Pergamon

Computers in Human Behavior, Vol. 14, No. 4, pp. 559–577, 1998

Printed in Great Britain
0747-5632/98 $19.00 + 0.00

PII: S0747-5632(98)00024-7

A Cross-Cultural Comparison of Gender Differences in Computer Attitudes and Anxieties: The United Kingdom and Hong Kong

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Abstract – *This study examined the computer attitudes and anxieties of 207 United Kingdom nationals and 286 Hong Kong nationals to determine the factorial structure for each sample and any gender differences. Both samples share a comparable educational environment and level of technological sophistication. The United Kingdom sample, however, reported more computer-related experience, less anxiety and more positive attitudes. There was a large degree of overlap between the factorial structure for computer anxiety and attitudes between the two samples which is consistent with previous research. For the United Kingdom sample, there were no gender differences in computer anxiety but males held more positive attitudes than females. For the Hong Kong sample, there were no gender differences in computer attitudes but males reported greater computer anxiety*

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than females. This is the first sample in which males have been found to be more computer anxious than females, despite Hong Kong males reporting more computer experience than females. An item-by-item analysis identifies Hong Kong males are more anxious when anticipating using computers (rather than when actually using computers).

Technophobia comprises negative attitudinal and affective responses towards technology with associated behavioral consequences (Jay, 1981; Rosen, & Maguire, 1990). Typically, a technophobe will possess high levels of computer-related anxiety, hold negative attitudes towards computers and avoid interaction with technology whenever possible. When a technophobe does use technology, they are likely to experience specific negative cognitions or self-critical internal dialogues (Rosen, Sears, & Weil, 1990, Rosen, & Weil, 1995) resulting in a slower and less accurate performance and a subsequent increase in levels of computer anxiety and negative attitudes (Rosen, & Maguire, 1990). Computer anxiety and computer attitudes have been found to be statistically separable constructs demonstrating both reliability and validity (Gardner, Reider, Ruth, & Ross, 1993; Harrison, & Rainer, 1992; Kernan, & Howard, 1990; Popovich, Hyde, Zakrajsek, & Blumer, 1987). There has been a plethora of research investigating the correlates of computer-related attitudes and anxieties identifying many consistencies within predominantly American and European populations. For example, females are typically found to possess higher levels of technophobia and to report less computer-related experience (see Brosnan, & Davidson, 1994; Maurer, 1994; Whitely, 1997 for reviews). Comparisons between US and European samples identify similar levels of computer attitudes for both populations with similar underlying factorial structures, whether comparing the US with Western Europe (Leutner, & Weinsier, 1994; Sensales, & Greenfield, 1995) or Eastern Europe (Martin, Heller, & Mahmoud, 1992).

Both computer attitudes and computer anxiety have been found to have three factors underlying their structure. Sensales, & Greenfield (1995) report that computer attitudes can be broken down into the following three factors; (a) negative effects at an individual level, (b) negative effects at a societal level and (c) positive effects at an organizational level. This confirms early research which suggested that individuals can hold both positive and negative attitudes towards computers simultaneously (Shaw, 1984). It is possible to believe, for example, that computers are deskilling at an individual level but efficient at an organizational level.

Similarly, Rosen, & Weil (1995) propose a three factor model for computer anxiety, namely; (a) Interactive computer learning anxiety, (b) Consumer technology anxiety and (c) observational computer learning anxiety. It is possible (for example) for people to be anxious about actively using a

computer or watching others use a computer, or both. In a recent revalidation of Marcoulides' computer anxiety scale, (Marcoulides, Rosen, & Sears, 1985) Dyck, Gee, & Smither (1998) identify a two factor structure (Direct Involvement and Indirect Involvement) which correspond closely with Interactive computer Learning Anxiety and Observational Computer Learning Anxiety (respectively). Thus, there has been much research into computer anxiety culminating in the conclusion that 'computer anxiety is a real phenomenon' (Moldafsky, & Kwon, 1994: p. 301).

Further evidence for this contention is supplied by evidence that computer anxiety extends beyond 'Western' cultures, although comparatively little research has been conducted outside the USA and Europe (Al-Khaldi, & Al-Jabri, 1998). Omar (1992) compared computer attitudes between US students and students from a Middle Eastern country (Kuwait). Differences between the two groups were attributed by the author to the relatively recent introduction of computers and the largely mainframe-based nature of the interaction in Kuwait. Thus cross-cultural differences may be enhanced, at least in part, by differences in hardware availability. Previous research contrasting 'Western' and 'Oriental' cultures has highlighted that computer anxiety is a reliable and valid construct (Marcoulides, 1991) and that Chinese and USA students show a similar underlying factorial structure for computer anxiety (Marcoulides, & Wang, 1990).

Maurer (1994) argues that the element interacting most directly with computer attitudes and anxiety is computer experience. Weil, & Rosen (1995) confirm this relationship in over nineteen out of twenty three countries, suggesting that in most countries males' greater computer experience relates to gender differences in technophobia. However, whilst Weil, & Rosen (1995) report significant correlations between computer anxiety with experience and computer anxiety with gender for the entire sample (of twenty three counties), these correlations are insignificant ($r = -0.02$ and 0.07, respectively) for the Oriental sample. The authors noted that Japan was the only country combining levels of 'high technophobia with moderate experience' (p.110) stating that 'The data from Japan present somewhat of an enigma' (p.125). The authors posit various educational differences as potential hypotheses to explain the enigma of high levels of technophobia being associated with moderate levels of experience.

Differences in the educational systems and amount of prior computer experience between countries have therefore been used to explain cross cultural differences in technophobia. Whilst the present Hong Kong (HK) sample is also Oriental in origin, the educational system in Hong Kong has been based upon the United Kingdom (UK) educational system for over 150 years. The present study aims to examine cross-cultural differences in computer anxiety and attitudes between students in two technologically advanced countries

which are under the same educational and political jurisdiction whilst being geographically distant, namely the UK and HK. The present study contrasts students from the UK and HK in 1996 when HK was under British jurisdiction (which reverted to China in July, 1997). English represents a communal second language in HK and is frequently spoken and written. Typically the QWERTY keyboard is used within higher education in HK along with many English language text books. Lectures are also given in English, requiring higher education students to have an extremely good knowledge of the English language.

As the HK educational system is based upon the UK educational system, a cross-cultural comparison between students of comparable educational standard who speak the same language will be undertaken. Despite these similarities, however, there can be little doubt that HK culture is redolent with Chinese influence. Confucian philosophical thought and practice is deeply rooted within the community at large. For example, the media depiction of males in dominant positions and females in subservient positions endemic within Western advertisements for computer technology (Ware, & Stuck, 1985) have not been observed in HK. It seems likely that such cultural differences between Western and Oriental cultures will impact upon gender differences in technophobia and differences in the underlying constructs of computer attitudes and anxiety.

METHOD

Participants

Four hundred and ninety three first year undergraduates drawn from the faculty of Social Science and Business Studies, with an average age of 22 years agreed to take part in the study. The sample consisted of 207 UK nationals (101 males and 95 females, 11 unstated) and 286 HK nationals (125 males and 126 females, 35 unstated). Participants were invited to complete the questionnaire just prior to a lecture. Whilst the voluntary nature of the task was emphasised, the vast majority of those asked completed the task. When comparing gender differences, data from those participants who did not state their gender will be omitted from the analysis (and will be reflected in varying degrees of freedom).

Measures and Procedure

Students were all presented with a demographic questionnaire assessing gender, age, age of first computer interaction and ownership (or intended

ownership) of a personal computer. Average weekly usage of applications packages (in hours) and the average weekly hours spent programming were also requested (after Gilroy, & Desai, 1986). In addition, an indication of how frequently application programs were used and programming undertaken was obtained using a scale from 1 to 7, as follows: 1 – 'not at all', 2 – 'less than once a week', 3 – 'about once a week', 4 – '2 or 3 times a week', 5 – '4 to 6 times a week', 6 – 'at least once a day', 7 – 'more than once a day'. This additional scale was used as previous research has identified that this measure significantly correlates with system-based measures of usage such as number of logins and time on-line (Davis, Bagozzi, & Warshaw, 1989). In this way, a profile was obtained of the participants' use of application programs and programming experience, describing both the hours spent, and the frequency of, computer interactions. Participants were then asked to complete a 20 item computer anxiety scale (Marcoulides, 1985) and a 20 item computer attitude scale (Nickell, & Pinto, 1986). Each item was endorsed on a 5 point Likert type scale (negative items reversed for scoring) resulting in possible totals between 20 (low anxiety or negative attitudes) and 100 (high anxiety or positive atitudes). The order of the anxiety and attitude questionnaires was rotated. These questionnaires were selected as they have both been used for cross-cultural studies previously.

RESULTS

Demographic Information

The UK sample were significantly more likely to own a computer ($t = 3.21$, $df = 472$, $p < 0.001$) and were older ($t = 7.70$, $df = 478$, $p < 0.001$) than the HK sample, although the HK sample tended to first use a computer at an earlier age ($t = 1.94$, $df = 473$, ns). There were four indices of current levels of computer usage. Both applications and programming experience were rated on the 7-point scale described in the Measures and Procedures section and the number of hours per week was reported. The UK sample reported greater applications usage for both measures than the HK sample ($t = 2.75$, $df = 476$, $p < 0.01$; $t = 4.64$, $df = 458$, $p < 0.001$; respectively). Programming experience was similar for both samples ($t = -0.17$, $df = 455$, ns; $t = 0.16$, $df = 475$ ns; respectively). In summary, both samples averaged less than an hour programming per week and used applications packages 2 or 3 times per week, the UK sample for 8 hours and the HK sample for 5 hours. These figures are presented in Table 1, and the experience with applications programs and programming are illustrated in Figure 1. Despite these differences, the overall sample was fairly computer literate. 336 students reported owning a com-

Table 1. Differences Between the HK and UK Samples (Means and Standard Deviations)

	HK ($N=286$)	UK ($N=207$)
Age (years)	20.5 (.99)	24.0 (7.65)
First used (years)	14.2 (4.84)	15.4 (8.42)
Applications usage (hours)	5.1 (5.41)	8.1 (8.36)
Applications frequency	3.7 (1.38)	4.1 (1.62)
Programming (hours)	1.0 (2.43)	1.1 (2.74)
Programming frequency	1.7 (1.07)	1.7 (1.26)
	Males only ($N=125$)	Males only ($N=101$)
Applications usage (hours)	6.4 (6.75)	9.8 (9.24)
Applications frequency	4.0 (1.41)	4.4 (1.87)
Programming (hours)	1.1 (2.46)	1.6 (3.34)
Programming frequency	1.7 (1.10)	2.0 (1.48)
	Females only ($N=126$)	Females only ($N=95$)
Applications usage (hours)	3.7 (3.21)	5.9 (6.64)
Applications frequency	3.4 (1.30)	3.7 (1.26)
Programming (hours)	0.7 (2.03)	0.3 (1.39)
Programming frequency	1.5 (0.80)	1.2 (0.68)

puter and 137 reported not owning a computer. Of these, 91 expected to purchase a computer within the year, leaving 46 (9.3%) students who did not own or plan to purchase a computer, evenly spread between the two samples.

Gender Differences in Computer Experience

Gender differences within the two samples were also examined and are reported in Table 1. For both samples, as has been reported elsewhere, males had significantly more experience than females. Within the HK sample, males

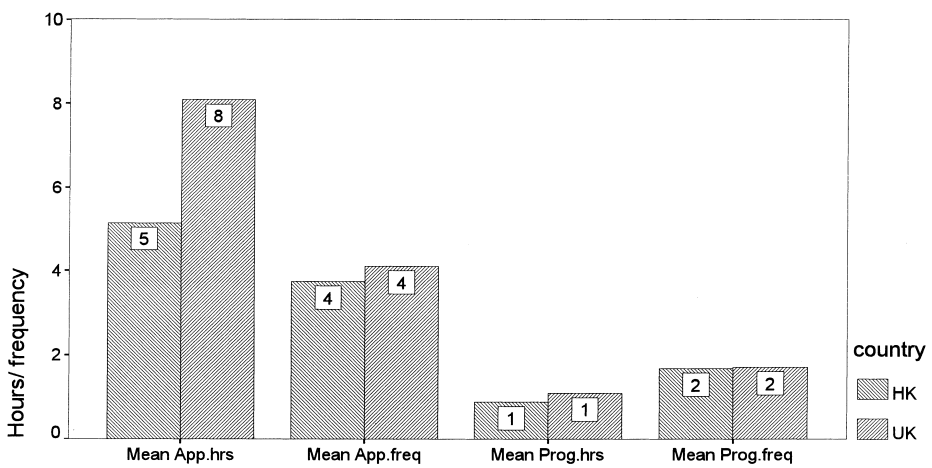

Figure 1. Computer experience by country.

averaged more experience with applications packages than females when rating the frequency of use and reporting the hours of use per week ($t = 3.64$, $df = 284$, $p < 0.001$; $t = 4.05$, $df = 249$, $p < 0.001$; respectively), with smaller differences in programming experience ($t = 2.28$, $df = 237$, $p < 0.05$; $t = 1.29$, $df = 249$ ns; respectively). These differences are illustrated in Figure 2. For the UK sample males averaged more experience with applications experience than females when rating the frequency of use and reporting the hours of use per week (4.4 hours v. 3.7 hours rounded to 4 in Figure 3; $t = 3.30$, $df = 190$, $p < 0.001$; $t = 3.14$, $df = 171$, $p < 0.01$; respectively) and more programming experience frequency and hours ($t = 4.57$, $df = 181$, $p < 0.001$; $t = 3.29$, $df = 186$, $p < 0.001$; respectively). These differences are illustrated in Figure 3.

Computer Experience with Computer Anxiety and Attitudes

A correlational analysis was conducted between computer anxiety and computer attitudes with the four measures of computer-related experience. For all the correlational tables, both measures of applications usage significantly correlated with each other and the same is true for both measures of programming experience. The average hours spent using applications programs also significantly correlated with the average hours spent programming for all samples (except males from HK). Table 2 highlights these correlations for the overall sample.

For the overall sample, there were no significant correlations between computer anxiety and any of the measures of computer experience although both the measures of using application programs significantly positively correlated with computer attitudes. The only significant correlation with computer

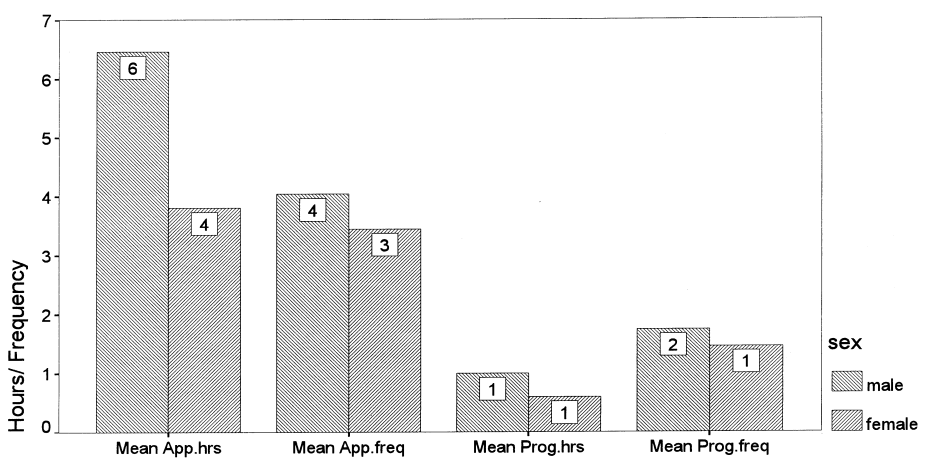

Figure 2. Sex differences in experience (HK).

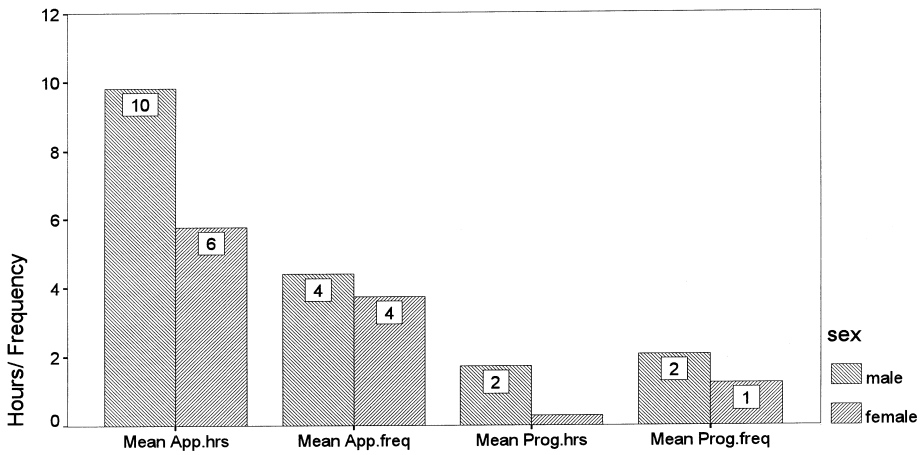

Figure 3. Sex differences in experience (UK).

Table 2. Correlations for the Whole Sample

$N = 478$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	−.30 ***	−.02 ns	−.03 ns	−.01 ns	.02 ns
Attitude	1.00	.27 ***	.29 ***	−.07 ns	.03 ns
App. (hrs)		1.00	.58 ***	.27 ***	.25 ***
App. (freq)			1.00	.06 ns	.30 ***
Prog. (hrs)				1.00	.56 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

anxiety was computer attitudes (in the expected direction). When examining the samples separately, this pattern of correlations was retained for the UK sample. The correlations for the UK sample are reported in Table 3.

A different pattern of correlations emerged within the HK sample, however. Table 4 shows that whilst computer anxiety and computer attitudes do not correlate, computer anxiety does correlate with measures of application

Table 3. Correlations for the UK Sample

$N = 199$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	−.32 ***	.08 ns	−.12 ns	.03 ns	−.08 ns
Attitude	1.00	.25 ***	.28 ***	.00 ns	.13 ns
App. (hrs)		1.00	.63 ***	.39 ***	.41 ***
App. (freq)			1.00	.23 ***	.47 ***
Prog. (hrs)				1.00	.64 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4. Correlations for the HK Sample

$N = 276$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	.03 ns	.14 *	.25 ***	−.01 ns	.17 **
Attitude	1.00	.17 **	.26 ***	−.21 ***	−.09 ns
App. (hrs)		1.00	.50 ***	.15 *	.05 ns
App. (freq)			1.00	−.10 ns	.13 *
Prog. (hrs)				1.00	.47 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

programs usage such that greater computer usage correlates with greater feelings of anxiety. Additionally, a negative correlation between programming experience and computer attitudes was found such that those with less programming experience held more positive attitudes.

Examining these correlations for the HK sample by gender reveals that for both males (Table 5) and females (Table 6), experience with applications programs significantly correlates with more positive computer attitudes. For both males and females, computer attitudes and anxiety do not correlate. Additionally, however, for males only, more hours spent programming (not frequency of programming) correlates with more negative attitudes. Again, for males only, more time spent using application programs (both rating of frequency and reported hours per week) correlates with higher levels of computer anxiety.

Examining the UK sample by gender, time spent using applications programs (frequency rating and hours per week) correlates with more positive attitudes for both males (Table 7) and females (Table 8). More positive computer attitudes also correlate with lower levels of computer anxiety for both sexes. Additionally, for UK females, more programming experience and less experience with applications programs correlates with higher anxiety.

There are some consistencies within Tables 2–8, therefore. Experience with applications programs (measured by frequency of use and hours per week) correlate with positive attitudes towards computers for both genders from both samples. Whilst experience with applications programs does not cor-

Table 5. Correlations for the Male HK Sample

$N = 125$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	.05 ns	.20 *	.31 ***	−.03 ns	.21 *
Attitude	1.00	.18 *	.21 *	−.31 ***	−.03 ns
App. (hrs)		1.00	.47 ***	.03 ns	−.04 ns
App. (freq)			1.00	−.17 ns	.13 ns
Prog. (hrs)				1.00	.46 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 6. Correlations for the Female HK Sample

$N = 125$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	.01 ns	−.04 ns	.15 ns	−.04 ns	−.02 ns
Attitude	1.00	.21 *	.31 ***	−.08 ns	−.08 ns
App. (hrs)		1.00	.52 ***	.20 *	.01 ns
App. (freq)			1.00	−.10 ns	−.02 ns
Prog. (hrs)				1.00	.44 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 7. Correlations for the Male UK Sample

$N = 98$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	−.26 **	.18 ns	−.08 ns	−.05 ns	−.19 ns
Attitude	1.00	.21 *	.21 *	−.05 ns	.12 ns
App. (hrs)		1.00	.60 ***	.35 ***	.33 **
App. (freq)			1.00	.23 *	.52 ***
Prog. (hrs)				1.00	.56 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

relate with computer anxiety for HK females and UK males, increased applications programs experience correlates with reduced computer anxiety in UK females and increased computer anxiety in HK males. Finally, computer attitudes and anxiety correlate for the UK sample only (males and females).

Computer Anxiety

Having examined the relationship between computer experience and computer anxiety, differences in computer anxiety within the samples were analyzed. Initially it was found that the HK sample reported greater levels of computer anxiety than the UK sample ($t = 12.35$, $df = 462$, $p < 0.001$), see Figure 4. This was further examined by looking at the gender differences within each sample. Within the UK sample, males ($N = 98$) had an average

Table 8. Correlations for the Female UK Sample

$N = 92$	Attitude	App. (hrs)	App. (freq)	Prog. (hrs)	Prog. (freq)
Anxiety	−.46 ***	−.14 ns	−.30 **	.26 *	.09 ns
Attitude	1.00	.28 *	.35 ***	−.05 ns	.09 ns
App. (hrs)		1.00	.65 ***	.31 **	.40 ***
App. (freq)			1.00	.01 ns	.13 ns
Prog. (hrs)				1.00	.75 ***

App. hrs – Hours per week using application programs, App. freq – Frequency of using applications programs, Prog. hrs – Hours per week programming, Prog. freq – Frequency of programming. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

computer anxiety score of 39.4 whilst females ($N = 92$) had an average computer anxiety score of 38.8, which were not significantly different from each other ($t = 0.028$, $df = 188$, ns), see Figure 5. Interestingly, a significant difference does exist for the HK sample, where males were significantly *more* computer anxious than females. Males ($N = 121$) had an average score of 56.0 and females ($N = 120$) had an average score of 52.8 ($t = 2.17$, $d = 239$, $p < 0.05$), see Figure 6.

The factorial structure of the anxiety scale was examined for both samples to identify any similarities and differences between the two samples. The factor analysis for the HK sample revealed 5 factors accounting for 59.3% of the variance. Examining how the items load upon each factor reveals that the first factor is associated with anxiety concerning the anticipation of using computers ('thinking about prepackaged (software packages) programs for a computer', 'learning computer terminology', 'learning to write computer programs', etc.) An appropriate title for this factor would therefore be 'anticipatory computer anxiety' (Eigen value = 6.19, Variance = 30.9%). The heaviest loading items upon the second factor revolve around anxiety aroused through watching computers or watching others at computers ('watching a movie about an intelligent computer', 'watching or listening to news programs about the increasing role of computers within society', 'watching someone working at a computer terminal', etc.) This factor will be termed 'vicarious computer anxiety' (Eigen = 1.81, 9.0%). Factors 3 (Eigen = 1.34%, 6.7%) and 4 (Eigen = 1.19%, 6.0%) relate to typing skill and situations where one is *required* to use technology (respectively). Lastly items concerned with actual use load upon factor 5 (anxieties about 'error messages' or 'networks going down'). As this anxiety is aroused through

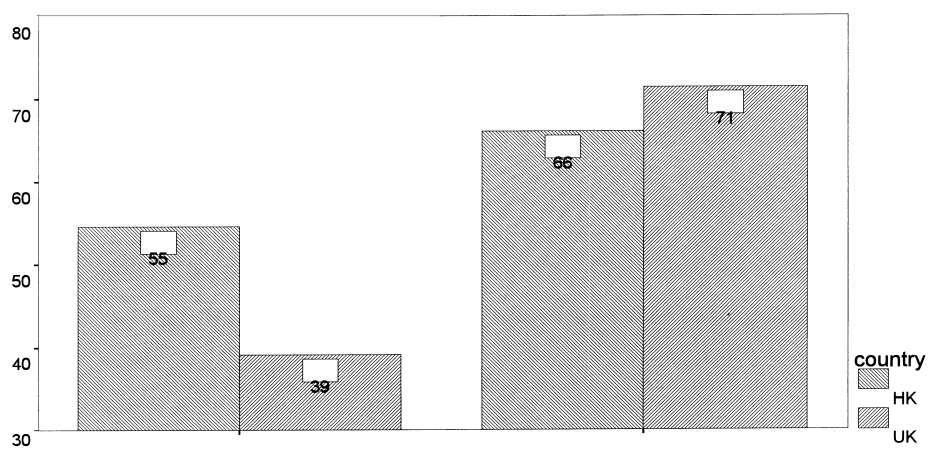

Figure 4. Computer anxiety and computer attitude by country.

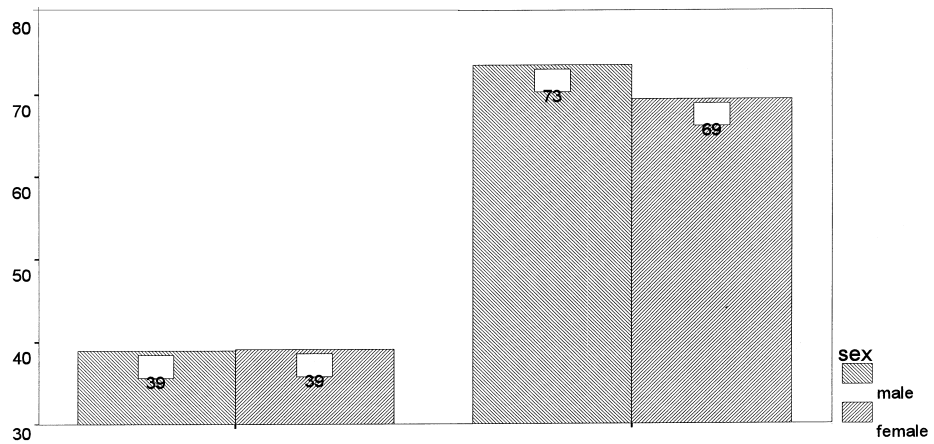

Figure 5. Computer anxiety and attitudes in UK sample by sex.

actually using computers, this factor will be termed 'enactive computer anxiety' (Eigen = 1.13, 5.6%).

An identical analysis for the UK sample reveals a 3 factor structure accounting for 60.3% of the variance. The loading of the items mirrors very closely the loading on factors 1, 2 and 5 from the HK sample. That is to say that anticipatory computer anxiety (Eigen = 9.10, 45.5%), vicarious computer anxiety (Eigen = 1.74, 8.7%) and enactive computer anxiety (Eigen = 1.22, 6.1%) are salient constructs for both the UK and the HK samples.

As a gender difference in computer anxiety had been identified above in the HK sample, an item by item analysis was conducted to identify in what

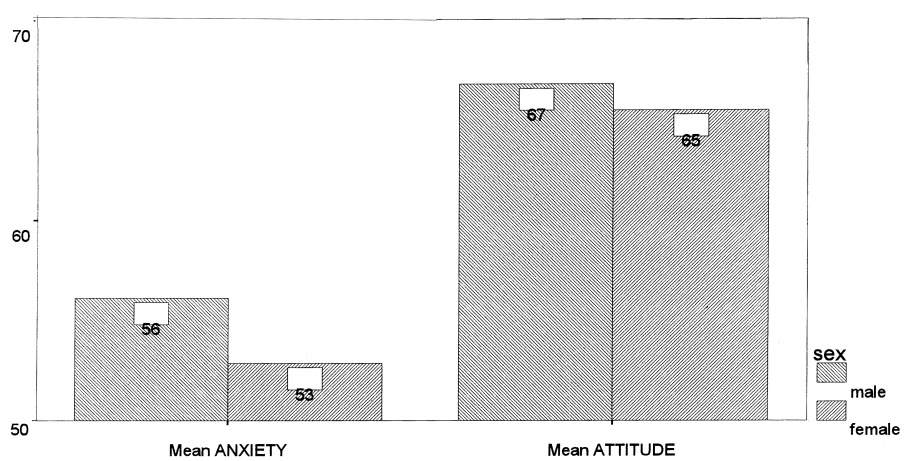

Figure 6. Computer anxiety and attitudes in HK sample by sex.

aspects of computer anxiety males were more computer anxious than females. The results revealed that there were three significant differences ($p < 0.05$) where males were more anxious, all of which loaded upon factor 1 ('thinking about prepackaged (software packages) programs for a computer', 'talking to a computer programmer', 'visiting a computer store'). Male anticipatory computer anxiety therefore exceeds female anticipatory computer anxiety, with no significant differences in enactive or vicarious computer anxiety.

The item by item analysis of gender differences was repeated for the UK sample. This revealed that there were four items in which males were significantly less anxious than females and four items in which females were significantly less anxious than males (consequently there was no difference in the overall anxiety score). Males were significantly ($p < 0.05$) less computer anxious than females on the items loading upon the enactive computer anxiety factor ('getting error messages from the computer', 'being refused information because the computer is down', 'erasing or deleting material from a computer', etc.) Conversely, females reported less computer anxiety for the items loading upon the vicarious computer anxiety factor ('watching a movie about an intelligent computer', 'watching or listening to news programs about the increasing role of computers within society', etc.)

Computer Attitudes

The UK sample had significantly more positive computer-related attitudes than the HK sample (71.34 v. 66.13; $t = 6.86$, $df = 454$, $p < 0.001$), see Figure 4. Examining the two samples separately reveals that males have more positive computer attitudes than females within the UK sample (73.45 v. 69.19; $t = 3.12$, $df = 186$, $p < 0.01$), see Figure 5. This is not reflected within the HK sample where males were not found to have significantly more positive computer attitudes than females (66.79 v. 65.62; $t = 1.38$, $df = 245$ ns), see Figure 6.

As with the computer anxiety scale a factor analysis (varimax rotation) was conducted upon the computer attitude scale for the HK and UK samples separately to examine similarities and differences in the underlying structure. For the HK sample, 58.4% of the variance was accounted for in seven factors. Examining the item loadings suggests the items centre around the following factors:

(a) Eigen = 3.21, 16%: computers eliminating tedious work ('Computers can eliminate a lot of tedious work', 'The use of computers is enhancing our standard of living'); (b) Eigen = 2.74, 13.7%: computers are difficult to understand ('Computers make me uncomfortable because I do not understand them', 'Computers are difficult to understand and frustrating to work with'; (c) Eigen = 1.35, 6.7%: computer deskilling people ('Computers are

dehumanizing to society', 'People are becoming slaves to computers'); (d) Eigen = 1.28, 6.4%: computers are intimidating ('Computers complexity intimidate me', 'I feel intimidated by computers'); (e) Eigen = 1.06, 5.3%: computers as controlling humans ('Soon our lives will be controlled by computers'); (f) Eigen = 1.04, 5.2%: computers displace work for people ('Computers are lessening the importance of too many jobs done now by humans'); (g) Eigen = 1.00, 5.0%: computers dehumanise people ('Computers turn people into just another number').

Of these headings, only the first could be considered to represent a positive attitude towards computers, namely that they eliminate the need for people to undertake tedious tasks. Conversely, four factors highlight the negative impact of computers upon the work of humans, characterising computers as deskilling/controlling/dehumanising/displacing work for humans. The remaining two factors are also negative, characterising the computer as complicated/intimidating. Under this analysis, only 16% of the variance is accounted for by the positive factor. The remaining 42% of the variance is accounted for by negative factors.

A similar analysis for the UK sample reveals a similar amount of variance (59.3%) accounted for by 5 factors, 4 of which mirror the factors described for the HK sample. The factors accounting for the largest potions of variance (respectively) mirror factors (b) Eigen = 4.62, 23.1% and (c) Eigen = 3.16, 15.8% above. The third factor appears not to be represented within the HK factorial structure. This factor (h) Eigen = 1.66, 8.3% has heavily loading items which refer to potential utopian benefits of computers ('Computers are bringing us into a bright new era', 'life will be easier and faster with computers') rather than relating specifically to work. The fourth factor mirrors factor (e) Eigen = 1.36, 6.8% above and the final factor mirrors factor (a) Eigen = 1.05, 5.2%. Interestingly, factor (a) accounts for the largest proportion of variance in the HK sample and the smallest proportion of variance in the UK sample. Combining the variance accounted for by factors (a) and (h) highlights that 13.5% of the variance in the UK sample is accounted for by positive factors.

Examining item by item gender differences reveals no gender differences for the HK sample and consistent gender differences for the UK sample, except for the items which load heavily on factor (c). There appears to be no gender differences in the attitudes towards computers deskilling people.

DISCUSSION

The UK population were found to have significantly greater experience, less anxiety and more positive attitudes towards computers than the HK sample.

This is despite comparable educational systems and technological sophistication. There were also disparate pattern of gender differences between the two samples. Whilst UK males held more positive attitudes than UK females with no differences in anxiety, HK males were more anxious than HK females with no differences in attitudes. This represents the first reported instance of females registering as less computer anxious than males and suggests that gender differences in computer attitudes and anxieties are not consistent across UK and HK cultures. As males report more experience than females, this unique gender difference in computer anxiety cannot be attributed to a unique pattern of gender differences in computer experience. As with the majority of other studies, males from both samples in the present study were found to have greater experience than females. Whilst there is a definite association between greater experience with applications programs and more positive computer attitudes, the relationship between experience with applications programs and computer anxiety was less straightforward. Firstly, there was not a significant correlation between these two variables for HK females and UK males and secondly, whilst greater experience with applications programs related to decreased computer anxiety in UK females, it related to increased computer anxiety in HK males. Whilst we might expect more experienced computer users to be less anxious (or possibly less anxious users to be more experienced) the relationship is confounded by anxious individuals avoiding computer interaction (Rosen, & Maguire, 1990). The etiology of the unique gender difference reported in the present study undoubtedly lies with the relationship between experience with applications programs and increased computer anxiety in HK males. Within an experimental setting, experience with applications programs has been shown to increase computer anxiety in initially anxious subjects (Carlson, & Wright, 1993), but this does not explain why the relationship is only salient in males within the present study nor why these anxious males continue to engage in more experience with applications programs than their less anxious female counterparts.

The item-by-item analysis of gender differences identified for which items in particular males were more computer anxious than females within the HK sample. At this item level, HK males reported being more anxious than HK females in situations which anticipated (factor 1: 'anticipatory anxiety') using computers rather than actively using computers. The items ('thinking about prepackaged (software packages) programs for a computer', 'talking to a computer programmer', 'visiting a computer store') are comparable to Rosen and Weil's *Consumer Technology Anxiety* (Rosen, & Weil, 1995) factor. The origins of this unique gender difference would therefore appear to lie primarily within this area, rather than the other two factors where no gender differences were reported. Additionally, the remaining two factors

consistent across both samples, 'vicarious anxiety' ('watching a movie about an intelligent computer', 'watching or listening to news programs about the increasing role of computers within society', 'watching someone working at a computer terminal', etc.) and 'enactive anxiety' (anxieties concerning 'error messages' or 'networks going down'), mirror Rosen and Weil's *Observational Computer Learning Anxiety* and *Interactive Computer Learning Anxiety* factors (respectively). The present study suggests that the factorial structure suggested by Rosen and Weil to underlie computer anxiety in the learning environment is generalizable. In addition, the terminology of 'enactive' and 'vicarious' computer anxiety is consistent with the model of technophobia based upon self efficacy theory proposed by Meier (1985). There is considerable support, therefore, for factors revolving around anticipatory, vicarious and enactive computer anxiety being cross-cultural. These factors are supplemented by anxieties concerning prerequisite typing skills and the compulsory nature of computer usage within the HK sample. The present study suggests that cultural differences may determine where gender differences reside within a relatively homogenous cross-cultural factorial structure of computer anxiety.

The opposite pattern of gender differences was found for computer attitudes. Whilst no gender differences were found in the HK sample, gender differences were reported upon all the factors for the UK sample, with the exception of the 'computers deskilling people' factor. UK males held both more positive attitudes (computers eliminate tedium; will lead to a Utopia) and less negative attitudes (computers are difficult to understand; computers will control humans) than UK females. Once again, this suggests that, whilst there is much overlap in the factorial structure of computer attitudes, gender differences are not consistent across UK and HK cultures.

The factor analysis for the HK sample revealed three additional factors, namely computers as 'intimidating', 'displacing work' and 'dehumanizing'. These three factors, combined with those shared with the UK sample, can be seen as subordinate to the categories proposed by Sensales, & Greenfield (1995) namely, the negative effects at both an individual and societal level and the positive effects at an organizational level. The more specific factor headings within the present study account for around an additional 20% of the variance than those of Sensales and Greenfield, as well as mirroring very closely the factors proposed by Omar (1992) for his US and Middle East Samples. The present study again confirms that there is a significant degree of homogeneity in the factor analytic structure of computer attitudes cross-culturally, despite significant differences in levels of experience.

There are similarities between the unexpected findings in the HK sample in the present study and the Japanese sample in Weil and Rosen's (Weil, & Rosen, 1995) study described in the Introduction. It is conceivable that the

Oriental cultures of HK and Japan share cultural factors that undermine the traditional association between experience and technophobia found in Western cultures (such as the USA and UK). One plausible cultural factor is the masculinization of technology that has taken place within Western cultures (Chivers, 1987; Hawkins, 1985) such that both sexes rate Information Technology as 'masculine' (Archer, & Macrae, 1991), perceive computers to be more appropriate for males than females (Wilder, Mackie, & Cooper, 1985) and perceive males to be more computer proficient than females (Williams, Ogletree, Woodburn, & Raffeld, 1993). Research has identified that psychological masculinity and femininity can account for apparent differences in technophobia between males and females in both the UK (Brosnan, 1998; in press; Colley, Gale, & Harris, 1994) and the USA (Ogletree, & Williams, 1990; Rosen, Sears, & Weil, 1987). As technology has developed a masculinized image, those higher in masculinity are motivated to engage in technology-related behaviour (see Bem, 1993 for a full discussion). Whilst Bem's measures of psychological masculinity and femininity have been validated for Oriental cultures (Ishida, 1994), further research is required into the extent to which technology has been masculinized within Oriental cultures. This type of cross cultural research that extends beyond Western cultures, potentially provides a significant methodology for conceptualising the role of cultural factors (such as the masculinization of technology) upon technophobia, gender differences and the interrelationships between computer related experience, anxiety and attitudes.

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