

Why are Women Underrepresented in IT? The Role of Implicit and Explicit Gender Identity

Full Paper

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Abstract

This study demonstrates that gender identity is an important factor affecting female university students' decisions to major in IT and join the IT profession. It introduces the concept of implicit gender identity, defined as the degree to which people unconsciously, automatically, and uncontrollably associate themselves with their biological sex. Data were obtained from 185 students by means of a survey and the Implicit Association Test. The findings reveal that gender identity plays different roles between men and women in its influence on IT major and career choices. Implicit gender identity is a strong predictor of IT major and career choices for women but not for men. Explicit gender identity influences IT career choice only for women. Males' and females' IT major and career choices are influenced by normative pressures to the same degree. This study shows that gender identity can be a reason driving women away from the IT field.

Keywords

Gender identity, implicit, explicit, implicit association test, IT profession, IT major.

Introduction

Gender imbalance has always been an Achilles heel of the IT sector because women are less likely to enter and are more likely to leave the IT workforce (Adya 2008; Armstrong et al. 2012). Thus, factors influencing women's discourse in the IT profession have attracted the attention of the MIS research community since the early 1980s (von Hellens et al. 2012). As a result, a better understanding of gender issues in IT has been developed (Gallivan 2013), including the impact of career barriers (Michie and Nelson 2006), cognitive challenges (Reid et al. 2010), congruity between personal goals and gender roles (Diekmann et al. 2010), and educational programs (Downey et al. 2016). Initially, the key focus was on the differences between the genders in terms of their likelihood of joining and remaining in the IT profession. However, many studies failed to explain IT career issues from the gender difference perspective.

Igbaria and Siegel (1993) showed that gender and IS career decisions are unrelated. Baroudi and Igbaria (1994-95) reported that neither job satisfaction nor organizational commitment of IS workers are linked to gender. Crook et al. (1991) found no differences between the factors driving career decisions of male and female IS professionals and suggested looking beyond variables that match jobs to genders. Other scholars came to similar conclusions (Jiang and Klein 1999). However, most previous researchers considered gender a binary variable, applied little theory, and rarely looked beyond stereotypical gender definitions (Gallivan 2013; Trauth 2013). In contrast, Klapwijk and Rommes (2009) observed that women represent a heterogeneous group who pursue different values and argued that, instead of focusing on differences between the genders, researchers should concentrate on various differences among females and consider gender identity a core variable. Based on a growing body of empirical evidence, Frieze et al. (2012), Trauth and Howcroft (2006), and Trauth (2006) concluded that researchers should concentrate on diversity within each gender – not gender differences – because “gender difference approaches to the participation of women in computing have not provided adequate explanations for women's declining interest in computer science and related technical fields” (Frieze and Quesenberry 2013, p. 445). Trauth and Quesenberry (2006) showed that “women vary with respect to factors that help to explain the

underrepresentation of women in the IT profession” (p. 1768), and Trauth and Booth (2013) demonstrated the role of within-gender variation of various factors, including gender identity.

Therefore, the present study focuses on the role of gender identity as an antecedent of university students’ decisions to major in IT and join the IT workforce upon graduation. Two types of gender identity – explicit and implicit – are theoretically explored and empirically tested. Explicit gender identity is the degree to which individuals deliberately and consciously associate themselves with their biological sex. It is the most commonly used category of gender identity measured by means of introspective self-reports. Implicit gender identity is the extent to which people unconsciously, automatically, and uncontrollably associate themselves with their biological sex. Because implicit gender identity may not be assessed by asking or observing respondents directly, in the present study it was measured by means of the Implicit Association Test (Greenwald et al. 1998). It was hypothesized and empirically confirmed that women’s but not men’s implicit gender identity is related to their IT major and occupational choices. At the same time, both genders are influenced by social norm to the same degree.

Theoretical Background

The Individual Differences Theory of Gender and IT

In order to understand the role of gender in career decisions of university students, this study extends the Individual Differences Theory of Gender and IT (Quesenberry and Trauth 2012; Trauth 2002; Trauth et al. 2008; Trauth et al. 2009). Instead of focusing on differences between males and females, this theory identifies three constructs that explain diversity within women in terms of their IT career decisions. The theory considers women “individuals who possess different technical talents and inclinations and respond to the social shaping of gender in unique and particular ways” (Trauth et al. 2008, p. 9). It identifies three high-level constructs which cumulatively explain why women enter and/or remain in the IT profession. These include individual identity, individual influences, and environmental influences (see Table 1).

Individual Identity	Individual Influences	Environmental Influences
Personal demographics (age, race, nationality, ethnicity, socio-economic status)	Personal characteristics (education, traits, abilities, aptitudes)	Cultural influences (national, regional, and institutional attitudes and values)
Career items (type of IT discipline)	Personal influences (mentors, role models, exposure to computers, life experiences)	Economic influences (employment opportunities, economic conditions, cost of living)
Gender identity (<i>implicit and explicit</i>)		Policy influences (anti-discrimination policies)
		Infrastructure influences (child-care availability and support)

Table 1. The Individual Differences Theory of Gender and IT (adapted from Quesenberry and Trauth (2012)).

The present study focuses on within-gender variation of gender identity (Trauth and Booth 2013) as a factor that may impact the way women respond to social messages regarding the IT profession and account for differences in women’s decisions in terms of starting their IT career. It extends the individual identity construct of the Individual Differences Theory of Gender and IT by proposing and empirically demonstrating the role of two different types of gender identity – implicit and explicit – in the context of career choices.

Implicit and Explicit Gender Identity

Gender identity is an individual’s personal experience of his or her gender – the degree to which someone identifies with male or female personality traits, attitudes, and behaviors (Boles and Tatr 1982; Palan 2001). Gender identity is formed under the influence of both biological factors (i.e., nature – genes,

hormones) (Swaab 2004) and social and environmental factors (i.e., nurture – parents, peers, teachers, role models, the media, observation of others) (Bussey and Bandura 1999; Eagly and Wood 2013). Whereas gender identity remains stable for many people, it may also gradually change, especially, under the influence of various socialization factors (Bussey 2011). Gender identity is different from other gender-related constructs, such as gender stereotypes and gender attitudes (Wood and Eagly 2009). In contrast to biological sex that is measured in terms of distinct categories, gender identity is considered a continuous variable measured on Likert-type scales (Bem 1974; Spence et al. 1975). This increases its explanatory power and makes it a good candidate for the inclusion in causal models which are frequently used in management research (e.g., see Ramkissoon and Nunkoo 2012).

In previous gender IT studies, researchers relied on explicit gender identity of users or employees. During surveys or interviews, subjects consciously access a self-concept pertaining to their gender identity in memory, deliberately constructed their gender identity construct, and explicitly reported it to the researchers. Thus, they provided a measure of their explicit gender identity which was every time constructed by means of a conscious cognitive process when engaging in self-retrospective analysis. However, explicit gender identity has several limitations. First, explicit constructs are context-dependent (Bargh 1994). For example, a female IT manager may deliberately empathize and report a somewhat masculine gender identity when discussing her relationship with the subordinates. In contrast, she may emphasize a feminine side of her gender identity in the context of her family. However, which gender identity is a true one? Second, people have different abilities for self-evaluation and self-retrospection (Devos and Banaji 2003). For example, a female may assume that she, similar to other females in her reference group, possesses only female characteristics, attitudes, and behaviors without even trying to truly understand her gender identity. Others, however, may diligently evaluate themselves and, therefore, report a more accurate explicit measure.

Third, explicitly measured constructs are affected by social desirability bias (Crowne and Marlowe 1960; Podsakoff et al. 2003) because respondents may deliberately report their explicit gender identity that is considered appropriate. In some cases, respondents may not be even fully aware of the source of influence over their adjustment of the explicitly reported factors. For example, a male IT employee may (knowingly or unknowingly) under-report feminine characteristics assuming they are a sign of weakness. Even in North America and Europe, many homosexual people still feel uncomfortable openly revealing their true gender identity. In this case, their explicit gender identity may deviate from their ‘true’ one which may reduce the predictive power of models employing explicit gender identity constructs. Thus, it behooves gender IT researchers to look beyond the commonly employed explicit gender identity measures and conceptualizations.

Stoller (1968), who coined the term gender identity in his foundational work “Sex and Gender,” indicated that one’s awareness of his or her gender identity may be conscious or unconscious. Recent advances in psychology demonstrated the existence and effect of implicit gender identity, defined as the degree to which a person unconsciously, automatically, and uncontrollably associates him or herself with his or her biological sex. It represents the strength of the association between one’s gender and a reference group (males or females) (Devos and Banaji 2003). Similar to other implicit constructs (De Houwer and Moors 2010; Gawronski and Bodenhausen 2006; Greenwald and Banaji 1995; Greenwald et al. 1998; Rydell et al. 2006), implicit gender identity forms through pairing of an attitude object (i.e., one’s gender) with its evaluations (i.e., male vs. female characteristics). Table 2 outlines differences between explicit and implicit gender identity.

Hypotheses

The Individual Differences Theory of Gender and IT posits that individual identity is an important factor determining women’s selection of an IT profession (Trauth et al. 2008). The present study extends this view by including implicit and explicit gender identity as a predictor of occupational choice of female university students. According to the theory of circumscription and compromise (Gottfredson 1981; Gottfredson 1996), one’s gender self-concept (i.e., gender identity) is related to his or her occupational aspiration. At a relatively young age, children develop stereotypes of male and female professions. As they grow, their degree of occupational stereotyping decreases, but its effect still remains. People make decisions on an IT profession early in life, generally in high school (Repenning 2012), when their gender-based occupational stereotypes are still active. Because STEM (science, technology – including IT,

engineering, and math) disciplines are considered male-dominant professions and are explicitly and implicitly associated with male-like attributes (Cundiff et al. 2013; Kiefer and Sekaquaptewa 2007; Michie and Nelson 2006; Smeding 2012), it is likely that females who have strong gender identity decide that the IT profession is inappropriate for them. For example, Oswald (2008) demonstrates that women who hold strong gender stereotypes about professions prefer feminine occupations. This line of reasoning may also apply in university setting when selecting a major and a future profession. Thus, the stronger explicit and implicit gender identity of a female is, the less likely she is to select an IT major and pursue an IT career upon graduation. The following hypotheses are suggested:

H1: Explicit gender identity of female university students has a negative effect on their intentions to major in IT.

H2: Explicit gender identity of female university students has a negative effect on their intentions to pursue a career in IT.

H3: Implicit gender identity of female university students has a negative effect on their intentions to major in IT.

H4: Implicit gender identity of female university students has a negative effect on their intentions to pursue a career in IT.

	Explicit Gender Identity	Implicit Gender Identity
Conceptual Definition	Degree to which someone consciously associates him/herself with his/her biological sex	Degree to which someone unconsciously, automatically, and uncontrollably associates him/herself with his/her biological sex
Construction/Retrieval Process	Deliberate	Automatic
Context-dependence	Dependent	Independent
Control and Correction	Easy	Extremely difficult
Degree of Awareness	High	None
Development Process	Fast	Slow
Influencing Factors	1. Biological Factors 2. Behavioral patterns in stable environments	1. Biological Factors 2. Behavioral patterns in stable and unstable environments, unique (single) emotional events, childhood experiences, deliberate thinking, reading, and active and passive socialization
Measurement in Self-reports	Possible	Impossible
Social Desirability Bias	Present	Not present
Temporal Stability	Low	High

Table 2. Explicit vs. Implicit Gender Identity.

Men and women differ in terms of their workplace cognitions, experiences, motivations, goals, and preferences (Joseph et al. 2015; Kuhn and Joshi 2009; Reid et al. 2010). Most importantly, men are unlikely to be influenced by their gender identity when selecting a (somewhat stereotypical) male occupation. Men are aware of their gender-IT occupation match – they know that their gender is consistent with their own and others’ implicit and explicit stereotypes of the IT profession. Thus, their gender by default matches the IT profession regardless of their gender identity. In an empirical study of

US college students' major and career choices, DiDonato and Strough (2013) observed that preferences for gender-typed occupations predicted decisions of female students but not of male ones. The following hypotheses are proposed:

H5: Explicit gender identity of male university students has no effect on their intentions to major in IT.

H6: Explicit gender identity of male university students has no effect on their intentions to pursue a career in IT.

H7: Implicit gender identity of male university students has no effect on their intentions to major in IT.

H8: Implicit gender identity of male university students has no effect on their intentions to pursue a career in IT.

As per the Individual Differences Theory of Gender and IT (Quesenberry and Trauth 2012; Trauth 2002; Trauth et al. 2008; Trauth et al. 2009), individual influences are another set of predictors that can impact the career choices of female students. In essence, career choices are often influenced by normative pressures from peers, parents, and educators (Adya and Kaiser 2005). For example, if friends of a female student choose a non-IT major, she may follow. The same applies to male students. The role of normative pressures is consistent with the Theory of Planned Behavior (Ajzen 1991) and other models of Reasoned Action (Fishbein and Ajzen 1975). Humans consider and often cave in to such pressures because conformity and sense of in-group are important values. Hence:

H9: Social norm has a positive effect on female university students' intentions to major in IT.

H10: Social norm has a positive effect on female university students' intentions to pursue a career in IT.

H11: Social norm has a positive effect on male university students' intentions to major in IT.

H12: Social norm has a positive effect on male university students' intentions to pursue a career in IT.

Methodology

245 business students of a North American university were invited to participate in the study in exchange for bonus points. Items measuring social norm were adapted from Morris & Venkatesh (2000). Items for intentions to major in IT and pursue IT career were developed based on the commonly used MIS behavioral intentions measures (e.g., see Venkatesh et al. (2003)). Explicit gender identity was measured with the question "Overall, I identify myself as being" accompanied by two 7-point scales 1) only female; mostly female; somewhat female; equally male or female; somewhat male; mostly male; only male, and 2) only woman; mostly woman; somewhat woman; equally man or woman; somewhat man; mostly man; only man. Males and females completed different surveys so that 7 (the highest score) corresponded to their biological sex. Social desirability bias was measured with Reynolds' (1982) instrument. Control variables included age, IT skills, and IT work experience.

Implicit gender identity was measured by administering the Implicit Association Test (IAT) (Greenwald et al. 1998). It is considered a valid approach for the measurement of various implicit constructs, including gender identity (Cundiff et al. 2013; Nosek et al. 2005; Nosek and Smyth 2011). The IAT measures the strength of the association between a target concept (self) and an attribute (male vs. female). During the test, the words representing concepts and attributes appear in the center of the computer screen, and the subjects are required to sort them into appropriate categories as quickly as possible while minimizing the number of mistakes. Gender identity IAT items were adapted from Lane et al. (2012). Table 3 presents the IAT design. The *FreeIAT* software tool was used to administer the test (Meade 2009). It reports two scores that were used to operationalize the implicit gender identity construct. For more information about the IAT, see Greenwald et al. (1998).¹

Four versions of the IAT were designed where constructs and attributes were assigned to different keys. Approximately half of the subjects completed an online survey followed by the IAT, and half did so in the

¹ Note that the IAT also has several limitations. For example, faking responses is very difficult yet possible, some people may find ways to consciously control their IAT responses, priming may influence results in some contexts, and the test sometimes shows low reliability.

opposite order. Thus, there were eight versions of the experimental procedure, and order effect bias was minimized.

Block	# of Trials	Left Key	Right Key
1 (practice)	20	Construct: Me (I, self, my, mine, myself)	Construct: Others (they, them, their, other, theirs)
2 (practice)	20	Attribute: Male (he, him, man, father, brother)	Attribute: Female (she, her, woman, mother, sister)
3 (test)	40	Me + Male	Others + Female
4 (practice)	20	Construct: Others (they, them, their, other, theirs)	Construct: Me (I, self, my, mine, myself)
5 (test)	40	Others + Male	Me + Female

Table 3. IAT Design.

Results

185 usable records were obtained. Fifty-three and forty-seven percent of respondents were female and male, respectively. On average, they were 24 years old, ranging from 19 to 42 years old. Based on item loadings, cross-loadings, and Cronbach's alpha measures, all constructs were found to be reliable and valid.

The model and gender-based differences were estimated with the multi-group analysis facilities of Amos 23 (Byrne 2004) following the two-step approach for structural equation model estimation (Anderson and Gerbing 1988). These tools estimated the unconstrained model using all records and then separately estimated model parameters with records from women and records from men in the sample. First, a confirmatory factor analysis model was estimated as a means for establishing reasonable convergent and discriminant validities. The model presented good fit [$\chi^2(135) = 177.5$; $\chi^2/DF=1.31$, CFI = 0.99; IFI = 0.99; TLI=0.99; RMSEA = 0.029], and all loading in the full sample and subsamples were significant. Next, a structural model which included all control variables (age, IT skills, IT work experience, and social desirability bias) was estimated. The model presented good fit [$\chi^2(243) = 275$; $\chi^2/DF=1.13$, CFI = 0.99; IFI = 0.99; TLI=0.99; RMSEA = 0.019]. Nevertheless, age and social desirability bias did not have significant effects, and hence for parsimony reasons were removed. The model was re-estimated and presented good fit [$\chi^2(177) = 210.3$; $\chi^2/DF=1.19$, CFI = 0.99; IFI = 0.99; TLI=0.99; RMSEA = 0.023]. The path coefficients for the entire dataset (in no parentheses), for women (in parentheses), for men (in square parentheses), and explained variances are presented in Figure 1.

The results indicate that if we look at a mixed-gender population of students, on average, their career choices are largely guided by social pressures and slightly by existing IT work experience and skills. When examining the path-coefficients for both genders, the aggregate picture may be deceiving – it seems that gender identity does not play a major role in determining occupational choices. As hypothesized, whereas women's IT career choice is guided (negatively influenced) by their implicit gender identity, men's IT career choices are not influenced by their implicit gender identity. Explicit gender identity only has a negative impact on women's intentions to pursue an IT career. There are also apparent differences in the role of IT work experience, which is important for men's career and major choices but not for women's.

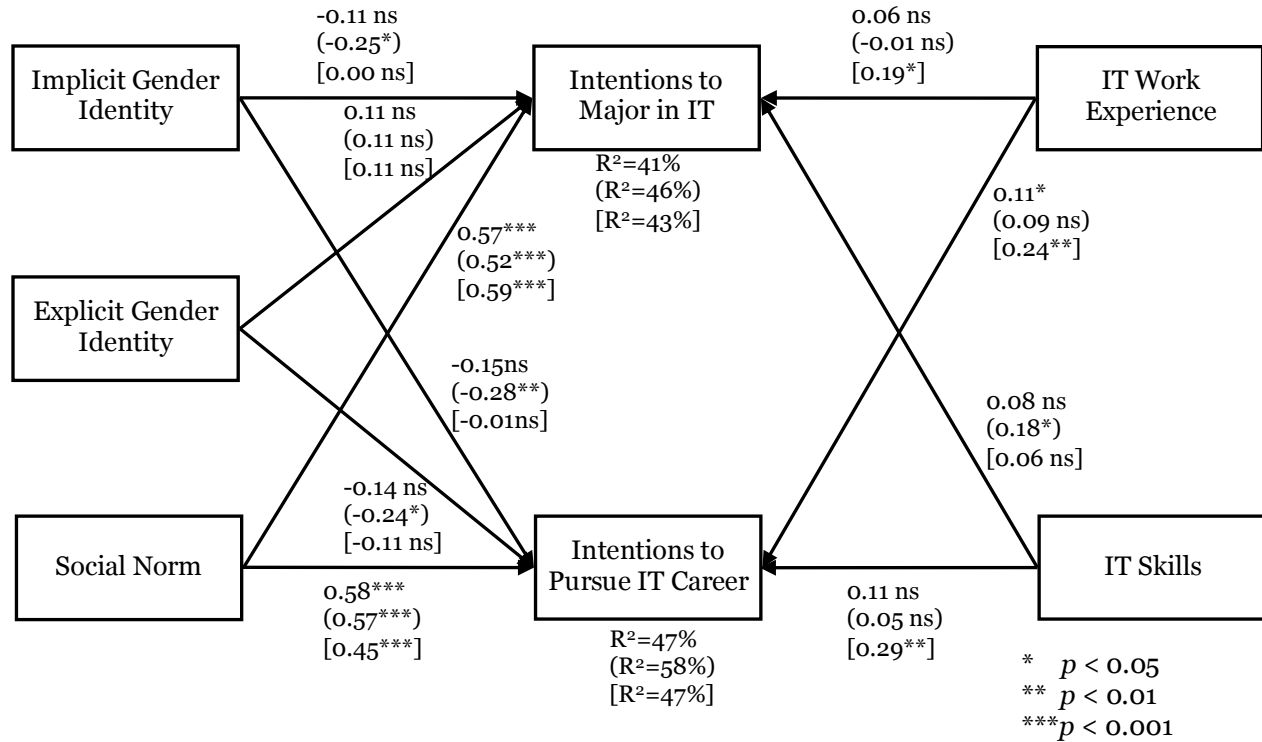


Figure 1. The Structural Models.

Conclusion

This study extended the individual identity construct of the Individual Differences Theory of Gender and IT in the context of IT major and career choices of female and male students. It highlighted differences between the genders explaining why women are underrepresented in the IT profession. The findings specifically indicate that males' and females' IT major and career choices are influenced by normative pressures. However, gender identity plays different roles between men and women in its influence on major and career choices. Implicit gender identity is a strong predictor of IT major and career choices for women but not for men. Explicit gender identity influences intentions to pursue an IT career only for women. Ultimately, this study introduced the concept of implicit gender identity and demonstrated why it can be a culprit which drives women away from the IT profession. Future research can rely on these findings and explore interventions for reducing the influence of implicit gender identity on women's IT career choices. IT faculty and administrators responsible for student recruitment need to realize that females' decisions are influenced by somewhat uncontrollable processes pertaining to their gender identity. In many situations, people are completely unaware of the existence of their implicit gender identity and its impact on their career decisions. However, once students become informed about this phenomenon, they may consciously reconsider the impact of their gender identity on their professional choices and start making better informed and more rational decisions.

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