Finger Length, Digit Ratio and Gender Differences in Sensation Seeking and Internet Self-Efficacy

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Abstract

Several studies have suggested a significant relationship between finger length and aspects of personality. In this study the ratio between second and fourth digit lengths, known as digit ratio, was correlated with sensation seeking and Internet self-efficacy. In addition the relationship between the fourth and fifth digits, i.e. the little finger and ring finger, and these two constructs was also examined. No significant relationship between sensation seeking and digit ratio was observed but, in males, significant correlations between digit ratio and Internet self-efficacy were found. The implications for IT education are discussed.

Keywords: Self-efficacy, Internet use, Digit Ratio, Gender differences, Sensation seeking

Introduction

Relative finger length, as a surrogate for prenatal hormonal exposure, has been shown to be related to a wide range of psychosocial factors including sporting potential, sexual orientation, personality, faculty membership, cognitive abilities and even the way men dance (Austin, Manning, McInroy, & Mathews, 2002; Brosnan, 2006; Fink, Neave, Laughton, & Manning, 2006; Lippa, 2003; Paul, Kato, Hunkin, Vivekanandan, & Spector, 2006). The purpose of this study is to extend this research into the domain of self-efficacy within the context of Internet use.

The ratio between the index finger (second digit, 2D) and the ring finger (fourth digit, 4D), i.e. 2D:4D has been known to be sexually dimorphic for more than 100 years (Ecker, 1875), with females typically having a higher ratio than males; females = 1 and males = 0.98 for UK samples (Brosnan, 2006). Manning, Scutt, Wilson, and Lewis-Jones, (1998) have suggested that the length of the ring finger is a measure of exposure to prenatal testosterone whereas the length of the index finger is determined by prenatal oestrogen. From this it can be concluded that the 2D:4D ratio provides an indication of the relative exposure to prenatal testosterone and oestrogen. Small 2D:4D ratios produced when the ring finger is longer than the index finger are an indication of greater exposure to prenatal testosterone and might therefore be considered a measure of masculinity. Similarly, larger ratios, where the index finger is equal to or longer than the ring finger, result from greater exposure to oestrogen and therefore might be thought of as a measure of femininity. These sexually dimorphic properties of the digit ratio appear to be consistent across all cultures and are independent of age and overall height (Manning, Stewart, Bundred, & Trivers, 2004).

The behavioural and psychosocial correlates with digit ratio appear to be wide

ranging. Csatho et al. (2003) used the Bem Sex Role Inventory to assess femininity and masculinity and found that women with smaller digit ratios reported more masculinised scores. Likewise, men with smaller digit ratios are perceived as more masculine and dominant by female observers (Neave, Laing, Fink, & Manning, 2003). Masculine attributes of achievement, ability and speed in sport and visual-spatial ability are also correlated with digit ratio in the predicted direction (Manning & Taylor, 2001).

Eysenck and Eysenck (1985) have suggested that the constructs of their personality theory: psychoticism, extraversion and neuroticism have a genetic basis and therefore it might be reasonable to assume a correlation with digit ratio. In a study by Fink, Manning, and Neave, (2004) an attempt was made to correlate digit ratio with the "big-five" personality factors (extraversion, neuroticism, openness, conscientiousness and agreeableness), but only very weak correlations were found. Evidence for a stronger association between digit ratio and personality has been provided by Austin et al, (2002) who looked at the relationship between digit ratio and a number of personality and cognitive tests. The personality tests used were those where it was known a gender difference in performance exists and included measures of psychoticism, neuroticism, extraversion, aggression, sensation seeking and depression. Similarly the cognitive tests of verbal fluency and mental rotation were chosen because of a known gender difference. It was predicted that for the scales where males were expected to score more highly, i.e. mental rotation, aggression, sensation seeking and psychoticism, there would be a negative correlation with digit ratio, whereas for the scales where females would be expected to score more highly, i.e. verbal fluency, neuroticism and depression-proneness, the correlation would be positive. No significant correlations were found for digit ratio and the measures of aggression, mental rotation and verbal fluency. Many of the statistically significant correlations were gender specific. For example, a significant correlation was reported for digit ratio and the disinhibition subscale of the sensation-seeking scale and also for the total sensation seeking score, but in both cases for females only. No significant correlations were found with the male participants. For the whole sample, males and females, significant correlations were found between digit ratio and psychoticism, extraversion and neuroticism, but only for the left hand.

Yet other research has focused on the relationship between the little finger and the ring finger. Ghosh and Garth (2006) hypothesised that males and females who have the tip of their little fingers below the distal finger mark (i.e. the upper crease) on the adjacent ring finger would score more highly on the neuroticism scale of the Eysenck Personality Questionnaire, compared to males and females who have a little finger that extends above the distal finger mark. Their findings confirmed this prediction for both males and females. It was also found that males who have a little finger tip below the distal finger mark scored more highly of the extraversion scale, though this did not apply to females.

Brosnan (2006) has suggested that these differences in digit ratio between males and females may also reflect faculty membership in academia. He examined gender differences in digit ratio across a Science Faculty and a Social Science Faculty. Although he failed to find the predicted gender differences, he did find that architects, economists, those involved with education and management and psychologists loosely described as "social scientists" of both sexes have a ratio consistent with the male norm (0.98 or below) Chemical engineers, physicists, mathematicians and computer scientists, i.e. the "scientists" tended to have a ratio closer to the female norm (0.995 or above). Brosnan concluded that the spatial skills that can lead to an ability to succeed in science are the result of either lower than average testosterone levels or higher than average levels. The relationship between digit ratio and cognitive abilities is probably more complex than had been suggested and is probably closer to an inverted U shape. At the extremes the testosterone levels enhance the development of the right side of the brain (at the expense of the left), and this results in the superior spatial thinking required of the "hard" sciences like mathematics and physics. In

between these two extremes the more moderate levels of testosterone will result in the "social science" brain.

Gender differences in the use of the Internet are in decline but significant differences have been observed. Weiser (2000) found that males tend to use the Internet mainly for entertainment and leisure, whereas females use it mainly for communication and education. Madell and Muncer (2004), in a study of UK school children found that there was a distinct male bias in Internet use and that for the purposes of equity these differences need to be addressed by educationalists and governments. The way in which gender differences in Internet use may be reduced will, in part, be determined by the factors responsible for these differences. Arguably, cultural, social and educational factors are more amenable to intervention than innate neurological differences. However for tutors who wish to use the Internet as a teaching and learning resource, they should be aware that gender differences in Internet access may influence the way in which their students are likely to utilise these resources.

The purpose of the present study is to extend the research on digit ratio into the field of Internet self-efficacy. This construct, as measured by the Web User Self-Efficacy scale (WUSE), comprises four sub scales: Information Retrieval, Information Provision, Internet Technology and Communications. Gender differences in these four sub scales and the WUSE as a whole have been found with males tending to score more highly on all four subscales and the total measure of Internet Self-efficacy (Eachus & Cassidy 2006). It was therefore hypothesised that there would be a significant correlation between measures of Internet self-efficacy and digit ration. Males also score more highly than females on sensation seeking, (Zuckerman, 1991), and since it has been reported that heavy use of the Internet can result in social withdrawal and sensation avoiding (Stockman, 2006; Young, 1996) it was hypothesised that this difference may also be reflected in digit ratio.

Method

The data in this study was collected via an Internet website designed specifically for this purpose. The first part of the website explained briefly the purpose of the study and included photographs detailing how measurements of the fingers were to be made. It was also made clear that no names were required and all data would remain anonymous. Participants were asked to measure the lengths of their index and ring fingers of both left and right hands. The units of measurement were to be in millimetres and participants were asked to record their measurements to the nearest 0.5 millimetre. In addition, participants were also asked to compare the tip of their little fingers with the upper crease on the adjacent ring finger and to record whether the tip was above or below the crease. The participants recorded the data in boxes provided on the website.

The second part of the website was described as a measure of personality and Internet use and was actually the Brief Sensation Seeking scale (BSSS) (Hoyle, Stephenson, Palmgreen, Lorch, & Donohew 2002) and the Web Users Self-Efficacy Scale, WUSE (Eachus & Cassidy 2006). Before completing the questionnaire participants were asked to provide some basic demographic data: age, gender and country of residence. They were also asked to provide details about Internet use, in particular how many hours per week they spent on the Internet, how many years they had been a regular Internet user, and their self-perceived level of Internet expertise. The 8 items of the BSSS and the 40 items of the WUSE scale were presented using a five-point Likert format where 1 = strongly disagree and 5 = strongly agree. Responses were made by using the computer mouse to click on the appropriate button from the five provided. On completion of the questionnaire the participants clicked on a submit button to return the data to the experimenter via the University server and then email.

Sampling

Participants were recruited for this study by posting a message on a number of Internet Usenet groups. The message briefly explained the nature of the research, assured the participants of anonymity and provided a link to the website. With this system of recruitment, a number of possible problems may arise. It is obviously impossible to calculate response rates because the size of the target population is unknown. It is difficult to know how representative the sample may be although collecting demographic data does aid in this respect. Despite these cautions, this method of sampling has been used elsewhere, e.g. Eachus and Cassidy (2006), Brosnan (2006), and it was therefore considered appropriate.

Scales

Two scales were used in this study in order to measure sensation seeking and Internet Self-efficacy:

The Brief Sensation Seeking Scale (BSSS) (Hoyle et al 2002).

> The BSSS is comprised of eight items, two per subscale, and uses a five point Likert format from strongly agree through to strongly disagree for responses. The sub scales are:
>
> *Experience Seeking*…..the need to seek out new experiences.
>
> *Boredom Susceptibility*……the tendency to become restless and the need for the unpredictable.
>
> *Thrill and Adventure Seeking*…..the need for excitement and adventure.
>
> *Disinhibition*…..the tendency to ignore societal inhibitions.

Web User Self-Efficacy Scale (WUSE) (Eachus and Cassidy, 2006)

> This is a 40-item scale that measures Internet self-efficacy on four sub scales:
>
> *Information Provision*..the ability to build websites.
>
> *Information Retrieval* ….confidence in finding information on the Internet.
>
> *Communications* ….confidence in using Internet communication channels.
>
> *Internet Technology* ….knowledge about Internet technologies.
>
> A five point Likert format from strongly agree through to strongly disagree is provided for responses.

For this study, the two scales were combined into a single web page.

Validation of data

Digit ratio data have been collected via the Internet elsewhere. In Brosnan's (2006) study of academia he showed that participants could accurately measure the length of their fingers by asking his respondents to submit a photocopy of their hands in addition to the measurements taken. Using this technique he was able to show that participants can measure finger length with an acceptable level of accuracy ($r = .82$, $p < .001$). A further validation technique is to ask participants to submit data from both hands. The resulting data should be highly correlated.

Results

After posting the message on the Internet Usenet groups, a deadline of two weeks was allowed for submission. By the end of this period 61 responses had been received. Of these 26 were from

males and 34 were from females (1 failed to indicate), the mean age was 40.3 years with a range of 19 - 75. Initial validation of the finger length data was conducted by correlating 2D and 4D finger lengths from both hands; for the 2D finger this was found to be, $r = .863$, $p < .001$, and for the 4D finger this was, $r = .889$, $p < .001$. These strong correlations do suggest a high degree of consistency in the measurements taken and it was therefore concluded that the finger measurements were very likely to be accurate.

In the first part of the study gender differences were investigated and the results are shown in Table 1.

Table 1 Gender differences

	Maximum possible score	Females Mean	Std. Deviation	Males Mean	Std. Deviation	t	df	sig
Right digit ratio	N/a	.9772	.04300	.9534	.04894	-1.998	58	.025
Left digit ratio	N/a	.9751	.05873	.9569	.04042	-1.350	58	.091
Mean digit ratio	N/a	.9761	.04383	.9552	.03995	-1.907	58	.032
BSSS	40	23.4412	6.40639	25.5769	7.28381	1.206	58	.116
Experience seeking	10	5.9706	1.80043	6.5769	2.24808	1.160	58	.125
Boredom susceptibility	10	6.1176	2.30631	6.3846	2.56245	0.423	58	.325
Thrill and Adventure seeking	10	5.4412	1.94143	5.9231	2.09615	0.920	58	.185
Disinhibition	10	5.9118	2.17935	6.6923	2.22296	1.363	58	.089
Information retrieval	50	38.9091	7.14302	45.6154	4.96449	4.071	57	.000
Information provision	50	24.6970	11.09754	37.000	10.95445	4.252	57	.000
Communications	50	31.6364	6.01466	38.6667	6.32914	4.262	55	.000
Internet technology	50	31.4118	8.15054	42.1923	7.00868	5.389	58	.000
WUSE total	200	126.4375	28.58596	162.1250	26.06566	4.799	54	.000
Weekly hours	N/a	11.8676	12.07383	23.5385	23.18315	2.526	58	.007
Years using Internet	N/a	6.8088	3.02518	8.7083	4.42797	1.943	56	.028
Self-rated Expertise	3	2.2353	.65407	2.6923	.54913	2.871	58	.003
Knowledge	3	1.5588	.89413	1.0000	.00000	-3.180	58	.001
Where Internet accessed	3	2.0000	.95346	1.6923	.92819	-1.253	58	.107
Age	N/a	40.8	16.83792	38.65	16.83792	-0.527	58	.600

The predicted gender differences in Internet self-efficacy are all confirmed with males scoring more highly than females on the WUSE and all its sub scales. The results show that males spend

more time on the Internet, almost twice the weekly hours of females. It is therefore perhaps not surprising to see that self-rated expertise is also significantly higher in males than females. The manner in which male and female participants acquire their knowledge about the Internet, i.e. whether they are self-taught or learn about it through school or college, is also statistically significant. In this sample, all males stated that they were largely self-taught whereas females were also likely to have made use of school or college courses. Significant differences were also found in the number of years of using the Internet. The differences observed do not appear to be age-related since males and females only varied very slightly in terms of age.

Previous studies that have found a gender difference in sensation seeking are contradicted by the findings reported here with neither the sub-scales, nor the BSSS as a whole, approaching statistical significance.

It was predicted that females would have a digit ratio larger than that of males and this is confirmed for the right hand and for the mean digit ratio but not for the left hand.

The main aim of this study was to look for a relationship between digit ratio, sensation seeking and Internet self-efficacy. The relevant findings are shown in

Table 2. When the mean of the left and right digit ratio for the whole group were correlated with the BSSS and WUSE scales, the only significant correlations found were for the Information Retrieval subscale of the WUSE ($r = -.252$, $p = 0.03$) and the Communications subscale of the WUSE ($r = -.288$, $p = .015$).

Table 2: Correlations of BSS, WUSE with mean digit ratio for whole group.

	Whole sample	sig	Females	sig	Males	sig
BSSS	-.089	.449	.008	.964	-.192	.347
Experience seeking	-.089	.500	.023	.897	-.248	.221
Boredom susceptibility	-.160	.221	-.191	.279	-.145	.481
Thrill and Adventure seeking	-.075	.568	.020	.910	-.180	.380
Disinhibition	.074	.575	.257	.143	-.047	.818
Information retrieval	-.252*	.030	.216	.227	-.648**	.001
Information provision	-.192	.145	.149	.408	-.382*	.050
Communications	-.288*	.015	.096	.595	-.501*	.013
Internet technology	-.192	.142	.126	.479	-.195	.341
WUSE total	-.231	.087	.149	.415	-.527**	.008

It can be seen from Table 2 that the mean digit ratio for males is significantly correlated with Internet self-efficacy as measured by WUSE and its subscales. Only knowledge of Internet Technology failed to reach significance.

Although highly correlated the digit ratios for the left and right hands are not exactly the same and therefore independent analyses for the two hands was carried out. The results are shown in Table 3. From this it can be seen that there are significant correlations between digit ratio of the right hand and Information Retrieval, Information Provision, Communications, and the WUSE overall. For the left hand, with the exception of Information Provision, a similar pattern of significant correlations is found.

Table 3: Correlations of BSS, WUSE with right and left hand digit ratio for males

	Right ratio	sig	Left Ratio	sig
BSSS	-.131	.524	.159	.438
Experience seeking	-.120	.560	-.272	.179
Boredom susceptibility	-.148	.471	-.057	.783
Thrill and Adventure seeking	-.102	.662	-.183	.372
Disinhibition	.003	.987	-.077	.709
Information retrieval	-.621	.001	-.525	.006
Information provision	-.448	.022	-.238	.241
Communications	-.406	.049	-.469	.021
Internet technology	-.130	.528	-.205	.316
WUSE total	-.517	.010	.417	.043

When correlations of BSS, WUSE with right and left digit ratio for females was investigated it was found that there were no significant correlations with BSSS, WUSE, or any of the subscales.

4D:5D Comparisons

Data was also collected on the position of the little finger tip relative to the distal crease on the adjacent ring finger. This was assessed for both left and right hands. One of the few studies to examine this comparison is that of Ghosh and Garth (2006) who looked at 4D:5D ratio with respect to personality as measured using the Eysenck Personality Questionnaire, which measures Psychoticism, Extraversion and Neuroticism. They found that where the little finger was below the distal crease, males scored more highly on Extraversion and Neuroticism, while females scored more highly on Psychoticism and Neuroticism. Thus there appears to be a relationship between this aspect of finger length and personality.

For the purposes of the present study participants were asked to indicate whether the tip of the little finger was above or below the distal crease on the adjacent ring finger. This data is presented below in Table 4.

Although there are significant differences in the proportions of participants recording the tip of the little finger as being above or below the adjacent ring finger when this was related to the measures of sensation seeking and Internet self-efficacy, few significant relationships were found. No differences were found for sensation seeking and only the Information Provision subscale

produced a significant difference with participants indicating that the tip of the little finger was above the crease, scoring more highly than those indicating the tip was below the crease; mean difference 9.89 (t = 2.611, df = 40, p = 0.011).

Table 4: Comparison of 4D:5D ratios

	Above Crease	Below Crease	Chi- Square	Degrees of freedom	significance
Whole Group					
Right Crease	30	19	7.714	1	.005
Left Crease	29	18	5.233	1	.022
Males					
Right Crease	13	5	3.556	1	.059
Left Crease	14	5	4.263	1	.039
Females					
Right Crease	16	7	3.522	1	.061
Left Crease	14	9	1.087	1	.297

Discussion

The aim of this study was to examine the extent to which differences in finger length might be related to sensation seeking and Internet self-efficacy. Although previous studies (Fink et al, 2006) have found a relationship between sensation seeking and digit ratio, in this study nothing of significance was found. However, a number of significant findings with respect to Internet self-efficacy have been recorded.

The rationale for digit ratio research has been based on initially identifying a construct for which a gender difference is known. This might be personality, musical ability, cognitive abilities, sporting performance and so on. Many of the studies described here have then gone on to explain these observed differences in terms of gender differences in digit ratio. The gender difference in digit ratio is of course simply a marker for differences in prenatal testosterone/oestrogen exposure, which it is theorized, results in differences in brain development. It is this difference in neurological development that ultimately leads to the observed cognitive and behavioural differences.

The gender differences in Internet self-efficacy that have been found in this study and have been reported elsewhere (Eachus & Cassidy, 2006; Eachus, Cassidy, & Hogg, 2006; Grace-Farfaglia, Peters, Dekkers, & Park, 2005; Wu & Tsai, 2006), need to be explained and several possibilities avail themselves. Weiser (2000) has suggested that the Internet is a “boys’ toy” that was developed by men for men and that females are actively discouraged from involvement. Socialisation is in part responsible for this technological gender gap which in the past was also reflected in the gender bias found in the study of maths and science (AAUW, 1992). More recent studies have found gender differences in Internet use that are similar to gender differences in attitudes towards

using computers, (Graphis, Visualisation, and Usability Center [GVU], 1999). This survey found that women typically report greater difficulty finding information on the Internet compared with men. Men report being more comfortable using the Internet and use it for more reasons. Men also have more sophisticated Internet skills than do women.

The findings in the present study clearly show that these gender differences in Internet use and self-efficacy still exist. The results of this study also show, that as far as males are concerned, there is a significant relationship between mean digit ratio and Internet self-efficacy; no such relationship is found for females. With the exception of the Internet Technology subscale, the other three subscales and the WUSE scale as a whole are all significantly correlated with mean digit ratio in males. Small digit ratios are associated with masculinity and therefore it would be expected that there would be a negative association between digit ratio and Internet self-efficacy. This prediction is confirmed by the data presented here. For females, all the subscales of the WUSE and the total WUSE score are all positively correlated with mean digit ratio, though not to a significant degree.

Bilateral neurological development as a function of testosterone/oestrogen exposure may also be reflected in differential digit ratio development. When this was investigated in males (Table 3), although differences in the correlations found did emerge, there was no obvious pattern present.

One anomalous finding from the examination of digit ratio and Internet self-efficacy concerns the Internet Technology subscale. Despite the fact that there are clear gender differences in scores on this subscale, with males scoring more highly than females (Table 1), this difference doesn't manifest itself in terms of differences in digit ratio.

What are the implications of these findings for IT education? Undoubtedly many of the gender differences in Internet self-efficacy are influenced by socialization and culture. That these differences are rapidly diminishing (Weiser, 200) will be due to education and changing cultural attitudes towards gender bias, and in this IT tutors will have an important role to play. However, if as these findings suggest, there may be fundamental neurobiological differences in men and women that influences their ability to fully exploit the technology, then tutors and students need to be made aware of this. As the Internet is used increasingly as a learning resource, tutors need to think about these gender differences and the way they may impact their students' ability to utilise these resources as part of their learning experience.

Conclusion

The findings reported in this study support previous work that has identified gender differences in Internet self-efficacy. Explaining this difference is likely to involve psychological, social, and cultural factors, and the present findings suggest that neurobiological factors may also be of importance. The notion that self-efficacy in using the Internet may be determined before birth may seem rather bizarre but then many human characteristics and ultimate behaviours are similarly determined. Where gender differences in characteristics that may influence student learning are identified, tutors should seek to minimize their impact through appropriate learning strategies and online resources.

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Biography

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