Odd girl out: an individual differences perspective on women in the IT profession

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Abstract *This paper develops a theoretical perspective on gender and information technology (IT) by examining socio-cultural influences on women who are members of the information technology profession in Australia and New Zealand. In-depth interviews with both practitioners and academics give evidence of a range of socio-cultural influences on the professional development and working lives of women IT professionals. The paper rejects the essentialist view of women and their relationship to IT that has been put forth in the information systems literature arguing, instead, the primacy of societal and structural influences. The particular contribution of this paper is a theoretical perspective of individual differences which is presented to characterize the way individual women respond in a range of specific ways to the interplay between individual characteristics and environmental influences. This perspective contributes to a better understanding of women's involvement in the IT sector and suggests areas for proactive policy response.*

Introduction

At the same time that unprecedented opportunity exists for information technology (IT) professionals around the world, the field is experiencing a skills crisis that stems from the shortage of qualified IT professionals. This skills crisis is due, in part, to the fact that certain segments of the population are under-represented in IT. Among those under-represented are women. Despite significant growth in the IT profession[1] in recent years, there remains a gender imbalance; there is evidence of a decline in the participation of women in the IT profession in some quarters[2]. One question on the minds of those concerned with IT human resources and the development of qualified IT professionals is how to go about addressing this problem. A deeper understanding of this issue is necessary for the development of appropriate

educational policies and workplace human resource strategies that will attract and retain more women. According to the National Science Foundation, "There is agreement among researchers and scientists that systematic research efforts are needed to address this problem" (National Science Foundation, 2001).

It is, therefore, ironic that at the same time that there is a documented need to study the gender imbalance in this field, this topic is both under-studied and under-theorized. It is under-studied in so far as there have been minimal published papers in top information systems (IS) journals on this topic. It is under-theorized in two ways. First, gender is seldom considered a relevant factor in socio-technical studies of IS in context (Wajcman, 2000). Second, gender and IS is under-theorized in so far as most of the published work focuses on data analysis rather than theoretical implications that relate to the existing body of gender, and gender and IT literature (Adam *et al.*, 2001). This paper endeavors to address these gaps.

The objective of this paper is to employ empirical data to theorize about women's participation in the IT sector. It is accomplished by examining the relationship between social shaping of IT and gender identity, and women's participation in the information technology profession. Specifically, it explores the ways in which individual and environmental factors have influenced a sample of Australian and New Zealand women in their professional development and current working lives as IT professionals. It also documents the individual ways in which they have responded to the challenges that they have encountered in navigating through what they perceive to be a socially constructed male domain. In adopting this perspective the paper argues the primacy of sociological and structural/institutional influences over biological and psychological ones while still acknowledging the role played by individual characteristics.

The structure of this paper is the following. The two dominant theoretical perspectives that are used to explain the engagement of women with information technology – essentialism and social construction – are examined for the insights that they offer on the issue of the under-representation of women in the IT profession. Against this backdrop are suggested areas for deeper exploration. The research study is then described and positioned within this landscape. Finally, the results from this study are used to support a theoretical perspective of individual differences to shed light on the participation of women in the IT profession.

Theoretical perspectives on gender and IT
Two dominant viewpoints are reflected in recent literature about gender and IT. From these perspectives we can extrapolate to explanations regarding the participation of women in the IT profession. The essentialist perspective focuses on the presumption of inherent differences between women and men to explain the perception of IT as a male domain. The other perspective focuses on the social construction of IT as a male domain, which is interpreted as problematic with respect to the social construction of female identity. From the

different theoretical perspectives reflected in these two viewpoints we can infer different recommendations for addressing the gender imbalance in the IT profession.

The essentialist argument
Essentialism is the assertion of fixed, unified and opposed female and male natures (Wajcman, 1991, p. 9). When applied to the IT realm, this viewpoint focuses on inherent differences between men and women to explain the differences in their relationship to IT (and, by inference, the participation of women in the IT profession). In doing so, it reflects an essentialist perspective that observed differences in men's and women's behavior are attributable to inherent, group-level differences that are based upon bio-psychological characteristics. Essentialism has long been a part of the debate in feminist literature about biology and destiny[3]. When applied to the IT domain, the essentialist perspective has spawned research that views gender as a fixed variable that can be manipulated within a positivist epistemology. An example from the recent IS literature is the work of Venkatesh and Morris (2000) and Venkatesh *et al.* (2000)[4]. This research includes gender as a variable in the application of the technology acceptance model (TAM) to understand differences in individual adoption and sustained usage of technology in the workplace. Their findings lead them to suggest that men, as a group, make decisions about using technology based upon different criteria than women, as a group. They conclude that men are influenced by the usefulness of the IT whereas women are influenced by social factors.

They employ the psychological literature on gender to guide their interpretations of the empirical data on the adoption and use of IT by the women in their studies (Bem, 1974, 1981; Maccoby and Jacklin, 1974; Minton and Schneider, 1980; Tashakkori, 1993; Williams and Best, 1990). And they draw upon a statewide attitudinal survey of California high school students conduced in 1982-1983 (Felter, 1985) to support their conclusion that "women typically display lower computer aptitude ... than men" (Venkatesh and Morris, 2000, p. 119).

Adam *et al.* (2001) provides an analysis of this perspective in their critique of research on gender and IT. They note the perils of ignoring existing gender and technology literature, particularly recent literature in this area[5]. They go on to argue that "focusing on a background literature of psychology places too much emphasis on individual gender characteristics where a form of 'essentialism' may creep in." It looks only to psychological explanations of observations without giving attention to the influence of context[6]. They point out that this perspective adopts a determinist stance with respect to gender.

The inference that can be drawn from this perspective about addressing the gender imbalance in the IT profession is that women and men should be treated differently. For example, Venkatesh and Morris (2000, p. 131) recommend that trainers may want to adopt different approaches when training men versus women. And they suggest that marketers may want to design different

marketing campaigns for men versus women. A logical extrapolation from this line of thinking would be the recommendation that there be two different workforces: a "women in IT" workforce and a "men in IT" workforce. Thus, policies for addressing the gender imbalance would focus on assumed inherent differences between women and men and the equality issue would focus on "separate but equal."

The social construction argument

An alternative explanation for women's relationship to information technology (and, by inference, their participation in the IT profession) can be found in societal rather than biological forces. The literatures of gender and technology in general (for example, Cockburn, 1983, 1988; Cockburn and Ormrod, 1993; Wajcman, 1991), and that of gender and information technology, in particular (for example, Adam *et al.*, 1994; Balka and Smith, 2000; Eriksson *et al.*, 1991; Lovegrove and Segal, 1991; Spender, 1995; Star, 1995; Webster, 1996) look to social construction theory (Berger and Luckmann, 1966) rather than biological and psychological theories. According to this view, the social shaping of information technology as masculine interacts with the social construction of femininity in such a way as to place IT outside the domain of women. The inference that can be drawn from this perspective about addressing the level of female participation in the IT profession is that the explanation lies in the social construction of the IT profession as "men's work." But the recommendations for addressing this gender conflict vary.

One school of thought is exemplified in the work of von Hellens, Nielsen, Greenhill and Pringle (Nielsen *et al.*, 1998, 1999; Pringle *et al.*, 2000; von Hellens *et al.*, 2000, 2001; von Hellens and Nielsen, 2001) which is based on a multi-year project to study the reasons for female under-representation in university-level information technology education and within the IT profession. The objective is to develop strategies for increasing women's participation in this field. An aspect of the research deals with success strategies employed by women who work in the IT field (Pringle *et al.*, 2000; von Hellens *et al.*, 2000). The women emphasized the need for extra-curricular socializing with male colleagues as necessary for career progression.

von Hellens *et al.* have focused on women who address their "odd girl out" status by developing coping strategies in their attempt to fit into this male domain. However, another school of thought within the social constructivist perspective focuses on the need to reconstruct the world of computing to become more of a "female domain." Webster (1996) is representative of this approach. Her focus is on the social shaping of female gender identity and the implication for women's relationship to workplace technologies. At the heart of the issue, she believes, exist structural inequalities between men and women in work and in their relationships to technology. One can infer that her approach to addressing the gender gap in the IT profession would be to operate at the group level in order to address "the *systemic* [emphasis original] nature of sexual divisions in occupations and technologies" (Webster, 1996, p. 4).

Spender (1995) also operates at the group level, but her concern is with female values. She analyzes the role of women as a social group in cyberspace with the goal of increasing the number of women who employ the Internet. Her argument is that what will follow from increased female presence will be the influx of female values into this new virtual world. By extrapolation, one can conclude that the same would happen as more women enter the IT profession.

Wajcman's (1991) thoughtful analysis of the social constructivist perspective on gender and technology reveals some of the issues embedded in its assumptions. She points out that there is no behavior or meaning which is universally and cross-culturally associated with either masculinity or femininity, that what is considered masculine in some societies is considered feminine or gender-neutral in others. It is not that gender difference does not exist but that it is manifested differently in different societies. Therefore, addressing the gender gap in IT employment based upon an assumed "woman's perspective" is problematic. She cites Harding (1986) in observing that there are as many different "women's experiences" as there are types of women.

> If a new feminist science is to be created from the standpoint of women's experience, should there be a feminist science based on the experience of "Black women, Asian women, Native American women, working-class women, lesbian women?" ... Qualities associated with manliness are almost everywhere more highly regarded than those thought of as womanly. Women have in common the fact that they have been marginalized from every powerful institution of our society ... This acknowledgment of subordination is not incompatible with a recognition of the specific and variable forms of this subordination. *Different groups of women have different needs and interests* [emphasis added] (Wacjman, 1991, p. 11).

So, what are the recommendations for addressing the gender gap in the IT profession that can be inferred from the social constructivist perspective? One is that women, who are subject to different social influences, need to accommodate to this "men's workplace" in order to be successful in IT; women need to concentrate on "fitting in" to this male domain. The alternative is that women should attempt to reconstruct the work and values of the IT profession into something that is less masculine. In other words, women should either accept the status quo of IT as a male domain and learn how to fit in or they should work to "feminize" IT work. Either way, the message is that women in the IT profession, as a group, are different from men, as a group, in the profession, albeit for sociological rather than biological or psychological reasons.

The individual differences perspective on gender and IT
While these two perspectives are completely different along some dimensions, in other respects they have strong similarities. It can be argued that both perspectives view gender and technology as fixed with the difference being the basis for "fixing" gender: bio-psychological or societal factors. Whereas essentialism and social construction differ in their reference disciplines – the former drawing from the biological and psychological literature and the latter

drawing from the sociological literature – what both have in common is their treatment of gender at the group level of analysis. This overview of the two prevailing theoretical perspectives suggests some gaps in the literature that can be filled by new research. One such need is the exploration of the way in which social shaping of gender and the IT profession operates at an individual level.

This theoretical stance focuses on the similarities among men and women as individuals, and the variation among members of each gender with respect to IT skills and inclination to participate in the IT sector. It looks to socio-cultural interpretation of IT work and power relations to explain the level of participation by women in IT. It represents an individual differences perspective on gender and IT (Trauth, 2000a). This perspective is informed by earlier work which investigated the skills and knowledge of IT professionals (Lee *et al.*, 1995; Trauth, 1993; Trauth *et al.*, 1993) combined with prior research on women and IT (Kwan *et al.*, 1985; Trauth, 1995).

The empirical data from the present study are used to support an emerging theory of gender and IT as socio-culturally constructed at the individual level. That is, women, as individuals, experience a range of different socio-cultural influences which shape their inclinations to participate in the IT profession in a variety of individual ways. Further, women respond in a range of individual ways to the social shaping of gender identity and of IT work. The individual differences perspective inhabits the middle ground between the essentialist and the social constructivist explanations of women in the IT profession.

Methodology
This alternative explanation, operating at the individual level of analysis, looks at each woman as an individual who possesses different technological talents and inclinations and who responds to social shaping in unique and individual ways. The research goal implied in this perspective is to learn about the particular ways that individual women are influenced by and react to the social shaping of both gender identity and IT. The following research questions flow from that goal:

Q1. How does this social shaping manifest itself in a woman's professional development and working life?

Q2. If the IT field is socially constructed as a male domain what is the effect of a woman's participation in the IT profession on her gender identity?

Q3. How does an individual woman respond to the way the IT profession is socially constructed as a male domain in her particular experience?

This research starts with the premise that there are individual differences among women with respect to participation in the IT profession, which result from a combination of individual characteristics and socio-cultural influences. It then goes on to consider the range of individual responses to these characteristics and these influences. The underlying assumption is that inherent IT capability and

interest spans the gender continuum. This view brings socio-cultural construction down to the individual level. This research is situated at the intersection of two literatures: that of socio-cultural influences on the information-sector workforce (for example, Trauth, 2000b) and that of gender and IT.

The objective of this study was to learn about the ways in which environmental factors are in operation to enhance or inhibit a particular woman's participation in this field. Statistics tell one story; this research tells the story behind that story. It explores, in depth, the voices of women who are part of the IT profession.

The empirical data used to support this theoretical perspective comes from in-depth interviews conducted with 31 women in Australia and New Zealand. Taken together, these women lived in 13 different countries for some portion of their development, hence a range of socio-cultural influences are in evidence. These women work in the IT field both as practitioners and as academics. Academics were included in the study because they are also members of the IT profession, and because they provide further insight into the development of women in the IT field. Through their own experiences, the respondents discuss the development of IT professionals and share insights about working in the profession. The respondents reveal the types of cultural, social and institutional influences on them as women and as women who entered the information technology field.

Open-ended interviews lasting, on average, 90 minutes in duration were conducted in Australia and New Zealand between March and December 2000. Respondents were identified by faculty and alumni at selected Australian and New Zealand Universities. In advance of the interviews, respondents were sent a two-page description of the research project, its motivation and the type of questions that would be asked in the interview.

The theory guiding the data analysis is the emergent theory of individual differences. This theoretical perspective rejects the essentialist view of women and their relationship to information technology that has been put forth in the IS literature. At the same time it offers a refinement of some under-explored areas of the social construction theory. The individual differences perspective looks to individual variation across genders, which results from a combination of individual characteristics and environmental influences, to shed light on women's participation in the information technology sector. It holds that the necessary skills and inclinations to enter and be successful in the IT field span the gender continuum. This view brings social construction down to the individual level. This theoretical stance looks to the influence of socio-cultural interpretation of IT work, societal institutions and power relations rather than bio-psychological essentialism to explain the level of participation by women in the IT field.

Results: individual responses to socio-cultural influences
The women who participated in these interviews spoke openly and willingly about their work histories, societal influences, and professional challenges. They offered insights about cultural influences on their education and

professional development. Three themes that derived from the research questions are used to present the results.

What is normal?

> I feel coming from a communist country, I think I was raised a little bit different way than girls are raised here. It was more an expectation on us to get into any field we wanted. And gender was not really an issue . . . It wasn't unusual for a woman to work, or even have some higher management positions [Charlene].

The first theme speaks to the socio-cultural influences of the gender shaping of IT on individual women. The result is their sense of "what is normal." Respondents talked about cultural influences on their education, professional development, daily work life and career progression in the IT field.

The influence of national culture was clearly in evidence. Some of the women received cultural messages that were consistent with having a career in IT. Others had to resist a cultural norm in which working outside the home is the exception and working in IT is even more unusual. But in all cases, their national cultures helped to shape their identities as women and their feelings of acceptance or alienation within the IT field.

A defining influence on Charlene, Anita and Cynthia was growing up in a communist society. These three women ranged in age from their 30s to their 50s, and the communist countries from which they emigrated to Australia were on different continents with very different societies. But what all these women had in common was that when they were growing up, it was normal for a woman to be working in a technical field.

Other respondents experienced cultural influences as a constraint. Donna spoke of a prevailing attitude in the Australia of her youth that a woman should stay at home once she was married and had children. In the beginning of Annie's career in New Zealand, in the early 1980s, she was often the only woman at a training class or a conference. Jane, who came to New Zealand from the UK, spoke about the not-so-subtle messages she received about a woman's place being in the home not the IT workplace.

> One or two of the members of staff were quite open that they really didn't think women should be working . . . [O]ne of them actually turned around at one stage and said, "I don't think women should be working" [Jane].

Jane replied with a forcefulness she said is characteristic of New Zealand women:

> And I said, "You should have retired permanently years ago" [Jane].

What concerns Nicole, who is in her late 20s, is the complacency of her age cohort about gender issues:

> I think that [these] men would be genuinely, righteously horrified if women were paid systematically less in New Zealand because it doesn't happen, and if it did it would be terrible and it would be like the most [awful thing in the] country you could think of. But the reality is that it does happen but they're not willing to believe it does so they don't do anything about it [Nicole].

Within each of their societies, the educational institutions exerted a clear influence on their development as IT professionals. The high school experience – particularly for those attending all-girls' schools – left an indelible mark on the respondents, for better and for worse. They spoke about gender segregation in courses of study, particularly with respect to mathematics and computer courses. As a consequence, both Martha, a recent Australian university graduate, and Jill, who graduated in 1989, found the adjustment to university computing courses difficult; they had not received the same preparation in high school as did their male classmates. Despite the similarity of their high school experience, Jill's and Martha's experiences in university were different. Jill's instructor assumed that everyone had taken computing courses in high school and taught the course accordingly. What made a difference in Martha's university experience was having some women professors who served as role models.

Other respondents experienced a positive influence on their professional development from attendance at a single sex high school. As evidence of that, I interviewed more than one woman whose daughters were attending the same all-girls' schools they had attended. And it was from the career night at the local all-girls' school – not the co-educational school she attended – where Lisa learned that the engineering and physics fields were available to women.

Besides the influence of single sex schools was the social shaping of gender identity that respondents experienced in secondary school. Lisa recalled an incident in which she received a strong message about "male domains."

> . . . [W]e were playing soccer. Boys and girls . . . And I'd gone to kick the ball and another guy came behind me and kicked the ball from underneath me and I fell down on my arse and got winded. And there was this relief teacher who was like an elderly gentleman, come and say to me you really shouldn't be playing boys' sports, basically. I thought that was a bit rude. Because that could have happened to a guy not just a girl [Lisa].

When reflecting on why there are not more women in the IT field, Donna thinks the schools have much to answer for.

> They don't necessarily plan that well ahead and get kids thinking in Year 10 what they want to do so that they are getting on the right track to choose the right subjects that they should be doing. If I didn't have my father who sat down, and you know, helped me choose the subjects, then I might have chosen the wrong subjects. I might have chosen the ones that I could get good grades in or that wouldn't have led to anything [Donna].

Another societal influence was family. Mitul was educated in India before emigrating to Australia. She attributes her participation in the IT field to her parents, husband and in-laws. Her parents, who were "a little bit more free thinking" than other parents in 1985, supported her decision to study engineering rather than a more female profession such as medicine. When her first child was born her in-laws played a significant role by supporting her return to work. Had they felt otherwise, resuming her career would have been perceived as going against her husband and unacceptable behavior.

Annie never felt bounded by life choices when she was growing up in New Zealand. She was the sole girl surrounded by brothers and a favorite of her

mother as well as her father. She considered being both an astronaut and a teacher when she was a child. Lisa's parents, who emigrated from Germany to Australia without extended family, instilled a sense of self-sufficiency in Lisa and her sister.

> . . . [M]y parents didn't bring me up in that fashion. We weren't really brought up to be the little princess or anything like that. We were very much more a down to earth, practical . . . [Lisa].

Donna's story exemplifies the range of significant people who influence one's career choices. Her mother was the level-headed one, she recalls, never pushing her towards marriage as her ultimate destiny, like many of her peers. She was subsequently strongly encouraged by a teacher at school.

> She seemed to take, I don't know, a special liking to me . . . she really encouraged us to do the scientific subjects more so than all the arty subjects. And, of course, backed up by my family that was good. I mean, I suppose I was encouraged to go to university and I had this natural thing to want to do well, that probably [was] pushed from my family situation . . . [Donna].

But her intention was to study maths. She had not had any exposure to computing while in high school in the mid 1970s. It was her father, a civil engineer, who suggested that she try computer science. Jill entered the IT field on the advice of an uncle who worked for an international accounting firm. But she stayed in it because of the support of her father during her first term in university when her lack of high school computing courses made progress difficult.

Public policy is a significant source of societal influence in the forms of maternity leave policies, equal opportunity and affirmative action legislation, and IT training schemes. But despite Australian maternity leave policy that enables a woman to protect her job for one year, Cynthia was reluctant to take more than three months off after having her baby. The IT field changes too quickly, she said. Consequently, she would not encourage a daughter to become an engineer. She said it is too difficult for a woman to keep up learning and never stop because women have two full-time jobs: the IT career and motherhood. In New Zealand in 1987 there was no maternity leave available to Linda. And since her employer had no system for managing part-time staff, she was forced to resign her job.

Respondents' stories reveal the unintended consequences of the best of intentions. For example, Donna, who is a manager, said that some people believe her position is due to the company's need to satisfy affirmative action reporting rather than her qualifications. Marianne, who is a senior manager in an IT department, explained that in the early 1980s in New Zealand, government apprentice programs attracted many women into programming positions and computing positions were seen as viable jobs for women. But when these apprenticeship programs ceased and the only door into the IT field was through formal education, the flow of women subsided.

"I was a topper"

> I was talking to the [company recruiters] recently about [gender as a barrier to success within jobs] and we were talking about discrimination against females generally and he said, "Well, I don't think I discriminate." But he said, "I suppose I do in a way because my [view] is that a

male will always know what he is talking about or what he is on about. He has to prove to me that he doesn't know. A female always has to prove to me that she does know." So a male starts as a positive and has to whittle away his credibility whereas the female is sitting on the zero line and has to build her sense up. I thought that was an interesting sort of proposal. It is not adverse discrimination but it is discrimination in a way [Margaret].

But he didn't view it as discrimination? [Author].

He didn't when we first started talking but after awhile, he didn't see it as being overt discrimination. He said, "I do think of males and females in a different sort of context." . . . I think it is probably true for a lot of things too. That a woman has to prove herself over and over again whereas a male has instant credibility because of his sex [Margaret].

The second theme considered the influence of individual characteristics on women in the IT field. The topics that were discussed related to respondents' individual characteristics and how they influenced their education, professional development, daily work life and career progression.

Mitul described herself as a "topper" to characterize her academic excellence in school. The most prevalent way in which this excellence was manifested was mathematical ability. Cynthia, who is Chinese, and Mitul, who is Indian, both got into the IT field because of their high marks in mathematics. In both countries, excellence in mathematics is encouraged and valued.

Following mathematical ability was an interest in technical topics. Annie got interested in computing through her interest in design – helping her father design boats.

. . . I was never afraid of the technical side of things. When I was at high school I got involved with computers and technical drawing. So I think those were things influenced by my Dad . . . There were computers when I was at school and I did more of the computer labs and subjects like that [Annie].

Beyond the specific areas of mathematical and technical competence, other traits that emerged were high intelligence and high performance. Typical of many of the respondents, Lisa was quite good at all subjects in high school. In her final year she chose to do exams in maths, physics, chemistry and English in order to have the greatest number of options in going to university. In her electronic engineering course, she started out as one of three women out of 35 students. By the time she graduated with First Class Honours, she was the only woman and one of five or six students to receive that distinction.

. . . just again depends on how much self-confidence you have and how you see yourself. I see myself as equal to the guys. I guess I was the best in the class anyway, so I never had that problem [Lisa].

Another kind of excellence that manifested itself in these interviews was the intellectual capacity that shone through the stories of women who were self-taught. Annie was not formally educated about computing in New Zealand; she learned through self-study and training courses and is motivated by the desire for new challenges. Marianne who studied law and commerce in university taught herself operating systems, programming and networking at a sufficient level to enable her to work as a consultant in the IT field.

A third personal characteristic that is consistently represented in the respondents' life histories is their strength and self-confidence. Charlene doesn't take "no" for an answer and addresses issues head on. She challenges things, raises the issues. She gave an example about career development. While her managers agreed on paper to her career development plan, they wouldn't let her have the experiences she needed in order to achieve them. So she made an issue of it.

> But as I said before, I'm not taking "no" for an answer. So I will be basically talking to my managers about it and then making them aware of it. That I do have my career aspirations and then they should be working with me . . . If not, I will leave this company [Charlene].

Virginia describes herself as a very task-oriented and aggressive person with a strong desire to avoid failure. Her ability to anticipate issues makes it difficult for others to set her up.

> . . . if there is any issue related to any of those projects, I make sure that I email or I copy the Chief Executive on everything. If my deadlines are tight and I am depending on somebody else to deliver, if they don't deliver on time, I escalate that. And I make sure that everything is visible rather than subtle. Because I feel that there is a danger that the manager that I report to could set me up to fail [Virginia].

It wasn't until the end of the interview, however, that she revealed the change that this represented in her demeanor.

> . . . [While] I was driving in I was thinking, "Ten years ago I wouldn't have agreed to this [interview]" [Virginia].

> Why? [Author].

> Because I was very . . . I wasn't sure who I am, what I wanted to be. What my career had to be and I was just all wondering what this whole thing was about: working . . . And now I feel a lot more self-assured about what I want [Virginia].

Inner strength and self-confidence came from supportive parents and teachers. Unlike some of her friends whose parents questioned their children's educational and life choices, Lisa's were always supportive of her decisions. Donna recalls being heavily influenced by a primary school teacher who strongly encouraged her to do well, who made sure she had the confidence to succeed. It was also linked to participation in competitive sports. Lisa pointed to her involvement with swimming to explain her self-confidence and comfort level with fierce competition.

> . . . [W]e were sports minded. My mother thought we should become involved in sports . . . in terms of being good physically and mentally. To be fit. We were heavily involved in swimming for a long time growing up. And that gives you a different perspective on what you are capable of. Because you actually end up being stronger than the boys. You know, better than the boys at sport . . . I always thought boys were just boys . . . I certainly didn't put them on a pedestal at all [Lisa].

Annie spoke at length about self-esteem. Self-esteem workshops for career women were particularly helpful in overcoming her reticence to confront older men about professional issues in the workplace. Charlene seems to float above

the very overt challenges to her authority in the workplace. While she is quite aware of what is going on, she is possessed of a strong sense of self-confidence that she obtained from her parents.

Age is a mitigating factor influencing each of the respondents' personal characteristics. Her age had a significant influence on a woman's experience of becoming and working as an IT professional. For example, women in their 50s recounted experiences of being the only female in school or in their departments at work. They were the exception to the norm in IT and had made it past the barriers by virtue of their exceptional ability. In contrast, those respondents who took for granted a place for themselves at the IT table tended to be under 30. As Annie explained:

> I went to all co-ed schools and at Intermediate School [11 and 12 years old] all boys and girls did classes together in sewing, cooking, metal work and woodwork. So there was certainly no stereotyping of girls can only do cooking and sewing. I'm not sure when this changed in schools, maybe only a year or two before me. I loved the metal work and woodwork and with a father as a builder I often used to help out in the shed with his various projects [Annie].

Odd girl out

> I have talked to a lot of people who believe that a woman's place, when she has children, is in the home. And people find it very difficult to see that different scenarios work for different people ... [W]hat we have to accept is that irrespective of gender, there are different roles. There are different people for whom different roles work and it is not a gender determined thing [Margaret].

The third theme was about individual responses to the gender shaping of IT. It considered individual ways that each woman responds to challenges and issues that confront them as women working in the IT field. This theme also addresses respondents' self-perceptions as women and as women in the information technology field.

One question explored whether women who are successful in IT perceive themselves to be "different" from other women. In view of the social shaping of IT as "men's work" what does their success in navigating this masculine domain say about their gender identity? The ways in which the respondents felt different from other women were closely aligned with gender stereotyping. The respondents, collectively, described themselves as powerful people: forthright, strong, driven, ambitious, mathematical, less social than other women, logical and competitive. They considered these traits to be necessary for success in the IT field and also what set them apart from other women.

It bothers Mitul that she receives negative reinforcement for her style while her male colleagues are more forceful and completely accepted. Virginia could not yet answer for herself whether she is innately driven or whether she became that way in order to succeed in the IT field.

> Now what I can't answer and I wondered this, have I become the person because I needed to survive in business because I am ambitious? ... Or is it part of my personality that I am like that ... more like a male than a female as you put it. And that helps me to survive in business ... [S]ometimes I have problems with this male/female thing. Because I really think it is those

qualities that I need as an individual to survive. Rather than, as you said, "females by nature maybe like that." I don't know. But I find that the women that are successful that I know of, I don't feel very differently to them. Some of the consultant friends that I have got that I still liaise with and network with, they don't seem too different to me. They are very driven, they're very hard working, they're very task oriented. They don't take any crap. You know? [Virginia].

Cynthia considers herself to be different from her girlfriends who prefer literature and history over mathematics. Martha believes women are inherently more social than men but that in order to be successful in the IT field a woman has to work alone and do things on her own. Donna considers her competitiveness to be unusual for a woman. Lisa feels different from other women because she is more logical. She began by talking about women not wanting to be logical. But then, went on to provide an example of a male co-worker who was not logical before coming to the conclusion that both men and women are capable of being illogical.

While nearly every respondent provided examples of issues and barriers she has had to overcome, their reactions varied significantly. Some of the women were rather placid about their status. For example, Jill's strategy for success in the IT field is to completely accept that she has entered a male domain. Her reaction to her status as "odd girl out" is that "boys will be boys" and to bide her time in the face of gender discrimination.

I think that women are just as capable and as comfortable technically as the men. I think that maybe the challenge that is out there is a little more basic than not understanding the technology. It is a man's environment. It is male dominated and my last technical role was as a level three support in a team of 15 and I was the only female. So I sat in an office with 14 men that would swear and burp and pass wind and do all sorts of vulgar things ... It was just boys being boys ... My father comes from a warehousing [business] and we spent every school holidays from a very young age in the warehouse. That was my part time job at Uni. So I was used to it ... That kind of environment doesn't worry me and I'm not offended by it ... And I think that if women are expecting [something different] of men being men, let's face it, boys will be boys, [they won't] survive in IT [Jill].

Can you tell me what you mean by "boys will be boys?" [Author].

Just the games that they play and the jokes that they play and if a short skirt walks through the office, things like that, the comments that will be made ... Or they'd come back from supporting someone and they'd say, "Has anyone seen the new chick on level whatever?" But I think you get that everywhere. I don't think that changes no matter where you are [Jill].

She also described a London consulting assignment in which she was assigned by her all-male team members to supervise the help desk and documentation while a less qualified male took over the network. In time, as she expected, he proved to be unequal to the task and their roles were reversed. Jill is typical of the woman who accepts that she is the "odd girl out."

Donna calmly related a similar experience in her first job.

I was the only female programmer in the whole of the process control area, and I don't think that some of the guys had ever seen a female in IT, in engineering or anything. It was a very macho man thing. But when I went up there the typical questions were, "How long are you going to stay around here?" You know, "When are you going to get married and have

children?" and that sort of thing . . . [But] I still got hired. I think at the time they were heavily recruiting, and because I had reasonable grades, then obviously it didn't go against me too much [Donna].

Typical of women who take unequal treatment for granted, Lisa didn't fully grasp the sexual harassment and challenges to her competence that she was encountering until a male colleague pointed it out to her.

One guy that I worked with he was prone to making female jokes, you know, with respect to their competence . . . but it was a friend of mine . . . who I went to university with who pointed out, "I didn't know how much shit you had to put up with," one day. And I suddenly thought, "You're right. I shouldn't have to put up with it." . . . So I did stand up for myself. And the guy who was making the jokes came back and complained. But he was very sorry about the upset and he had every respect for me professionally and otherwise and would try to refrain from doing so . . . I've got quite good self-confidence. Like it didn't really affect me but in terms of thinking of how somebody else would be influenced by that I think it could have a detrimental effect on some women. I did actually catch up with one lady – she probably would have been a recent graduate – at a conference last week and I think she made a reference that she felt like she wasn't part of the environment that she was working in . . . [Lisa].

The male world of IT reaches backwards from the workplace to the university as well. Mitul spoke at length about the difficulty of being the only woman in her program in university and how she responded to it. While she started her studies as one of four out of 60 students, the other women eventually dropped out leaving her to be the sole female in her class.

It wasn't easy . . . [I]f there are too many boys in one class, they just walk all over you and don't think that you exist at all [Mitul].

Made you invisible? [Author].

Sort of, but they couldn't because I wasn't that invisible. That is one thing. I had a mind of my own, I think, right from the beginning. Now that I am talking to you, I realize that I never thought of it that way before this. But I had a mind of my own, that's the reason why I got into IT and persisted. People left actually when I was in year two; two of the girls actually left the course and went away . . . In the first year we were four girls. And as I progressed to year two . . . I was alone . . . I think the boys made it very hard [Mitul].

She went on to talk about the teasing, the sexually explicit comments that were carved into the desks and that greeted her from the chalkboard as she entered the classroom. She thought her classmates saw her as a potential love interest rather than as an intellectual peer. Consequently, it was very lonely in university. At the end of our interview she recommended that something be done about the derogatory things that are said and written about women.

. . . I would really, really appreciate it if there was someway of taking away graffiti and bad comments on women, you know, made on women in universities, in any part of the world . . . It would be very nice, I would be so happy if one day my daughter comes to me and says, "I had a wonderful day at school and nobody said anything to me" [Mitul].

Donna's mathematical prowess helped her to get on with her male peers because she tutored them. But it didn't protect her from unwanted attention.

In my degree course . . . there were five females in the whole three years . . . I helped them with some of their maths and I was tutoring there as well so from that point of view I was

accepted because I could help. But then you were treated like an object, I suppose, because you were only a female. So you're given a lot of attention and some of it you don't want and that sort of stuff [Donna].

One topic which highlighted the respondents' "odd girl out" status was that of motherhood. This issue was on Lisa's mind because she and her partner were discussing marriage and children. They preferred that one of them be at home with the child and were considering options. On the one hand, Lisa was not raised to think of marriage and motherhood as her only life option. But at the same time she did acknowledge the industry expectation of working long hours, which many women would find incompatible with motherhood. When Mitul had her first child she was still living in India. She was expected to stop working in order to stay home with the baby. When she didn't her managers tried to make life difficult for her.

I was told to sit in the office and manage stuff. I had just come out of Uni; I wanted to learn stuff. I wanted to be there, hands on and learn like the other engineers. Like other male engineers. But I wasn't given that opportunity. Because I was a girl, I had to sit in the office and manage stuff [Mitul].

Nevertheless, she stayed there for five years because she said she knew it wouldn't be better in any other organization. Everywhere, it was simply a fight against a man's world.

While these women supported equality of women in education, in the IT profession, and in their career paths, they did not want to adopt the label of "feminist." Their reasons varied. Some younger respondents thought there were no more battles to be fought. Others were concerned about being labeled as victims if they called themselves feminists. A third group thought that being viewed as a feminist in the workplace would jeopardize their work relationships with their male colleagues with negative consequences for their careers. Nevertheless, Charlene acknowledged the power differential between men and women.

... [T]he expectation from society is always for a male to keep the position of power, the position of making a decision, a strategic decision and I think that it is some sort of stereotype that has been carried for very, very long. From the beginning of let's say, going back a few centuries ago, and I think it is still the current stereotype [Charlene].

Discussion

These respondents experienced a range of individual, institutional and cultural influences on their professional development and progression through the IT field. They also possess a variety of personal characteristics, which have helped them to cope and succeed. Finally, they exhibited many different ways of responding to the challenges of being "odd girl out" in the IT profession. These results, then, provide compelling evidence in support of the individual differences perspective on gender and the IT profession.

That the definition of men's and women's work varies by country is illustrated in the assumptions about "women's work" held by the women who grew up in communist countries. That the definition can change is illustrated in New Zealand. When programming work was accessible via training schemes

and apprenticeships, computer programming was considered a viable position for a woman. But when these programs ceased and formal, post-secondary education became the route to IT work, the perception shifted.

The results of this study show the pitfalls associated with analyzing all women as a group with respect to their relationship to information technology and the IT profession. For example, in a direct challenge to the conclusion of Venkatesh and Morris (2000) that women are not motivated by the usefulness of IT, Laura, an academic commented that:

> ... the one thing that all the studies and interviews and things I've done, show that women see computers as tools ... something to help them get on with the job [Laura].

Nevertheless, a common thread running through the respondents' comments was the effect of the social shaping of gender and information technology on their gender identities. The personal traits that they possess, which helped them to be successful in the IT field, led many of them to become "odd girls out."

These results show that women who work in the IT profession represent considerable variation. Women who are IT professionals do not all experience the same influences, nor do they all respond in the same ways. Each individual woman is shaped by the cultural assumptions of the countries which formed her, by her parents, family and teachers, and by significant others and events. And each of these women has responded in individual ways to these socio-cultural influences.

The individual differences perspective contributes to that literature of gender and IT, which argues that gender identity is neither fixed nor monolithic. Wajcman (2000) notes that early feminist studies of gender and technology tended to theorize gender as a fixed and unitary phenomenon that, then, interacts with technology. In contrast, feminists such as Butler (1990) perceive gender identity as being more fluid. Similarly, the relationship between gender identity and participation in the IT profession is not the same for all women. Each individual woman experiences societal influences in a different way. Each individual woman brings different personality and intellectual characteristics with her into the IT profession. Each individual woman is "odd girl out" in her own, unique way.

At the same time there is no question that certain themes reverberated throughout these life histories. The women spoke of being held to a higher standard than their male peers both in school and in the workplace. Whereas men can assume a seat for themselves at the IT table, these women spoke of needing to earn a place. These women experienced both blatant and subtle discrimination and other barriers in their attempts to enter and navigate the male domain of the IT world. That there are common experiences across such diverse cultural backgrounds reinforces the social shaping of IT and the IT profession as a male domain.

As Adam *et al.* (2001) point out, a serious problem with the essentialist perspective is that the recommendations that flow from it would further isolate women as they emphasize gender stereotypes that can patronize women. At the

same time a difficulty with some of the social constructivist writing on this issue is the development of remedies based upon the assumption of a monolithic "women's view" or "women's values."

The findings from this study address both of these issues. The message of the individual differences perspective is that the subtle gender shaping of individuals and technology needs to be addressed at the individual level. In varying degrees, through selective reinforcement in the culture, the home, the school and the workplace, women have learned that the IT world is alien to them. A select few have made it by virtue of their intellectual excellence, personality characteristics, hard work and socio-cultural influences. From these "odd girls out" we can learn lessons about how selective reinforcement operates to convey messages to women about what they can and cannot do. The recommendations that derive from the individual differences perspective is that if we are serious about addressing the gender imbalance in the IT profession, all of the stakeholders – governments, schools, families and employers – must examine their contribution to social shaping. Several respondents commented that they had not thought about some of these issues until they were raised in the interviews. This paper offers a theoretical framework by which greater awareness can occur.

Conclusion

At the end of the interview with Mitul, in which gender harassment played a prominent part, I made the following comment to her:

> . . . in this kind of research it is important to have the stories behind the statistics. We have the statistics now about participation rate, but I think people need to hear explicitly why, why do we have the participation rates, and this is why I need to have the quotes from people to put a face, if you will, on this [Author].

It is the contention of this paper that the topic of women in the IT profession has not one but many faces. Interview data from this field study of Australian and New Zealand women in IT was used to support an emerging theory of individual differences. This emerging theory is positioned as a rejection of the essentialist argument even as it deepens our understanding of social construction theory. It does so by exploring the individual ways that individual women experience the social shaping of both gender and IT. The purpose of this theoretical framework is to help us better understand the many faces of the gender gap in the IT sector. From this understanding can come greater awareness; from this awareness can come proactive responses by governments, employers and educators.

Notes

1. The "IT profession" is viewed in this paper as comprising the following types of work: software engineering, information system design and development, and information system/services consulting. This work is carried out both in IT firms and in firms which employ IT people. Further, those preparing students for careers in the IT sector are included as well.

2. See, for example, Camp (1997), Freeman and Aspry (1999), and Information Technology Association of America (1998) for discussion of gender and the skills crisis in the USA. See Ignite (2001) for a discussion of IT skills in Australia.

3. This debate has been played out in a wide range of settings. See Heyes (1997) for a discussion of the essentialist debate as it relates to education and the work of Gilligan (1982). See Zasloff (1994) for a discussion of the essentialist debate as it relates to authorship of the Bible. And see Foss (1996) for a discussion of essentialism as it relates to intellectual inequality and the writing of Kimura (1992). Two socialist feminist critiques of essentialist elements in radical feminist theory can be found in Eisenstein (1984) and Segal (1987).

4. Other examples of recent works which, treating women as a group, manipulate gender as a variable within a positivist epistemology are Gefen and Straub (1997) and Dennis *et al.* (1999).

5. For example, considerable changes have occured in American society since 1982 regarding both gender and the use of IT. Cleary (2001), for instance, challenges the generalization from Felter's (1985) study that boys have more exposure to computers in the home than girls. His study of the digital divide among American children, found that gender was not significantly correlated with the degree of Internet use in the home.

6. See Wilson and Howcroft (2000) for an example of how context enriches the analysis of observed differences in behavior toward IT based upon gender.

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