Picture perfect: Girls' and boys' preferences towards visual complexity in children's websites

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Abstract

This experiment examined children's aesthetic preferences for websites designed for them. It applied Berlyne's theory of aesthetic preference to these websites: a theory that suggests that people prefer a medium level of stimuli to a low or high level of stimuli. The experiment used a 2 × 3 between-subject design and involved 45 boys and 45 girls. In the experiment the children were asked to rate 12 children's learning websites for aesthetic preference. The websites had been classified according to whether they displayed a high, medium or low level of visual complexity. The results of the experiment showed that overall the children preferred websites that displayed a medium level of visual complexity to those that displayed a high or low level of visual complexity. Thus the results supported Berlyne's theory. However, when the children's ratings were analysed with respect to their gender, it was found that the boys preferred a high level of visual complexity and the girls preferred a medium or low level of visual complexity. In other words, Berlyne's theory was partly supported. Further analysis revealed other gender related aesthetic preferences. This paper should be of interest to anyone who designs learning websites for children.

1. Introduction

The Web has become a ubiquitous information and communication tool. As the Internet user population is continually increasing, it is becoming important for web designers and stakeholders that host websites deliver a good user experience for people. Although many studies in the field of web design have been conducted into usability, resulting in numerous design guidelines (e.g. Nielsen, 2000; Shneiderman, 1998), many of the subjective aspects have, until recently, been neglected. One subjective aspect which has started to receive attention is that of visual appearance. Research conducted in this area includes studies into: first impressions (Lindgaard, Fernandes, Duduk, & Brown, 2006); the aesthetic judgments of first impressions (Tuch, Presslaber, Stocklin, Opwisa, & Bargas-Avila, 2012); and the importance of aesthetics with respect to the context of the website (van Schaik & Ling, 2009). Although much of this research is still in its infancy, and little refers to children, there does seem to be evidence that visual aesthetics critically affect how a user perceives a website in terms of ease-of-use and interaction enjoyment (e.g. Hassenzahl, 2004; Van der Heijden, 2003).

One of those factors which influence visual aesthetic preference is visual complexity. Its impact on aesthetic preference is very well documented in numerous publications (e.g. Kartiko, Kavakli, & Cheng, 2010; Michaillidou, Harper, & Bechhofer, 2008; Pandir & Knight, 2006; Tuch et al., 2012), but knowledge about the influence of visual complexity on children's websites, and their aesthetic preference, is limited. Another point that needs clarification is whether there is any correlation between aesthetic preference and children's gender. Previous studies have looked at gender difference in website design preference, blog interface preference and aesthetic perception (Cyr & Bonanni, 2005; Hsu, 2012; Simon, 2001). Nevertheless, studies investigating aesthetic preference with respect to children are rare. Thus, it is important that researchers, practitioners and children educators explore possible interactions between aesthetic variables and gender effect in children's websites as the findings may help designers develop more appropriate websites for children.

Therefore, this study aims to explore the relationship between visual complexity, aesthetic preferences and gender differences and their effect on children's websites. It was conducted to test Berlyne's theory on aesthetic preference which suggests that people prefer medium stimuli to high or low stimuli. It also tests whether there are gender effects in children's websites. The research questions in this study are:

1. Do the different levels of visual complexity have an impact upon children's aesthetic preferences with regard to children's websites?
2. Are there gender differences in relation to aesthetic preferences in children's websites, and what aesthetic preferences contribute to these differences?

Keywords: Visual complexity, Children's website, Aesthetic preference, Gender, Children

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(3) Is there an interaction between different levels of visual complexity and gender differences in relation to aesthetic preferences in children's websites?

To setup a framework, an overview of the influence of visual complexity on aesthetic preference, and a brief introduction to Berlyne's experimental aesthetic theory was given; this was followed by a report on the measurement of the impact of visual complexity on aesthetic preference and gender difference in aesthetic perception.

2. Background of study

2.1. The impact of visual complexity on aesthetic preference

Early studies in experimental aesthetics led to several theories, the most influential of which was formulated by Berlyne (Martindale, Moore, & Borkum, 1990). Berlyne (1971, 1974) proposed an important theory that has dominated experimental aesthetics for several decades. According to Berlyne's model, aesthetics relates to a number of so-called 'collative variables', where each person's pleasure is related to the arousal potential of a stimulus. This relationship is linked to the Wundt (inverted-U shape) curve for pleasure, with a linearly increasing line for the arousal potential of a stimulus. One prediction of the model is that medium levels of stimulus would be preferred, whereas stimuli with low and high arousal potentials are less pleasant. According to his theory, arousal potential is linked to collative properties such as complexity, novelty, and hedonic value. Among those properties, visual complexity plays a crucial role in the perceived aesthetic preference (Michailidou et al., 2008; Pandir & Knight, 2006; Tuch, Bargas-Avila, & Opwis, 2010a). A number of experiments have been conducted with respect to users' preference and perceived visual complexity. In a study of children's aesthetic preferences for websites, Wang and Bowerman (2012) showed that children preferred both classical and expressive aesthetics of a medium level of perceived visual complexity, supporting Berlyne's theory. A similar result was found in research by Kaplan, Kaplan, and Wendt (1972), who conducted an experiment to evaluate viewers' perception of photographs. The images were of rural and urban landscapes and it was found that the photographs of rural settings were preferred to the urban ones. However, when each type of photograph was analysed separately there was a positive linear relationship between preference and complexity. They concluded that people desire landscapes which contain a moderate degree of complexity. Geisll, Zinkhan, and Watson (2006) tested Berlyne's theory in a study of users' attitudes towards home pages with respect to perceived visual complexity. The researchers found that users responded more favourably to websites with a medium level of perceived complexity than to those with a high or low level of perceived complexity and concluded that the findings of their study supported Berlyne's theory. Ochsner (2000) found a negative correlation between visual complexity and affective valence, and a positive correlation between visual complexity and arousal in photographs which were a part of the IAPS (International Affective Picture System).

However, in another study that also tested Berlyne's theory, Pandir and Knight (2006) emphasised the effects of individual differences in personal interests and tastes on preferences through an experiment using screenshots of 12 homepages. According to the researchers, a negative correlation between complexity and pleasure in website perception was found; therefore, they could not directly support Berlyne's theory. However, from an analysis of participants' verbal reports, they confirm Berlyne's definition of objective complexity which supports the idea that people have similar understandings of complexity. The study also indicated that individual differences in taste and lifestyle are highly personal factors that influence aesthetic preference. In a recent study, Tuch, Bargas-Avila, & Opwis, 2009, in a test that looked at both cognitive and emotional issues, found that websites with a low level of perceived complexity were preferred. Furthermore, Ben-Bassat, Meyer, and Tractinsky (2006) provided a demonstration of the context dependency of aesthetic perception. They found that participants did not rank beauty as the main predictor of aesthetic perception. This result was consistent with that of another study by van Schaik and Ling (2009). They investigated the effect of context in webpages on aesthetic perception and found that the perceived aesthetic value increased when the website provided context. These disparate findings arguably limit the use of previous research when attempting to predict the aesthetic preferences of children when visual complexity is a factor on learning websites, and suggest that more research in this area is needed.

2.2. Measuring the visual complexity of websites

There are many different aesthetic theories related to preference and beauty. Most of the literature agrees that aesthetics are the combination of objective and subjective elements (Ashford, 1969; Berlyne, 1971; Martindale et al., 1990). For instance, when people describe a painting, they can mention the colour, line, and shape of the painting, which can be perceived by anyone. These are the objective elements in aesthetics (Hanfling, 1992). On the other hand, the subjective elements are the preferences for the painting which are the physiological and psychological aspects of the viewing experience. Subjective elements depend on individual difference and will change over time. Tilghman (2004) suggests that to closely evaluate subjective elements we need to base our analysis on people's sensibility, education and taste. Despite the differences between objective and subjective elements of aesthetics, one should view them holistically. In this research, we try to evaluate children's preferences with regard to the subjective elements of aesthetics for a children's website, and we chose some websites which contain different levels of the objective elements (complexity), in an attempt to assess aesthetic preference. One way to assess the complexity of an image is to analyse the elements of that image and to manipulate the number of elements according to the level of complexity. Michailidou (2008b) developed a metric to count the different levels of visual complexity of a website. According to their research, visual complexity is the degree of difficulty in providing a verbal description of an image. Therefore, descriptions of the complexity of an image might include the number of objects, clutter, openness, symmetry, organization, and variety of colours. Based on this theory, they analyse the website's visual complexity in terms of the density and diversity of the elements on the page. The current experiment employed this same metric to divide the sampled children's learning websites into three levels of visual complexity (high, medium, and low).

2.3. Gender difference in aesthetic perception

The importance of aesthetics has been well documented in the field of psychology research (Cyr & Bonanni, 2005). However, only a few studies have focused on gender differences in aesthetic perception and web site design preferences (Cyr & Bonanni, 2005; Simon, 2001). An early piece of research conducted by Frumkin (1963) found that females had a greater appreciation of modern painting than their male counterparts. More recently, Cyr and Bonanni (2005) found that men and women had significantly different responses to the visual appeal of a website. Men had more impressed by how site organization and product information were...
presented while women were concerned with the meaningfulness of animation on the website. Thus, the findings indicated out that gender should be considered as one of the factors that influence people’s aesthetic perception and appreciation. Studies should look into participants’ gender to investigate the aesthetic perception of websites.

A few studies have examined the relationship between participants’ gender and their preferences in website design. For example, in a study which discussed the context of web design, Simon (2001) examined the information richness, communication effectiveness, and communication interface of a website. He found that women felt less satisfied with the visual appeal and perception of the websites than did men. Further, women indicated that they preferred sites that were less cluttered, with minimal use of graphics. Men, on the other hand, preferred extensive use of graphics and animation. In the area of visual design, Tuch et al. (2010) studied the symmetry, intuitive beauty, classical and expressive aesthetics of a website. Their results indicated that only men react unfavourably to asymmetrically designed websites; women are not influenced by the symmetry effect. COURSARIS, SWIERENGA, and Watrall (2008) explored gender and the effects of color temperature on perception of aesthetic preferences (such as classical and expressive aesthetics) in websites. From their findings, it appeared that there was no gender effect in the color temperature in related to website aesthetic preferences, but the study implied that there may be gender differences with regard to the warmer color temperatures in the website. There are a few studies which have explored hedonic and social aspects in relation to the user’s gender. For instance, Hsu (2012) employed Multidimensional Scaling (MDS) analysis to examine the relationship between gender differences and aesthetic preferences for blog interfaces. Men preferred more text in the blogs while women preferred more images. This is supported by Maltby, Chudry, and Wedande (2003), who indicated that men are more information oriented, while woman value emotional or visual expression. Other research found that gender differences existed in the area of website visual content (Moss, Gunn, & Heller, 2006) and linguistics (Williams, Burden, & Lanvers, 2002).

An online survey, conducted by Page, Robson, and Uncles (2012), discussed the social aspects of websites, and concluded that females with design experience have a higher self-belief and that their knowledge of the web’s value is stronger than that of males. Cyr, Hassanein, Head, and Ivanov (2007) found that the influence of social value encourages people to use technology and is stronger for women than for men. Moreover, men, more than women, use the Internet for personal interest, and women regard the Internet as a tool for work rather than as a toy for gaming when compared to their male counterparts (Li & Kirkup, 2007).

In summary, research into the aesthetic perception of websites indicates that gender differences exist in terms of visual appeal, context of web design and the social aspect of websites. However, it seems that there is no empirical research that investigates the effects of gender on aesthetic perception in relation to children. Further research is needed to explore the aesthetic preferences of children, so that web designers and instructional designers may be used in a children’s website.

3. Method

3.1. Participants

Ninety primary school children volunteered for this experiment (45 boys and 45 girls). They were all Taiwanese, with a mean age of 13.56 years (SD = .543), whereas the age ranged between 12 and 14 years. The experiment took place in Yuline county, Taiwan; it was conducted in 2012. All of the children could read Chinese and had basic level of computer experience. They had received computer lessons at least twice a week and reported that they often used computers for gaming and browsing the Internet at home. This indicated that the participants were familiar with computers. After each participant had completed the experiment, they were given a toy as a reward. Participants were randomly assigned to one of the three experimental conditions.

3.2. Experimental design

A 2 x 3 between-subjects experimental design was used. The first independent variable was visual complexity with three levels: low, medium and high. The second independent variable was gender. The dependent variable was aesthetic preference which included four factors: classical aesthetic, expressive aesthetic, pleasure, and attractiveness.

3.3. Materials

In order to define an appropriate set of stimuli and prevent any bias of choosing homepages, a three stage selection process was used. The first stage involved collecting a pool of 138 websites, which were taken from domains such as government, museums, galleries, libraries, and educational establishments. The organisations had all developed special versions of their website for children. The homepages of 138 children’s websites were captured. All screenshots were taken at the same size, 1024 x 768 pixels, and saved as .jpg files. In the next stage, the initial pools were reduced to 36 websites according to their visual complexity (high, medium and low), using Michaelidou (2008b) metric ranking system, which they developed to determine the level of visual complexity in a website. The metrics used to measure visual complexity were elements of page composition, namely: (1) menus, (2) images, (3) words, (4) links, and (5) Top Left Corner (TLC). Each of the stimuli used in the initial pool was analysed according to the metrics.

In the final stage, the remaining 36 websites were reduced to 12 by six judges, with a mean age of 13.50 years (SD = .837). The judges comprised three boys and three girls; none of them participated in the experiment. The judges individually rated all websites with the aid of a Likert scale on visual complexity. The statement was: ‘I think this is a high visual complexity homepage’ and the Likert scale ranged from 1 (very strongly disagree) to 7 (very strongly agree). All 36 website screenshots were arranged randomly for each judge on the computer. In order to assess the interrater agreement of the visual complexity, the inter class correlation (ICC) for each judge was calculated. The average ICC coefficient across all six judges was high (ICC = .82; SD = .20), suggesting a high agreement between all six judges. According to the means of those scores, 12 of the 36 websites were allocated to the three experimental conditions (high, medium and low visual complexity) so that each condition included four websites (see Table 1).

3.4. Procedure

The experiment was carried out in a computer lab with groups of fifteen children who were tested independently. The children were placed into groups randomly. The experiment was conducted in a total of six sessions. The children were told that they were going to be shown four websites each and would be asked a few questions about them. No restrictions were placed on how far away the children sat from their computer screens.

Each session commenced with a practice trial. The trial was performed to ensure that the children understood the computer program they were to use in the experiment. The children were...
Table 1
Different levels of visual complexity children's learning website used in this experiment.

| High level of visual complexity | HVC1 | http://www.mdnkids.com |
| Medium level of visual complexity | MVC1 | http://www.klcg.gov.tw/children/index.jsp |
| Low level of visual complexity | LVC1 | http://eln.tnc.gov.tw/ |

All the websites were accessed on 13 May 2013.

all shown one homepage from a website on their computer screens and asked to answer two multiple choice questions about it that were displayed below. Both questions were simple; for example, one read: ‘How many frogs are on the website?’ The questions were asked solely to ensure that each child looked carefully at the screen. To answer the questions, the children needed to click a checkbox next to the appropriate answer. Once the children felt that they had answered both questions correctly they were instructed to click a button labelled ‘Done’.

Once the practice trial had been successfully completed the experiment commenced. In the experiment, each time the ‘Done’ button was clicked a new website and a new set of questions were shown. In total each child saw four websites and answered four sets of questions. Each child saw websites of the same level of visual complexity (high, medium or low). The websites and their respective questions were shown in a random order for each child. Each of the 12 websites used in the experiment were looked at by fifteen boys and fifteen girls.

After everyone had seen their four websites, the questionnaire was handed out. All the children filled out the questionnaire at the same time and each question was explained by the experimenter. Finally the children were given a form to collect their demographic details.

3.5. Measurement tools

The survey instrument consisted of a two-part questionnaire. The first part collected subjective measures on participants’ perceptions of aesthetic preference. The second part collected information on the participants’ gender, age, level of education, reasons for using computers, and time spent on computers per week. The questionnaire employed Likert scales, ranging from 1 (very strongly disagree) to 7 (very strongly agree), to capture each child’s level of agreement with statements about the website’s aesthetics.

3.5.1. Developing questionnaires

The questionnaire was initially constructed in English and then translated into Chinese. Perceived aesthetics used in the questionnaire were adapted from Lavev and Tractinsky (2004), who conducted an experiment that looked at website aesthetics and to establish their reliability and validity. The attractiveness aspect was based on a study by Sutcliffe (2001) and Hartmann, Sutcliffe, and De Angelis (2007), who developed a heuristic evaluation based on Adaptive Decision Making theory for assessing website attractiveness. Thus, the questionnaire satisfied content validity. The scale consisted of the following four factors:

(1) Classical aesthetics: the questions on classical aesthetics were about four topics which can be summed up in the following words and phrases – well organised, clarity, cleanness and symmetry.

(2) Expressive aesthetics: the questions were about five topics – creativity, fascination, use of special effects, sophistication, and original design.

(3) Pleasure: the questions were about four topics – joy, gratification, relaxed and satisfaction.

(4) Attractiveness: the questions were about seven topics – use of colour, aesthetic style, structured layout, depth of field, unusual images, people and personality, and choice of media.

3.5.2. Instrument validity and reliability

In order to ensure the questionnaire accurately measured the psychological construct, techniques to examine the construct validity of the questionnaire were employed. Principal component Analysis with varimax rotation of the initial 20 items was used. As a rule of thumb, an item is significant if its loading coefficient is above 0.6 (Hair, Anderson, Tatham, & Black, 1995). In order to ensure construct validity, from the initial 20 items, three items were removed due to a low loading. They were: original design (.409), people and personality (.365), and choice of media (.279).

Construct reliability was assessed using Cronbach’s Ï€-value. After removal of three items, the reliability for classical aesthetics was 0.81, for expressive aesthetics 0.81, for pleasure 0.81 and for attractiveness 0.82. Nunnally (1978) recommends that the Cronbach’s Ï€-value of the scale should be greater than 0.7 for items to be used together as a construct. Therefore, all the constructs passed the test of construct reliability in the study.

4. Results

In order to analyse the results, the data were divided into overall aesthetic preferences and four aesthetic factors which were each examined in terms of rating. Analysis of variance (ANOVA) was employed to evaluate the effect of visual complexity in terms of differences in mean scores; and a post-hoc comparison was used to test for differences between the different levels of visual complexity. For all statistical tests an alpha level of .05 was used.

4.1. Overall aesthetic preference

Table 2 illustrates the mean and standard deviation for the ratings of aesthetic preference. The results showed that an interaction between children’s gender and the different levels of visual complexity had a significant effect on aesthetic preference, $F(2,84) = 5.651, p = .005, \eta^2 = .119$, and a significant main effect for the different levels of perceived visual complexity, $F(2,84) = 19.526, p = .000, \eta^2 = .317$, but no main effect for children’s gender, $F(1,84) = 2.816, p = .097, \eta^2 = .032$, see Table 3. The aesthetic preference ratings for the different levels of visual complexity were the medium level of perceived visual complexity, followed by the high level of perceived visual complexity, and last, the low level of perceived visual complexity. Further multiple comparisons using the Scheffé statistical test showed that the differences between high levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .000$); and those that had a medium level of visual complexity were significantly higher than those that had a low level of visual complexity ($p = .000$). However, no differences was found between...
the aesthetic preference ratings for the websites that had a high level of visual complexity and those that had a medium level of visual complexity ($p = .967$). It seems that boys preferred a high level of visual complexity, followed by a medium level of visual complexity; whereas girls preferred a medium level of visual complexity than high level of visual complexity (see Fig. 1).

### 4.2. Classical aesthetics

Analyses identified a main effect of different levels of visual complexity on children's perceived classical aesthetics, $F(2,84) = 3.382, p = .039, \eta^2 = .075$. Multiple comparisons with Scheffé showed that the differences between medium levels of perceived visual complexity were significantly higher than for those that had a low level of perceived visual complexity ($p = .044$). However, no difference was found between high level of perceived visual complexity and medium level of perceived visual complexity or between high level of perceived visual complexity and low level of perceived visual complexity. There was a significant main effect for gender, $F(1,84) = 4.989, p = .028, \eta^2 = .056$. It seems that classical aesthetic preference ratings made by boys were affected by the different levels of visual complexity, $F(2,42) = 3.698, p = .033, \eta^2 = .150$. In contrast, girls were not affected by the different levels of visual complexity, $F(2,42) = .734, p = .486, \eta^2 = .034$. Both genders showed a similar trend toward the different levels of visual complexity. However, girls evaluated the low level of visual complexity more positively than boys.

### 4.3. Expressive aesthetics

A main effect of different levels of visual complexity was also identified for expressive aesthetics, $F(2,84) = 9.498, p = .000, \eta^2 = .184$. Multiple comparisons with Scheffé showed that the differences between medium levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .003$). Moreover, the differences between high levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .001$). However, no difference was found between high level of visual complexity and medium level of visual complexity.

### 4.4. Pleasure

A main effect of different levels of visual complexity was also identified for pleasure, $F(2,84) = 7.264, p = .001, \eta^2 = .147$. Multiple comparisons with Scheffé showed that the differences between medium levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .003$). Moreover, the differences between high levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .012$). However, no difference was found between high level of visual complexity and medium level of visual complexity.

### 4.5. Attractiveness

The results also showed a main effect of different levels of visual complexity on children's perception of perceived attractiveness, $F(2,84) = 3.865, p = .025, \eta^2 = .084$. Multiple comparisons with Scheffé showed that the differences between high levels of visual complexity were significantly higher than for those that had a low level of visual complexity ($p = .040$). However, no difference was found between high level visual complexity and medium level visual complexity or between medium level visual complexity and low level visual complexity. There was a significant main effect for gender, $F(1,84) = 4.034, p = .048, \eta^2 = .046$. It seems that

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### Table 2

Descriptive statistics for aesthetic preference, children's gender and visual complexity ($n = 90$).

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>Boys (n = 45)</th>
<th>Girls (n = 45)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M SD</td>
<td>M SD</td>
</tr>
<tr>
<td>Overall aesthetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.77 .54</td>
<td>4.26 .55</td>
</tr>
<tr>
<td>Medium</td>
<td>4.67 .48</td>
<td>4.42 .29</td>
</tr>
<tr>
<td>Low</td>
<td>3.76 .49</td>
<td>4.03 .31</td>
</tr>
<tr>
<td>Classical aesthetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.30 1.15</td>
<td>4.38 .89</td>
</tr>
<tr>
<td>Medium</td>
<td>4.37 .87</td>
<td>4.68 .66</td>
</tr>
<tr>
<td>Low</td>
<td>3.65 .72</td>
<td>4.37 .85</td>
</tr>
<tr>
<td>Expressive aesthetic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.95 .84</td>
<td>4.13 .93</td>
</tr>
<tr>
<td>Medium</td>
<td>4.62 .77</td>
<td>4.30 .80</td>
</tr>
<tr>
<td>Low</td>
<td>3.63 .90</td>
<td>3.75 .74</td>
</tr>
<tr>
<td>Pleasure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.98 .81</td>
<td>4.28 1.12</td>
</tr>
<tr>
<td>Medium</td>
<td>4.97 .70</td>
<td>4.52 .75</td>
</tr>
<tr>
<td>Low</td>
<td>3.90 1.12</td>
<td>3.97 .74</td>
</tr>
<tr>
<td>Attractiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.84 .98</td>
<td>4.24 1.08</td>
</tr>
<tr>
<td>Medium</td>
<td>4.72 .72</td>
<td>4.19 .72</td>
</tr>
<tr>
<td>Low</td>
<td>3.95 .75</td>
<td>4.03 .63</td>
</tr>
</tbody>
</table>

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### Table 3

Results of ANOVA on aesthetic preference.

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>Mean square</th>
<th>F value</th>
<th>p Value</th>
<th>$\eta^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>1</td>
<td>.586</td>
<td>2.816</td>
<td>.097</td>
<td>.032</td>
</tr>
<tr>
<td>Visual complexity</td>
<td>2</td>
<td>4.063</td>
<td>19.526</td>
<td>.000</td>
<td>.317</td>
</tr>
<tr>
<td>Two-way interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender x visual complexity</td>
<td>2</td>
<td>1.176</td>
<td>5.651</td>
<td>.005</td>
<td>.119</td>
</tr>
<tr>
<td>Errors</td>
<td>84</td>
<td>.208</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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attraction preference ratings made by boys were affected by the different levels of visual complexity, \( F(2,42) = 5.193, p = .010, \eta^2 = .198 \). In contrast, girls were not affected by the different levels of visual complexity, \( F(2,42) = .266, p = .768, \eta^2 = .012 \). Both genders had similar attractiveness preferences toward the high and medium levels of visual complexity. However, girls evaluated the low level of visual complexity more positively than boys.

4.6. Correlation between gender and aesthetic factors

In order to determine the correlation between aesthetic factors, Pearson's correlation analysis was employed. The results showed a positive correlation between aesthetic preference factors, \( r = .448, p = .000 \). There was also a significant correlation between expressive aesthetics and pleasure factors, \( r = .240, p = .022 \).

5. Discussion

The experiment examined the relationship between visual complexity, aesthetic preferences and children's gender in children's websites. It tested Berlyne's theory on aesthetic preference which claims that people prefer medium stimuli to high or low level stimuli. It showed that visual complexity had an impact on aesthetic preferences, children preferred medium levels of visual complexity. This was in line with Berlyne's theory. More precisely, children preferred a medium level of visual complexity with respect to expressive aesthetics, classical aesthetics and pleasure, but a high level of visual complexity with respect to attractiveness. The results demonstrated there were differences between boys and girls regarding their classical aesthetics and attractiveness preference towards children's websites; in general, boys preferred a high level of visual complexity while girls preferred a medium level of visual complexity in children's websites.

5.1. Gender effect in children's websites

Boys generally provided higher aesthetic preference ratings than girls with respect to children's websites. This finding reflects that of Tuch et al. (2010) who, in an experiment that explored the aesthetic preferences of undergraduate students with respect to symmetrically and asymmetrically designed websites, also found that males provided higher aesthetic preference ratings than females with respect to websites.

The finding reflected Berlyne's theory on aesthetic preference only for girls. Girls preferred medium levels of visual complexity to high or low level stimuli in almost every aesthetic preference rating (expressive aesthetics, classical aesthetics and pleasure). Boys preferred the websites with a high level of visual complexity.

5.2. Factors of aesthetic preference

Boys and girls were not affected in the same way by aesthetics preference. The findings revealed that overall girls provided higher preference ratings than boys for classical aesthetics with respect to low visual complexity. Girls rated low levels of visual complexity as high as boys rated medium levels of visual complexity. One possible explanation of why that girls had more favourable impressions of classical aesthetics than boys is that girls preferred websites with better organised and clear information design. According to Lavie and Tractinsky (2004), the classical factors of aesthetic perception refer to a traditional notion of aesthetics, including attributes like pleasure, clear, clean and symmetric design. Thus, for the girls, the website with low visual complexity was more favourable in terms of classical aesthetics. This is in line with research from the field of HCI which supports the “less is more” statement which refers to the fact that people prefer less visually complex websites to more complex websites (Michailidou et al., 2008a; Tuch et al., 2009). Another similar result was obtained by Cyr and Bonanni (2005), who conducted an interview on an e-business website. In their interview, one of the female participants said: “Make it (the website) less busy in its design... It needs less flashy gimmicks and should be a bit more simple.” An early piece of research conducted by Simon (2001) also concluded that females prefer simply designed websites with less clutter and minimal use of graphics. In present experiment, a similar result was found, that girls were more attracted by visually simple than by complex websites.

On the other hand, boys preferred websites with medium visual complexity with respect to classical aesthetics. This finding can be compared to that of Hsu (2012) who investigated the gender effect on blog interfaces with respect to visual aesthetic preferences. He found that males preferred blog interfaces with more text than images while females’ preference was reversed. A study of websites by Cyr and Bonanni (2005) reflected his findings. They found that some specific information design elements, for example product information, were perceived more favourably by men than by women. Moreover, the testing website samples used in this experiment employed Michailidou’s (2008b) metrics of visual complexity. Amongst her metrics, the proportion of text was one of the measurements for counting visual complexity and as the proportion of text increased in the website the visual complexity rose. Therefore, it was reasonable to conclude that boys preferred high or medium visual complexity to low visual complexity with respect to children’s websites.

From the perspective of expressive aesthetic and attractiveness, children preferred high levels of visual complexity in terms of both of these factors. The results also showed that expressive aesthetics are closely related to pleasure factors. According to a study by Lavie and Tractinsky (2004), expressive aesthetics involve feelings of creativity, fascinating design, and sophistication and the use of special effects. Thus, children rating the website with high levels of visual complexity were aware of more creativity, fascination, sophistication and pleasure when viewing these websites than when viewing those with other levels of visual complexity. This result was in line with Chang, Lin, and Lee (2005), who concluded that children preferred images used in learning English vocabulary to employ with entirely dynamic effects and high levels of visual complexity. A similar study by Tuch et al., (2009) also concluded that there was a correlation between visual complexity and aesthetic preferences, and that appropriate levels of visual complexity in a website could enhance the aesthetic preferences.

Present experiment also showed that attractiveness was influenced by children’s gender. Children preferred a high level of perceived complexity; they considered that websites with more images and information were more attractive than those with fewer images and less information. Moreover, girls provided higher preference ratings than boys for attractiveness with respect to low visual complexity. This again proved that girls preferred simpler websites to boys.

6. Conclusion

This experiment clearly identified that different levels of visual complexity significantly impact the relationship between aesthetic preferences and children's gender. The data plainly showed that children considered that the children's websites with medium levels of visual complexity were more aesthetically appealing. The results also demonstrated there were differences between boys and girls regarding their aesthetic preference towards children's web-
sites. These findings should be taken into consideration by practical educators, instructional designers and web designers to create better websites for children, especially when they aim to design for different genders. For example, there are three times more girls had ADHD (Attention deficit-hyperactivity disorder) than boys in Taiwan (Chang, Chen, Li, Chen, & Shih, 2010), so that for designers to create website for ADHD children should consider the gender difference to attract the target users.

It remains unclear to what extent the visual complexity effect in learning websites can be generalised among other user groups (for example, age groups or grade levels, different cultures, and social backgrounds). Further studies with larger and more varied samples are needed. Moreover, it should be noted that participants’ generalisation of website samples can be prejudiced by their preference rather than by visual complexity. In order to avoid such bias, the metrics devised by Michailidou (2008b) were employed. Therefore, the final 12 website samples used in this experiment may not be the ones selected by researchers conducting a similar experiment.

Finally, the current findings are limited to children’s websites. Further studies may benefit if the methodology employed in this study were used to investigate other kinds of user interface.

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