of a web designer). With this distinction between hard and soft skills, male and female users seem to perceive their skills along gender stereotypes.

As noted, females seem more likely to yield to social pressures and norms and seek advice from others. With website design experience, however, they will exhibit similar levels of confidence in their web knowledge to males and exhibit less task-related anxiety than would otherwise be the case. In such circumstances, female attitudes would be more akin to male stereotypes. For females, this change in confidence in their knowledge will have a stronger effect on the shift of the knowledge-usability link from intrinsic to extrinsic focus than for male users. As such:

H_{4a}. The moderation effect of site design experience on the relationship between perceived web knowledge and PU will be stronger for females than for males

H_{4b}. The moderation effect of site design experience on the relationship between perceived web knowledge and PEOU will be stronger for females than for males.

3. Method

3.1. Survey design and administration

A cross-sectional web-based survey design with participant self-selection from survey advertising was used to test the hypotheses. The study population was Internet users

from a highly developed western country, with the survey hosted on the server of a leading University. To minimize sample non-response and response bias, ensuring variance of participants with and without website design experience, monetary incentives (i.e., a competition) and multi-channels for participant recruitment (i.e., both online and offline) were used (Birnholtz et al., 2004). Visual design of survey questions, such as question grouping and multi-page layout, and radio-button question response format was used to aid response efficiency and survey completion (Peytchev et al., 2006).

3.2. Measures

The focus of the measures for this research is the macro technological context of perceived web knowledge and web usability, coupled with the usage context of web design and user demographics. The scale items are disclosed in Table 2.

3.2.1. Perceived web knowledge

Detailed content analysis of existing measures of perceived knowledge of technology-based products was conducted. To measure perceived web knowledge, existing items of perceived knowledge of computers (Selnes and Gronhaug, 1986) and procedural knowledge of the web (Novak et al., 2000) were adapted, consistent with the discussion of perceived web knowledge by Potosky (2007) and Pillai and Hofacker (2007). Eight Likert items (anchored by 1=‘strongly disagree’ and 7=‘strongly agree’) were used to measure perceived knowledge of the web; this global measure comprises both declarative and procedural knowledge facets.

3.2.2. Web usability

Research on the ease of use and usefulness of technological developments was reviewed to assess existing item structure and design (e.g., Venkatesh et al., 2003; Legris et al., 2003; Hornbaek, 2006). Scale items used and validated in prior work (e.g., Shuchih et al., 2009) were employed here to measure PEOU (4 items) and PU (13 items) on seven-point Likert scales (anchored by 1=‘strongly disagree’ and 7=‘strongly agree’). Ease of web use is treated as a first-order construct, while web usefulness is conceptualized as a second-order construct comprising three dimensions (i.e., communication, purchase, and information search) that received support in pre-study interviews.

3.2.3. Website design experience

Website design experience was measured with a self-report measure asking users to report their experience with the design and/or maintenance of websites in either a professional or unprofessional (e.g., as a hobby) capacity (0=‘no experience’ and 1=‘experience’). This item does not measure the extent or duration of usage, but classifies participants according to their experience of this usage context. This was undertaken as opposed to a classification based on ‘profession or occupation’ because our participants might have site design experience but not as professionals (e.g., as students,

as a hobby, as second profession). This is evident in Fig. 2 which shows most occupational groups contain those with and without site design experience.

3.2.4. Usage

Current usage of the web was a control variable. Typically, this is measured with the single item, usage frequency (i.e., how often the web is used in the current time frame) (Venkatesh et al., 2003). Duration of usage (i.e., how long the web is used across a certain time frame) also has been employed as a measure of current web usage in media studies (Dreze and Zufryden, 1997). As usage frequency and duration are not necessarily correlated, current usage of the web is conceptualized as a second-order formative construct. Current usage was measured with two ordinal scale items. A single, eight category multiple response question was used for current web frequency (ranging from 1=‘once a month’ to 8=‘5 or more times a day’) and for current web duration (ranging from 1=‘less than 15 min’ to 8=‘13 or more hours’).

3.2.5. Demographics

Sex, age, education, employment status and income were measured, with sex being the demographic variable of interest in testing the relationships hypothesized.

3.3. Participant profile

A total of 2246 participants were recruited to the web survey. Due to duplicate and incomplete entries 169 responses were removed, leaving 2077 usable responses. As shown in Table 1, for representativeness, the sample has a reasonably even distribution across sex and age categories, with 56% male and 52% aged 30 years and younger. Of the sample, 45% are full-time wage earners and 19% are currently studying at university, while 56% of participants had website design experience. As shown in Table 1 and Fig. 2, having website design experience is not unique to occupations within the IT industry and therefore using ‘profession’ as a proxy might not be an accurate reflection of a user’s experience. Increasingly users of digital technology from across industries, professions,

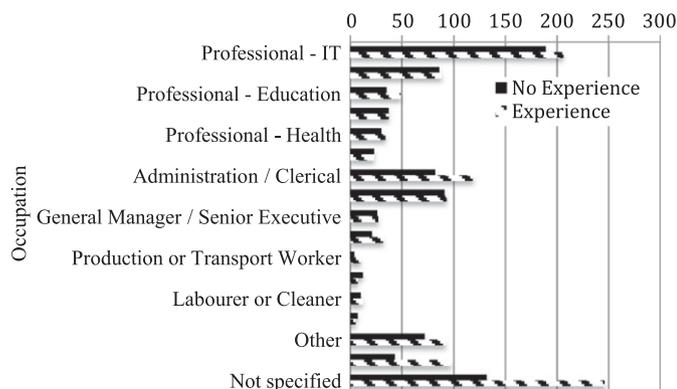


Fig. 2. Participant Occupation by Website Design Experience.

education levels and socio-economic status are gaining website design experience.

4. Analysis and findings

4.1. Measure validation

Analyses were performed using the structural equation modeling software EQS. We estimate the model using the elliptical reweighted least squares (ERLS) method which is equivalent in performance to the maximum likelihood method for normal data and superior in performance for non-normal data (Sharma et al., 1989). Indeed, scholars have recommended that ERLS be the preferred method as it yields unbiased parameter estimates irrespective of the form of data distribution (Robson et al., 2008). A single measurement

Table 1 Participant profile (Count).

	With no design experience	With design experience	Total
<i>Participants No.</i>	900 (44%)	1077 (56%)	2077 (100%)
<i>Biological Sex</i>			
Female	374	532	906
Male	526	645	1171
<i>Age Cohort</i>			
Younger than 18	68	107	175
18–24	216	260	476
25–30	211	220	431
31–39	160	290	450
40–45	102	112	214
46–54	92	140	232
55 years and over	51	48	99
<i>Labour Force Status</i>			
Full-time	418	512	930
Part-time	89	103	192
Self-employed	103	112	215
Full-time student	140	174	314
Part-time student	17	25	42
Retired	22	36	58
Unemployed	28	71	99
Other	83	144	227
<i>Past Web Experience</i>			
Less than 3 months	99	24	123
3–5 months	32	6	38
6–11 months	85	25	110
1–2 years	226	133	359
3–4 years	293	404	697
5–6 years	127	399	526
7 or more years	38	186	224
<i>Web Usage Frequency</i>			
Once a month	4	1	5
Once every 2 weeks	4	4	8
Once a week	15	5	20
2–3 times a week	58	31	89
4–6 times a week	70	54	124
Once a day	212	171	383
2–4 times a day	340	411	751
5 or more times a day	197	500	697

n = 2077.

model was estimated to assess the validity of the measures. This model included all the rating scales for the first- and second-order constructs (see Table 2). The chi-square statistic for the model is significant ($\chi^2_{(291)}=1987.26$, $p < .001$), as might be expected due to the large sample. The other fit indices indicate a good fit (normed fit index (NFI)=.97, non-normed fit index (NNFI)=.97, comparative fit index (CFI)=.98, root mean square error of approximation (RMSEA)=.053, and average off-diagonal standardized residuals=.041). The items load heavily on their posited first-/second-order constructs and have t -values above 18.30. Composite reliability and average variance extracted estimates (see Table 2) meet the recommended respective levels of .70 and .50 (Hair et al., 2006). Thus, the results demonstrate convergent validity.

Evidence of discriminant validity is provided by the fact that the average variance extracted for each construct is greater

than the squared correlation between that construct and any other construct in the model (Fornell and Larcker, 1981). Table 3 presents the correlation matrix and summary statistics.

4.2. Main effects

A main effects structural model was first estimated. Then, to assess the role of website design experience and sex in conditioning the paths from perceived web knowledge to web usefulness and ease of web use, two sets of subgroup analyses were undertaken. The goodness-of-fit indices suggest the main effects model fits the data reasonably well ($\chi^2_{(292)}=2115.07$, $p < .001$; NFI=.97; NNFI=.97; CFI=.98; RMSEA=.055; AOSR=.045). Positive relationships were observed for perceived web knowledge \rightarrow PU ($\beta=.18$,

Table 2
Measurement model.

Factors and items	Standardized loading ^a
PU^b	
<i>Communication</i> (CR=.81, AVE=.55)	.68 (18.31)
The communication between organizations and consumers is reliable through the web	.62 ^c
Communication with organizations through the web is fast	.78 (24.02)
Communication with organizations is very efficient through the web	.76 (23.50)
The web is useful for communicating with organizations	.84 (25.13)
Using the web to communicate with organizations saves me time	.80 (24.50)
<i>Purchasing</i> (CR=.78, AVE=.59)	.62 (18.38)
Using the web to purchase products saves time	.73 ^c
Using the web to acquire products is fast	.76 (27.36)
The web is useful for the purchase of products	.70 (25.08)
Purchasing products is very efficient with the web	.86 (29.89)
<i>Information Search</i> (CR=.77, AVE=.55)	.81 (20.75)
The web enables access to high quality information	.65 ^c
The web is useful for the acquisition of information	.67 (21.93)
The web enables fast acquisition of information	.85 (25.75)
Using the web to search for information saves time	.79 (24.70)
PEOU (CR=.81, AVE=.64)	
Information about the web is easy to acquire	.81 (35.50)
It is easy to gain knowledge about using the web	.68 (28.16)
Learning what the different features of the web do is easy	.83 (36.81)
Learning how the different features of the web work is easy	.86 (38.91)
Perceived web knowledge (CR=.91, AVE=.71)	
I am very knowledgeable about web terminology	.88 (41.02)
I am very knowledgeable about features and attributes on the web	.72 (31.09)
I have a high level of knowledge about what the web is	.86 (39.55)
I have a high level of understanding of the language of the web	.84 (38.50)
I know a lot about what the bad features of the web are	.87 (40.67)
I consider myself knowledgeable about good search techniques on the web	.90 (42.58)
I know a lot about how to use the web	.83 (37.96)
I am very skilled at using the web	.83 (37.69)
Web usage^d	
Session duration/frequency	.95 (45.95)

Note. The goodness-of-fit indices were: $\chi^2(df)=1987.26$ (291), $p < .001$; NFI=.97; NNFI=.97; CFI=.98; RMSEA=.053; AOSR=.041; CR=composite reliability; AVE=average variance extracted.

^aThe t -statistic for each estimate is in parentheses.

^bSecond-order construct.

^cItem fixed to set the scale.

^dFormative construct.

Table 3
Descriptive statistics and correlations.

Construct	Mean	SD	1	2	3	4	5	6	7	8	9
1 PU—communication	4.96	1.13	1.00								
2 PU—purchasing	4.78	1.13	.43	1.00							
3 PU—information search	5.65	.98	.46	.39	1.00						
4 PEOU	5.04	1.18	.36	.38	.48	1.00					
5 Perceived web knowledge	5.23	1.26	.25	.27	.44	.59	1.00				
6 Website design experience	.57	.50	.02	.10	.13	.24	.53	1.00			
7 Gender	.56	.50	.01	−.01	−.03	.00	−.01	−.04	1.00		
8 Session duration	3.59	1.48	.08	.12	.19	.18	.25	.17	−.01	1.00	
9 Session frequency	6.83	1.21	.06	.13	.11	.18	.34	.23	.01	.08	1.00

Note. Correlations of .06 and above are significant at the .01 level.

$t=4.54$, H_1 supported at $p < .01$), and perceived web knowledge \rightarrow PEOU ($\beta = .68$, $t=24.89$, H_2 supported at $p < .01$). In line with prior research, positive relationships were also observed for PEOU \rightarrow PU ($\beta = .53$, $t=10.95$, $p < .01$), PU \rightarrow web usage ($\beta = .15$, $t=3.17$, $p < .01$), and PEOU \rightarrow web usage ($\beta = .21$, $t=4.85$, $p < .01$).

4.3. Moderation effects

The data were divided into two groups depending on whether or not the user had website design experience. Restricted (i.e., imposing an equality constraint on the hypothesized perceived web knowledge \rightarrow PU path or the perceived web knowledge \rightarrow PEOU path between groups) and freed (i.e., permitting these parameters to vary between the groups) models were estimated. As indicated in Table 4, in the case of perceived web knowledge \rightarrow PU, the freed model was superior ($\Delta\chi^2_1=5.15$, $p < .05$). Perceived web knowledge is linked to PU ($\beta = .15$, $p < .05$) in the ‘no’ site design experience group; but the path is stronger ($\beta = .28$, $p < .05$) in the ‘yes’ site design experience group. These results provide support for the assertion (H_{3a}) that the positive relationship between perceived web knowledge and PU is stronger for users with website design experience. For perceived web knowledge \rightarrow PEOU, the freed model proved better than the restricted model ($\Delta\chi^2_1=18.94$, $p < .01$). Here, though, the ‘no’ experience group rather than the ‘yes’ experience group exhibited the higher coefficient ($\beta = .78$, $p < .01$ and $\beta = .49$, $p < .01$, respectively). The positive relationship between perceived web knowledge and PEOU becomes weaker for users that have website design experience, as per H_{3b} . All other structural paths remain stable between the two site design experience groups.

Dividing both site design experience groups into two, based on sex, sheds further light on this moderator (see Table 5). The research investigated the effects of equality constraints for perceived web knowledge \rightarrow PU and perceived web knowledge \rightarrow PEOU between the two experience groups for females and then for males. Among females and concerning the perceived web knowledge \rightarrow PU path, the freed model proved better than the restricted model ($\Delta\chi^2_1=3.97$, $p < .01$). Specifically, the perceived web knowledge \rightarrow PU path was significant in the ‘yes’ site design experience group ($\beta = .20$, $p < .01$), but

not in the ‘no’ site design experience group ($\beta = .07$, $p > .05$). Similarly, for the perceived web knowledge \rightarrow PEOU path, the freed model was superior ($\Delta\chi^2_1=9.15$, $p < .01$). The ‘no’ experience group rather than the ‘yes’ experience group exhibited the higher coefficient ($\beta = .77$, $p < .01$ and $\beta = .48$, $p < .01$, respectively).

Among males, for the perceived web knowledge \rightarrow PU link, there is no significant difference between the freed and restricted groups ($\Delta\chi^2_1=1.12$, $p > .05$). The path coefficients are significant and equivalent in the ‘yes’ and ‘no’ site design experience groups ($\beta = .34$, $p < .01$ and $\beta = .21$, $p < .01$, respectively). Thus, the moderating effect of web site design on the relationship between knowledge and PU is stronger for females than males, in support of H_{4a} . Site design experience encourages females, in particular, to focus more on the utility or benefits for which web technology can be used. As regards the perceived web knowledge \rightarrow PEOU path, the freed model is superior to the restricted model ($\Delta\chi^2_1=9.66$, $p < .01$). The association between perceived web knowledge and PEOU is stronger for males in the ‘no’ site design experience group ($\beta = .79$, $p < .01$) compared to the ‘yes’ site design experience males ($\beta = .51$, $p < .01$). However, as the moderation effect of site design experience on the perceived web knowledge \rightarrow PEOU path is present for females as well as males, H_{4b} is not supported. Site design experience lowers the intrinsic motivation for web usability for both females and males. All other structural paths remain stable across the four site design experience \times sex groups.

4.4. Common method bias

Gathering cross-sectional data from key informants for perceptual measures creates the potential for common method bias (CMB) to be an explanation for the observed relationships. Studies suffering from CMB run the risk of reporting incorrect results. Accordingly, Podsakoff et al.’s (2003) steps for limiting and then assessing the effects of CMB were followed in the study. First, careful construction and clarity of the scale items was achieved using a systematic questionnaire and scale development process (e.g., pre-study checks for item ambiguity, use of different scale anchors). Second, most construct items were not

Table 4
Website design experience moderating effects.

Parameter			Website design experience	
			No standardized estimate ^a	Yes standardized estimate ^a
Perceived web knowledge → PU			.15 (2.27)*	.28 (5.57)**
Restricted ^b	$\chi^2_{(585)} = 2236.32$	$\Delta\chi^2_1 = 5.15^*$		
Freed	$\chi^2_{(584)} = 2231.17$			
Perceived web knowledge → PEOU			.78 (19.65)**	.49 (12.23)**
Restricted ^b	$\chi^2_{(585)} = 2250.11$	$\Delta\chi^2_1 = 18.94^{**}$		
Freed	$\chi^2_{(584)} = 2231.17$			

Note. ** Estimate is significant at the .01 level; * estimate is significant at the .05 level.

^aThe *t*-statistic for each estimate is in parentheses.

^bRestricted refers to the restriction of the beta coefficient to be equal between the two groups; the freed condition relaxes this constraint.

Table 5
Website design experience × gender moderating effects.

Parameter			Website design experience	
			No standardized estimate ^a	Yes standardized estimate ^a
<i>Female segment</i>				
Perceived web knowledge → PU			.07 (.66)	.20 (2.76)**
Restricted ^b	$\chi^2_{(585)} = 1341.97$	$\Delta\chi^2_1 = 3.97^*$		
Freed	$\chi^2_{(584)} = 1338.00$			
Perceived web knowledge → PEOU			.77 (12.87)**	.48 (8.13)**
Restricted ^b	$\chi^2_{(585)} = 1347.15$	$\Delta\chi^2_1 = 9.15^{**}$		
Freed	$\chi^2_{(584)} = 1338.00$			
<i>Male segment</i>				
Perceived web knowledge → PU			.21 (2.43)*	.34 (5.06)**
Restricted ^b	$\chi^2_{(585)} = 1597.76$	$\Delta\chi^2_1 = 1.12$		
Freed	$\chi^2_{(584)} = 1596.64$			
Perceived web knowledge → PEOU			.79 (15.14)**	.51 (9.61)**
Restricted ^b	$\chi^2_{(585)} = 1606.30$	$\Delta\chi^2_1 = 9.66^{**}$		
Freed	$\chi^2_{(584)} = 1596.64$			

Note. ** Estimate is significant at the .01 level; * estimate is significant at the .05 level.

^aThe *t*-statistic for each estimate is in parentheses.

^bRestricted refers to the restriction of the beta coefficient to be equal between the two groups; the freed condition relaxes this constraint.

grouped together and instead were located separately within general topic categories. The logic is that informants would not be able to infer readily which items belong to which constructs and predict the relationships between predictor and criterion variables. Third, evaluation apprehension was reduced by asking participants to answer questions as openly and honestly as possible considering that there were no right or wrong answers.

The possibility of CMB in the data was empirically assessed in two ways. First, Harman’s single-factor test was conducted. This entailed re-estimating the measurement model using a single latent factor for all the measures (Podsakoff et al., 2003). The results suggest a poorly fitting model ($\chi^2_{(299)} = 19241.59$, $p < .001$; NFI = .72; NNFI = .70; CFI = .72; RMSEA = .18; AOSR = .11). Thus, there is no general factor that accounts for the majority of the covariance across the measures, alleviating concerns of potential CMB.

Second, a variant of Lindell and Whitney’s (2001) marker variable technique offered by Malhotra et al. (2006) was used. Essentially, this technique assesses potential CMB by estimating and accounting for a common method-related correction (Frazier et al., 2009). First identified was the second smallest positive correlation among the manifest variables in the study (i.e., .02) as this has been claimed to be a reasonably proxy for CMB (Malhotra et al., 2006). Based on this marker variable, the CMB-adjusted correlations between all the variables in the study were computed using the equation:

$$r_A = (r_u - r_M) / (1 - r_M)$$

where r_A is the CMB-adjusted correlation; r_u the original correlation; r_M the marker variable.

This procedure made no difference to the statistical significance of any correlation. Moreover, a CFA using the

CMB-adjusted correlations was estimated. Very small differences between factor correlations ($\Delta r \leq .04$) for the adjusted versus observed correlations was found. None of the original factor correlations are significantly different to their CMB-adjusted counterparts ($\Delta\chi^2_{(1)} < 3.84$). A path model using CMB-adjusted correlations to acquire corrected structural relationships for the main effects was then estimated.² Negligible difference between path coefficients ($\Delta\beta \leq .02$) for path models estimated with adjusted versus observed correlations was found. The CMB-adjusted path model yields results that are substantively similar to those of the proposed model. Thus, though CMB cannot be ruled out, the results of these tests indicate that such bias does not explain the results.

5. Discussion

This study extends our understanding of the complex interplay between the perceptions of what a user thinks they know about the web, the context within which they have been socialized to use it, and their sex in driving the usability perceptions of how useful and easy the web is to use. Results highlight the importance of the context in which users use and learn about web-based digital media. A factor often ignored in much usability research, other than inclusion as a descriptor variable of the sample for which a model is tested. The observed nuances concerning how knowledge links to PU and PEOU are especially important in the context of digital activities, since those who consume them could greatly differ in their knowledge and experience of the web from those who design them.

5.1. Perceived web knowledge and perceived web usability

Our research found that users with higher confidence in their knowledge will report the web as easier and of more value. Existing literature shows that perceptions of usability have a direct positive relationship with usage (Moon and Kim, 2001), so, based on our results, it would be surprising if users with high knowledge do not fully realize the utility and ease of use of web-based communications and digital services. This suggests attention should be given to a user's confidence in their knowledge, in addition to web usage or experience metrics, when thinking about segmentation strategies in digital media management and design.

5.2. Usage context, perceived web knowledge, and perceived web usability

Our research also found that the relationship between a user's confidence in their knowledge about the web and how they perceive it in terms of its usefulness and ease of use is significantly moderated by the context within which

they have used and therefore learnt about the web. In this study we moved away from the convention of focusing on cumulative usage experience (length) to consider usage context instead. We show it is the experience that matters, not the number of years experienced. Our example of a car driver and mechanic rings true here. They could both have over 10 years driving experience, but their confidence in what they know about how a car works, and its value, is moderated by the context within which their knowledge of the car is socialized.

Results also revealed that under conditions of site design experience, a user's confidence in their knowledge about the web has a stronger influence on how valuable they perceive the web (usefulness) than how easy they perceive it to use. In essence, users with technical design experience have more self-belief in their knowledge about the web, are more confident in what they know about the technology, and this provides a focus on the web's utility for achieving their goals than on how easy it is to achieve this. Past research tells us that more knowledgeable and experienced users suffer less anxiety and less cognitive overload, have fewer navigational problems, and are more involved with the technology (Chevalier and Kicka, 2006; Pillai and Hofacker, 2007). As such, users with different profiles in terms of confidence in their own knowledge, reveal different perceptions of what is both useful and easy to use about the web.

Developments in digital and social media further highlight the importance of considering the social-context within which technology is used. Users are evolving very quickly both as consumers and, more recently, as co-creators of sites and services (deValck et al., 2009; Mangold and Faulds, 2009). This is not only blurring the roles between designer and consumer (Ritzer and Jurgenson, 2010; Page and Pitt, 2011), but, based on our results, it will influence user self-beliefs of how knowledgeable they think they are about the technologies they are consuming (Pillai and Hofacker, 2007). However, this confidence in web knowledge is relative to the operational-technical proficiency of setting up a web page, a blog or establishing a social network account, not the social-cultural knowledge required for its effective, appropriate and professional usage. Our study does not address the question of digital social knowledge, however further research in this area should explore the role and effect of user confidence in their knowledge on adoption, perceptions and effective and appropriate usage.

5.3. Sex, usage context, perceived web knowledge, and perceived web usability

Our study shows the importance of usage context on shaping male and female self-beliefs about web technology. Past research has identified that females use the web less, are more focused on social (not instrumental) cues, report lower levels of confidence and knowledge, and take fewer risks on the web, than male users (Garbarino and

²Difficult to predict, moderated effects should be impervious to CMB. Thus, tests for CMB using structural equation modeling require direct, linear effects (Andrews et al., 2004).

Strahilevitz, 2003; Rodgers and Harris, 2003). However when females have design experience, this profile is altered. Females with design experience not only have higher self-belief than the average female user, but the influence of this knowledge on their perceptions of the web's value is stronger than for males with design experience. We suggest this moderation effect is more pronounced for females than males because of the way females yield more to social pressures (Crawford et al., 1995) and look more to the opinions of others as opportunities to learn about their own abilities (Roberts, 1991). The effect of social influence on the behavioral intent to use technology is stronger for females than males (Venkatesh et al., 2003; Cyr et al., 2007) and interplays with historical differences in design experiences (Cyr and Bonanni, 2005; Moss and Gunn, 2006) and web skill perceptions. These results have implications for how schools and higher education institutions consider the socialization of male and female computing design students, how organizations should design websites for both sexes, and the communication we use with males and females about web-based digital media services.

This research contributes to an understanding of the gendering of perceptions of web usability—which is a notable omission from prior usability research (Venkatesh and Morris, 2000). Often the rationalization of conflicting results focuses on the length of usage experience between males and females, as opposed to the context within which their usage takes place (Comber et al., 1997; Dyck and Smither, 1994). Relatively little research has theorized the combined role of sex differences and website design (Cyr and Bonanni, 2005); the commonly held belief is that 'technology is sex neutral' (Wilson, 2004). However, can the web be sex neutral if the web design profession and technology usage are dominated by males (Moss and Gunn, 2006; Simon and Peppas, 2005), creating a 'masculine computer culture' and 'masculine discourse' and causing the prioritization of technical over social issues (Robertson et al., 2001) in web design? Our research contributes by showing that confidence in one's knowledge and perceptions of web technology are not sex neutral, but in fact highly influenced by the sex of both the user and designer.

6. Limitations and future research

In this study the importance of the usage context of website design for male and female web users was examined. However, this is just one of many usage contexts (e.g., education, work, socializing, shopping). Users may be online at home, at work, in transit, during the day, evening, or middle of the night to experience these contexts. These usage contexts blur the lines between work and leisure, and between formal and informal learning. As the socio-cultural context of technology usage evolves, so too must our research in recognizing the importance of the usage context on our understanding of digital divides and

web participation. Further research that builds upon the present findings by incorporating a wider range of user contexts is essential.

Another theme involves studying the broader role of user heterogeneity in shaping user confidence in their knowledge, usage context and usability relationships. The present research makes the important distinction between female and male effects, but is silent as to whether there are knowledge interpretation differences arising from age, education, culture, geography, and socio-economic status. Further, the cross-sectional research design adopted is unable to capture the evolution of users' self-confidence and usability perceptions, both of which are important for an understanding of how digital experiences are changing.

A further limitation of our study is that it does not account for the interplay of socio-psychological gender with respect to perceptions of web usability (Zahedi et al., 2006) and gendered identity in the information technology profession (Trauth, 2002). In this, user identification with gendered cultural values, and masculinity and femininity norms, could play a critical role in moderating the relationship between a user's self-confidence in their knowledge and usability perceptions across various contexts. Research along these lines would extend thinking beyond the dominant discourse of user classification according to biological gender.

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