A fundamental question in e-commerce is to understand how consumers process online information, how they allocate their attention, and whether there exist any cultural differences. This research makes a first step in this direction. We examined eye movement data collected while consumers chose businesses from the yellow pages of a Chinese telephone directory on a computer screen. All subjects were from China and read and spoke Mandarin. The findings are based on 15,820 eye fixations, 3,510 unique ad viewings, and 512 choices from 64 participants. Participants noticed 90% of the quarter-page display ads but only 6% of the plain listings. They noticed more colour ads than non-colour ads and viewed quarter-page colour ads 11% longer than equivalent ads without colour. Attention is an important component of subsequent choice behaviour. Consumers spent twice as much time viewing ads for businesses they ended up choosing. Using logistic regression, ad size had the largest influence on choice, followed by graphics and then colour. The results are consistent with previous findings for yellow pages in the United States demonstrating few if any cultural differences in attention to ads.

** MOTIVATION **

A fundamental question in e-commerce is to understand how consumers process online information, how they allocate their attention, and whether there exist any cultural differences (Geertz 1973; Hofstede 1994; Kerne 1998). In 1997, Lohse published an analysis of eye movement patterns in telephone directory yellow pages from the United States. For multinational publishers, it is important to understand the degree to which these findings generalize to other countries. This research replicates the study by Lohse (1997) using yellow pages from Shanghai, China.

Visual attention is a basic psychological information process for humans. With normal visual processing, eye movements reflect innate information processing characteristics of humans in general. As such eye movements should not vary as a function of culture differences (Geertz 1973; Hofstede 1994; Kerne 1998). Anecdotal evidence abounds about what advertisement characteristics – colour, copy content, size, and so forth – influence consumer attention. One way of discovering how people acquire information from a telephone directory is by recording their eye movements as they scan the yellow pages. Eye movement data provide a detailed reflection of cognitive information processing in many different contexts.
kinds of displays (Ford et al. 1989; Hill 1989). Lohse (1997) collected eye movement data while consumers chose businesses from telephone directories from the USA, this study examined yellow pages from Shanghai, China. Samice and Jeong (1994) note that single-culture studies are of limited use to academicians interested in cross-cultural international advertising contexts. However, they also claim that there is an acute need for research that explores similarities in successful global advertising campaigns, particularly those that use unique research methodologies. We selected Shanghai yellow pages because (1) the use of telephone directories is growing in China – a reflection in the growth and change of the Chinese economy, (2) Mandarin is a character-based language different from languages in western cultures and (3) to our knowledge, there are no previously published studies using eye tracking data for advertising research in China. Thus, we believe that the use of eye tracking coupled with a comparison of previous results make an interesting contribution from a methodological, cultural and practical perspective. Specifically, the study addresses exactly the same three questions as Lohse (1997) in order to compare: (1) what particular features cause people to notice an ad, (2) whether people view ads in any particular order, and (3) how viewing time varies as a function of particular ad features. This research provides some practical insights for online yellow pages advertisers and publishers in China.

CONCEPTUAL FRAMEWORK

Models of perception and cognition from cognitive science provide insight about the underlying human information processing mechanisms (Lachman et al. 1979). Visual primitives such as texture (Julesz 1975) and colour (Kahneman and Henik 1981) are detected and organized in parallel during pre-attentive visual processing. Large differences in physical variation of a feature are more noticeable than subtle differences. Also, the greater the contrast between a feature and the background, the more readily we observe the feature. These underlying principles from psychology and prior research findings provide a basis for developing the following propositions.

Attention to Ads: Do People Notice Some Ads More than Others?

People perceive some visual features more readily than others (Kahneman and Henik 1981). Because colour facilitates parallel search, objects coded in colour are three times faster to locate on a page than if the objects were coded with other graphic features, such as shape, which require serial search (Treisman 1982). Because colour is an inherent part of human information processing, we expect that colour will have a similar impact on Chinese yellow page ads.

Hypothesis 1a. Yellow pages users are more likely to notice colour ads before ads without colour.

Detection is also fundamental to human visual information processing (Lachman et al. 1979). The larger the ad, the more likely people were to notice it (Berdie and Hauff 1986; Feldman and Halterman 1963; Rouse 1991; Valiente 1973; YPPA 1998). We expect this finding to extend to subjects viewing Chinese yellow pages.

Hypothesis 1b. Yellow pages users are likely to notice large ads before small ads.

Advertisers have long known that photos or artwork with greater contrast between product and background produced better results (Hill 1989). This reflects a fundamental understanding of human visual information processing. The greater the contrast between a feature and the background, the more readily we detect and perceive an object (Lachman et al. 1979). Further, gaining attention to products has an important impact on subsequent sales. After all, customers cannot buy products they don’t see. Lohse (1997) found no significant differences between ads with and without graphics; however, subjects noticed 96% of the ads with graphics. The lack of a difference between ads with and without graphics was considered a ceiling effect. On the other hand, the Chinese language is extremely graphic as it belongs to the category of the so-called Xiang Xing or graph oriented language. Thus, we expect graphics to have a strong effect in Chinese yellow pages.

Hypothesis 1c. Yellow pages users are likely to notice ads with graphics before ads without graphics.

Viewing Sequence and Patterns of Eye Movements

The reader’s eye can move in almost any pattern over a page, but some patterns are more natural than others. Modern reading in Chinese begins in the upper left corner of text and proceeds from left to right, from top to bottom, and from the front of the book to the back of the book. In contrast, traditional Chinese reading begins in the upper right corner of text and proceeds from right to left, from top to bottom, and from the back of the book to the front of the book. Understanding prototypical patterns for acquiring information helps identify factors that could influence decision processes.

The prototypical information acquisition patterns have important implications for subsequent choice behaviour. Many vendors of infrequently purchased services name their firms to have top placement in the Yellow Pages (For example, AAA Aardvark Towing). Being listed first in a heading resulted in more business. We note also that firms procure top placement in the results of search engine queries through large up-front payments. Indeed this is the premise underlying the business model for GoTo.com [www.GoTo.com, accessed on 12/11/2000].
In the United States, businesses in the yellow pages are listed in alphabetic order under each business heading. Jackson and Parasuraman (1986) reported that more than 50% of the participants in their study examined alphabetic listings before viewing large display ads. Lohse (1997) notes that serial position of an ad on the page influences choice even though order says nothing informative about the business. Order matters because people scan listings in alphabetic order and their scan is not exhaustive; as a result, people do not notice all of the ads. Businesses near the end of the listing have less chance of being chosen because the search terminates prior to scanning the complete listing.

The strong learned spatial patterns for processing information (e.g., alphabetic and reading order) suggest that people will first view business names that are in the leading serial positions. However, Chinese telephone directories lack a comprehensive index. Finding the listing for a particular organization may entail wading through different headings and subheadings if it is not immediately obvious how the organization is likely to be categorized. Further, corporate rank – from president to managers – often dictates the order of the entry of listings in Chinese yellow pages. However, while listings of companies are not strictly alphabetical, the reading of entries in a heading begins in the upper left corner of text and proceeds from left to right and from top to bottom. They are essentially two ways to index the Chinese telephone directory, one way is to order according to the complexity of Chinese characters, and the other is to use Ping Yin method. The first method involves counting how many essential graphical elements are needed to construct a Chinese character, which requires a significant amount of mental and cognitive effort. The second method is to use a western alphabetic system to record the pronunciation of the Chinese character, then use the corresponding alphabetic to index. However, these two methods are rarely used in the current Chinese telephone directory. The dominant indexing method currently being used seems to be government, political parties or corporate rank.

Hypothesis 2. Yellow pages users are more likely to view advertisements near the beginning of the heading than those near the end of the heading.

Method Viewing Time: Do People View Some Ads Longer than Others?

Once an ad captures attention, the information content of the ad must convince the consumer that the product should be purchased. Once an ad captures attention to a product, the designer must aid the consumer in their processing of the information in the ad needed to make the purchasing decision. The copy content of the ad is important in subsequent choice behaviour. Berdiec (1992) reports that the amount of information in an ad is extremely influential in consumer choice behaviour. Feldman and Halterman (1963) claim advertisements with more copy outperform ads with less copy. Time spent viewing ads not only indicates attention, but also suggests consumer preferences. Viewing time per ad integrates many factors that cause a consumer to focus on a certain advertisement. Some viewing time differences relate to comparisons of attributes between businesses. In the study by Lohse (1997), information content of the ad had a large effect on attention and choice. Ads with high information content were viewed before ads with low information content; however, too much information in an ad decreased viewing time. Thus, time spent viewing ads demonstrates the importance of attention on subsequent choice behaviour. Again, we expect the viewing time findings to extend to Chinese yellow pages.

Hypothesis 3. Yellow pages users are likely to spend more time viewing advertisements of businesses they end up choosing than those of businesses they do not choose.

Methods

Yellow Pages Directories

Eight directory pages were created by Bell Atlantic in Shanghai. The pages are virtually indistinguishable from real yellow pages in terms of fonts, ink and colour. Each page represented a typical assortment of advertisements under one business heading: two quarter-page and two one-sixteenth-page display ads, large and small in-column ads, and plain listings. The headings are a mix of business-to-consumer and business-to-business categories. The eight headings are advertising, automobiles, plastics, transportation, hotels, restaurants, business clothing (uniforms), and travel. Each of the businesses under each heading has a real address and telephone number corresponding to an actual geographic location in Shanghai.

Data

To be able to compare directly with the Lohse (1997) results, exactly the same equipment and experimental procedure were used, with the exception that the content was replaced with Chinese and the participants were Chinese rather than Americans.

A diverse group of 64 people associated with two eastern universities volunteered for this research. Eighty percent were students from Chinese Student Organizations working on graduate degrees in a range of subjects. The other participants were from the local Chinese community. All subjects were native to China and read and spoke Mandarin. Mean age was 32.5 with a range from 21 to 60. All subjects were screened to ensure that they had used yellow pages previously. Participants received a payment of US$20 for taking part in the study.
The experiment was conducted separately for each subject in one 60-minute session. First, subjects practised using the eye tracking equipment. Once calibrated, participants read instructions for the yellow pages choice study. They were instructed to imagine that they had just moved to Shanghai and needed to use the yellow pages directory to locate products or services. Participants were given a goal for each selection (e.g., ‘You have just been relocated to Shanghai and you want to purchase a car for business use’ or ‘You want to take your clients to a restaurant for dinner’) and chose the one business under each heading that they would be most likely to patronize. The experimenter recorded the participants’ choice. After each choice, the experimenter mounted another page into the special holder on the face of the computer screen. The procedure continued until each subject had made a total of eight choices – one for each of eight headings. After completing the task for all business headings, subjects completed a short questionnaire.

RESULTS

Figure 1 is an example of the eye fixation data. Each circle represents a fixation. The area of the circle codes fixation duration. The larger the circle, the longer the subject looked at that area. Lines connecting fixations show the subject’s scan path. A large square represents the first fixation. Figure 1 is a serial scan by a subject of the practically ordered listings according to the complexity of the first Chinese character under the Hotels heading. She started with her eye fixation on a display ad of Shanghai Garden Hotel, which is one of the most well-known luxury hotels in Shanghai. In the upper right corner column listing, she viewed the listings in a top down, left right order. She first viewed the bold listing for Qi Chong Tian (Seven Layer Heaven) Hotel, then moved down the listing and moved to the right column. The large in-column display list at the right lower corner of the listing for Sang Da Hotel (a less popular hotel in Shanghai) was completely ignored. It should be noted here that it is very difficult for the consumer to use the index to search in the list because although the first Chinese character was ordered according to the complexity, they are not lexicographically ordered. For example, the first characters (Qi and Ba) of the first bolding listing and the second listing both have the complexity, Liang Hua (two counts), the second character (Chong) of the first listing – Jiu Hua (nine counts) – is significantly more complicated than the second character (Yi) of the second listing – Yi Hua (one count). Collectively, the statistical analyses examined the effects of advertisement features on attention to ads, search patterns, and viewing time. Table 1 describes the variables used in the eye fixation data analysis.

We analysed the data to address the research questions stated above. This involved mapping the x, y pixel locations of the eye movement data to a specific ad on the Shanghai yellow pages. The software provides information about time spent viewing an ad, the sequence of information acquisition, as well as whether the ads were noticed. In addition to analyses of attention, the choice data were analysed using a multinomial logistic regression model.

Attention to Ads

Figure 2 shows the percentage of ads noticed for each ad category. Noticed ads had at least one eye fixation. Subjects noticed 83% of the display ads but only 6% of the plain listings. This effect is a function of size. The larger the ad, the more likely people were to notice it. Subjects noticed more than 90% of the quarter-page display ads, 76% of the 1/16th page display ads, and 36% of the large in-column ads but only 6% of the plain listings.

A multivariate ANOVA model examined what particular features cause people to notice in-column and display ads. There were 270 unique in-column ads and display ads in the 8 headings. The ANOVA analysed the percentage of the subjects noticing each ad. The main effect for colour was significant (F(1,265) = 12.65; p = .0005). A statistical comparison of least squares means shows that people noticed colour ads more than ads without colour (44% vs. 35%). Hence, colour ads lower the visual search cost by making target information more noticeable. No significant differences were found between ads with and without graphics. However, subjects noticed 84% of the ads with graphics. As the lack of a difference between ads with and without graphics might be a ceiling effect, it is difficult to determine whether a display ad with graphics would be noticed more than an equivalent display ad without graphics.

Table 1. Variables Included in the Data Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>subject</td>
<td>1 to 64</td>
</tr>
<tr>
<td>heading</td>
<td>Text version of business category name advertising, automobiles, plastics, transportation, hotels, restaurants, business clothing (uniforms), and travel</td>
</tr>
<tr>
<td>Ad_type</td>
<td>Ad categories (display ads, in-column ads, plain listings)</td>
</tr>
<tr>
<td>sbus</td>
<td>Serial position of ad on the page (1–48)</td>
</tr>
<tr>
<td>asize</td>
<td>Ad size in square centimetres</td>
</tr>
<tr>
<td>colour</td>
<td>0 = black, 1 = at least some colour</td>
</tr>
<tr>
<td>graphic</td>
<td>0 = no graphic, 1 = graphic</td>
</tr>
<tr>
<td>chosen</td>
<td>0 if ad was not chosen; 1 if ad chosen</td>
</tr>
<tr>
<td>noticed</td>
<td>0 = no recorded fixation on ad; 1 = at least one fixation on ad</td>
</tr>
<tr>
<td>fix_num</td>
<td>Ordinal number of each fixation on a page (1 = first to N = last)</td>
</tr>
<tr>
<td>sumtime</td>
<td>Fixation duration in milliseconds</td>
</tr>
</tbody>
</table>
Prototypical Patterns of Eye Movements

Another set of analyses examined whether people view ads in any particular order. Search pattern is indicated by the fixation number sequence. Fixations were numbered serially from 1 to \( n \). The average value of the fixation number indicates the relative order in which people viewed an ad. Serial position of each business corresponds to the alphabetic order of each listing on a page. The data collection program numbers each fixation on a page in consecutive order. Average fixation number on a business indicates search order.
Figure 2. Percentage of Ads Noticed by Ad Category

Table 2. Viewing Time per Ad

<table>
<thead>
<tr>
<th>Ad Type</th>
<th>Ads per Page</th>
<th>Percent Noticed</th>
<th>Ads Viewed per Page</th>
<th>Seconds per Ad</th>
<th>Seconds per Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarter</td>
<td>2.0</td>
<td>90</td>
<td>1.8</td>
<td>5.7</td>
<td>10.2</td>
</tr>
<tr>
<td>Eighth</td>
<td>1.0</td>
<td>85</td>
<td>0.9</td>
<td>4.5</td>
<td>3.8</td>
</tr>
<tr>
<td>Sixteenth</td>
<td>2.0</td>
<td>76</td>
<td>1.5</td>
<td>2.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Lg Column</td>
<td>3.0</td>
<td>36</td>
<td>1.1</td>
<td>2.3</td>
<td>2.6</td>
</tr>
<tr>
<td>Sm Column</td>
<td>10.0</td>
<td>16</td>
<td>1.6</td>
<td>1.4</td>
<td>2.3</td>
</tr>
<tr>
<td>Listing</td>
<td>3.3</td>
<td>6</td>
<td>0.2</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Average</td>
<td>21.0</td>
<td>33</td>
<td>7.1</td>
<td>3.3</td>
<td>23.4</td>
</tr>
</tbody>
</table>

Subjects scanned the directory listings and in-column ads in a top-down, left to right manner. A simple linear regression of the serial position of the listings and in-column ads and average fixation number was significant ($F_{(1,1374)} = 4.50; p = .0341$), although the regression only explains 3% of the variation in average fixation number. A separate analysis examined search order effects for display ads. The ANOVA for search patterns is based on the average fixation number from 12,815 fixations for the display ads actually viewed under each of the eight headings by the 64 subjects ($n = 2,134$). The fixations not on display ads were on the listings, in-column ads, filler, headings, index, and margins or were off the page. Subjects viewed ads with graphics before ads without graphics ($F_{(1,2128)} = 9.21, p < .0024$). They viewed large display ads before small display ads ($F_{(1,2128)} = 16.60, p < .0001$). Ads with colour did not affect viewing order ($F_{(1,2128)} = .43, p > .5120$). Figure 3 shows that display ads were viewed first 89% of the time. Specifically, subjects viewed quarter-page display ads first more often than for eighth-page or sixteenth-page display ads (39% for ad 1 and 27% for ad 2 versus 15% for ad 3, 4% for ads 4 and 5).

Table 3. Percentage of Subjects Ending up Choosing the Ad they Viewed First

<table>
<thead>
<tr>
<th>Heading</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising</td>
<td>29</td>
</tr>
<tr>
<td>Plastics</td>
<td>21</td>
</tr>
<tr>
<td>Hotels</td>
<td>21</td>
</tr>
<tr>
<td>Restaurants</td>
<td>26</td>
</tr>
<tr>
<td>Clothing</td>
<td>26</td>
</tr>
<tr>
<td>Transportation</td>
<td>29</td>
</tr>
<tr>
<td>Travel</td>
<td>35</td>
</tr>
<tr>
<td>Automobile</td>
<td>27</td>
</tr>
<tr>
<td>Average</td>
<td>26</td>
</tr>
</tbody>
</table>

Viewing order also has a significant effect on choice. A large percentage of the ads viewed first were subsequently businesses that subjects chose to patronize (Table 3). In the logistic regression analysis, order of the ads in the heading had a significant effect on choice (Table 4). Businesses near
the end of the list had a smaller chance of being selected. The position of an ad on the page had a large effect on whether people view a business, even though the position says nothing informative about the business. Position matters because people do not scan all the ads.

Ad Viewing Time

Viewing time measured the total time (in milliseconds) a subject viewed an ad. In all the eight headings combined, there were 170 unique ads. With 64 subjects, there was a potential of 10,880 observations (64 subjects \( \times \) 170 ads). Since subjects only viewed about 33% of the ads, the ANOVA examined how total viewing time varied as a function of particular features on the 3,510 ads actually viewed. Chosen ads represent the one business in each heading participants were most likely to call. On average, subjects spent about 30 seconds per heading to make their choice. Viewing time for individual headings ranged from 14 to 144 seconds.

Business choice had the largest effect. Subjects spent twice as much time viewing ads for businesses they ended up choosing (\( F_{(1,3475)} = 778.34, p < .0001 \)). A significant interaction effect between ad category and whether an ad was chosen explains the viewing time effect (\( F_{(1,3475)} = 10.28, p < .0014 \)). Subjects spent more time viewing display ads and in-column ads for businesses they chose to patronize. The information content of the ads explains this interaction effect. Display ads and in-column ads had more types of information than listings. Subjects’ decision to patronize businesses with listings was based only on the name and address. Hence, the additional viewing time can be attributed to the evaluation of the additional information in the display and in-column ads. The fact that consumers spent twice as much time viewing ads for businesses they ended up choosing demonstrates the importance of attention for subsequent choice behaviour.

Ad size had the next largest effect on viewing time (\( F_{(1,3475)} = 278.22, p < .0001 \)). On a per-ad basis, subjects spent more time viewing large ads. Figure 4 shows seconds of viewing time per ad. Larger ads commanded a longer viewing time. Subjects viewed quarter-page ads for 5.7 seconds but only spent 1.2 seconds on average viewing a listing.

The heading of the business significantly influenced the amount of viewing time per ad (Figure 5). Subjects spent more time viewing ads for plastics (\( F_{(1,3475)} = 13.2, p < .0001 \)) and transportation (\( F_{(1,3475)} = 21.4, p < .0001 \)) and less time viewing ads for restaurants (\( F_{(1,3475)} = 8.9, p < .0013 \)) and clothing (\( F_{(1,3475)} = 10.4, p < .0028 \)). It seems reasonable to assume that subjects would spend more time viewing ads for businesses that were less familiar to them. Also, subjects may spend more time viewing ads for businesses whose products or services have a higher value (e.g., plastic products vs. restaurants).

A significant main effect was found for ads with graphics (\( F_{(1,3475)} = 20.81, p < .0001 \)). Subjects spent twice as much time viewing ads with graphics. For Hotels, there was a significant interact effect between heading and graphics. People spent three times as much time viewing ads with graphics (\( F_{(1,3475)} = 6.66, p < .0099 \)) that was significantly above the twofold average viewing time increase for ads with graphics. No other business category had a significant amount of additional viewing time beyond the twofold average increase for ads with graphics suggesting that the ads with graphics for Hotels were particularly effective.

For viewing time, the effectiveness of colour varied by heading and size of ad. Colour resulted in additional viewing time for quarter-page ads. People spent 11% more time viewing a quarter-page colour ad than the equivalent ad without colour (6.1 versus 5.5 seconds). In the Travel heading, there was a significant interact effect between heading and colour. People spent half as much time viewing colour ads as compared to other headings (\( F_{(1,3475)} = 6.91, p < .0086 \)). No other business category had a significant difference in viewing time for colour ads suggesting that the use of colour in the Travel heading was not very effective.
Choice Model

We analysed the data using a logistic regression model. The logistic regression model has the form: \( \logit(p) = \log\left(\frac{p}{1-p}\right) = \alpha + \beta'x \), where \( \alpha \) is the intercept parameter and \( \beta \) is a vector of slope parameters. Each \( \beta \) coefficient measures the importance of the contribution of each explanatory variable. If a coefficient, \( \beta_i \), is statistically different from 0, the explanatory variable has a reliable impact on choice. The associated significance levels show the probability of obtaining a model coefficient that large by chance. When the probability is less than 0.05, the model coefficient is significantly different from zero. The coefficient shows the total change in choice probability per unit change of the explanatory variable.

Table 4 summarizes the logistic regression analysis. Large ads have the greatest influence on choice. The larger the ad, the more likely consumers will choose to patronize that business. Graphics also had a statistically significant influence on choice. Ads with graphics were more likely to be chosen. Colour had a statistically significant influence on choice. Colour ads were more likely to be chosen than ads without colour. For listings and in-column ads, serial position had a significant influence on choice. Businesses near the end of a listing had less chance of being chosen because the search terminated before the complete listing.
of businesses was scanned. Ads viewed first were more likely to be chosen.

SUMMARY AND DISCUSSION

Briefly, we review the support for our hypotheses and compare the results to those from a similar study for American subjects. Only Hypothesis 1c was not confirmed. There were no significant differences for noticing ads with graphics before ads without graphics. Surprisingly, colour did not have a significant effect on the order ads subjects viewed ads, although this finding could be an artefact of the number of colour ads (saturation) on a page. In a typical heading, 60% of the ads contained colour. Also, in a simple regression model, order (serial position in a heading) explains a much smaller percentage of the variation than in the previous study by Lohse (3% versus 49%). While alphabetic order is a well-learned information-processing pattern in the United States, it is less significant in China. Again, this might be due to the fact that the dominant indexing method currently being used seems to be government, political parties or corporate rank or due to the significant computing and mental effort required to process the order of Chinese characters even if the telephone directory is indexed. Total viewing time per page is about half that reported in the study by Lohse. The average number of ads per heading is less than half that used in a previous study by Lohse (21 versus 48). Differences reflect the typically small 6 or 7-point fonts used in business listings versus the size of characters in the Chinese language. Characters in the Chinese language are not comparable directly to English words. Viewing time comparisons between ads from China and those from the United States were similar. Average viewing times for quarter-page display ads were 5.7 China versus 6.4 USA seconds. Average viewing times for sixteenth-page display ads were 4.5 China versus 4.4 USA seconds. Listings from both directories had an average viewing time of 1.2 seconds. For the same object, the number of Chinese characters to describe the English word is less, or vice versa.

This research validates previous findings about size of ad, colour and graphics (Hornik 1980; Rossiter 1981, 1988; Schindler 1986; Valiente 1973). To our knowledge, this is the first eye tracking study in China for marketing research. Our eye tracking research noted many similarities between how people view ads from yellow pages in the USA and China. The major reason for the similarities is human visual perception. The psychology literature suggests that basic visual attention to colour, ad size and graphics is universal. In contrast, studies on cross-cultural analysis of print advertising focus find many differences between countries (Whitelock and Chung 1989). Cutler and Javalgi (1992) noted that there are more country differences than similarities and suggested that standardization of print advertisements will not be simple. Such studies are at a much higher level of analysis comparing use of people in ad, gender of people in ad, type of copy appeal, etc. The lower-level eye tracking analysis provides a basis for us to understand how the consumers process online information, how they allocate their attention, and whether there exist any cultural differences – these are rather essential in e-commerce.

Our research has implications for studying information-processing patterns of Chinese on the adoption or diffusion of e-commerce in China. Several decades ago, it was once debated whether China should adopt a completely new alphabetical system (this triggered the development and mandate adoption of the Ping Yin system in elementary schools across the nation) as an alternative to Chinese characters (as happened in Japan). This was based on the belief that Chinese characters are not efficient for modern information processing, for example, it might take more time and effort to input Chinese into the computer, compared with the western alphabetic system. However, consistent with findings in our experiment, recent developments in Chinese information processing technology (e.g., encoding, machine reading for print Chinese, and Chinese handwriting recognition) proved that this belief was not true. For example, a well-trained user can input Chinese documents into computers as efficiently as the same Ping Yin or English translated document.

China, as a developing country, is still in the infancy stage of e-commerce, with the current focus on the development of a national information infrastructure. Liu (1997) outlines three major challenges: investment, technology and IT workforce. Due to the lack of infrastructure, there is only a tiny portion of people who can access the Internet or even check email, generating too small a sample for empirical research. For example, the first online bookstore, opened in Zhejiang province in affluent Eastern China, tried to develop China’s version of Amazon.com and went out of business quickly due to lack of customers. The dot com bookseller was only able to sell one book within the first month of operation. However, as information infrastructure and e-commerce grow and develop in China, deep understanding of the relationship between information processing patterns of Chinese and the adoption/or diffusion of e-commerce in China will be a very interesting future research project.

Many e-commerce business models depend on online advertising. Designers of online advertisements face a myriad of decisions about how best to organize and present product information often without knowing how their design influences subsequent consumer behaviour. Given the low conversion rates for Web ads, effectiveness of the ad is essential in helping Internet companies achieve their objectives for becoming profitable. This research extends our understanding of how consumers process information from Yellow Pages advertisements in English to those in Chinese. Understanding the similarities and differences not only will help the development of yellow pages directories in China but also provide insights into the design of online Chinese advertisements for the Internet.
example, Beijing-based Internet consultancy BDA China forecasts $25 million of ad revenues in China in 2000 (see, e.g., Rates 2000). By demonstrating similarities and differences between how people process English and Chinese yellow pages ads, this research helps the community of graphic artists, marketers and advertisers design more effective ads for achieving their marketing and business objectives.

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