A Study on Time Differences between Actual Advertisement Viewing and Retrospective Perception

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Abstract. Upon entry into the digital age, the number and importance of images in media has increased considerably. This paper discusses the similarities and differences between implicit and explicit memory produced by the subjective perception of time when viewing images and text in advertisements. The durations involved in implicit memory were measured using scientific instrumentation (eye-tracking devices), while explicit memory was gauged via a self-administered questionnaire. Three out of ten subjects retrospectively perceived browsing times that differed from the actual times measured through eye tracking, indicating a difference between implicit observation and explicit memory. We also investigated the layout preferences of subjects with various backgrounds in terms of images, text, and logos. These results could assist advertisers to enhance the effectiveness of communication regarding content as well as brand recognition through the use of strong narrative methods.

Keywords: Eye movement, Explicit memory measurement, Psychological time, Layout.

1   Introduction

The Chinese proverb, "time is like an arrow" echoes the English saying, "time flies". Happy times often feel brief, while painful moments appear like an eternity. Most people describe the duration of their experiences according to subjective impressions. The dissemination of digital content has increased the reliance of advertisers on images and text in order to attract public attention, whether employing mass media advertising or personal pages on Facebook. The time readers spent on images and text is our main focus.

Is reading order associated with the layout of image and text? Do elements such as the time used to browse images and text, the order of the browsing, and individual perception vary from person to person? Researchers have employed eye tracking to

investigate the order in which images and text are viewed (Rayner, Rotello, Stewart, Keir & Duffy, 2001). They have also used this technology to explore the attention and memory for advertisement of brands (Wedel & Pieters, 2000) and investigate the saccadic pathways in the layout of news articles (Tang & Jhuang, 2005). Eye tracking instruments have become fundamental tools in the field of psychology to reveal cognitive processes hidden with the function of the human brain. Although the traditional questionnaire survey method is susceptible to errors resulting from subjective introspection, it remains an effective approach for the collection of opinions, feelings, and responses from target subjects. Researchers have proposed the use of paper-and-pencil questionnaires or memory tests as a supplement for eye tracking to compensate for the inadequacies of self-reporting by experiment subjects. Nevertheless, studies have failed to verify the consistency of results derived from the two types of experimental methods.

2   Objectives

This study conducted an in-depth exploration of various issues related to print advertising, including the time required to browse images and text and the order in which layouts are browsed. We also sought to determine whether measurement methods using scientific instruments and traditional questionnaires provide complementary results. The objectives of this study were as follows:

1. Establish whether the time measured by eye tracking differs from the subjectively perceived time of test subjects;
2. Determine whether test subjects differ in their preferences and browsing time;
3. Determine whether the layout of advertisements influences when the logo of the advertised product is noticed;
4. Reveal the image and text browsing preferences of test subjects with different educational backgrounds.

3   Literature Review

3.1   Eye Tracking

Eye tracking has been widely applied in the fields of physiology, pathology, psychological cognition, and to evaluate cultural differences. Conscious eye movement is associated primarily with the shift of attention, high-level memory, and the processes of understanding and cognizing.

Constant eye movement is used to provide comprehensive visual acuity. Generally, both eyes must be fixed on the target object for approximately 200 to 500 milliseconds in order for the image to form in the clearest region on the retina, the fovea. This action is known as fixation. A series of iterative fixations and saccades form a scan path. Current eye tracking instruments can effectively record these eye movements and are believed to be able to obtain results similar to those of questionnaires.

Nodine, Locher, and Krupinski (1993) analyzed the eye movement of art-trained and untrained viewers looking at paintings. They discovered that the former focuses on structural relationships among pictorial elements that express narrative theme, while untrained viewers pay attention to representational issues (i.e., how accurately individual pictorial elements conveyed objective reality). Observing the internet viewing behavior of male and female individuals, Schiessl, Duda, Tholke, and Fischer (2002) conclude from empirical data and describe women as being text-oriented and accurate, and men as icon-oriented and loose. Eye tracking has already established that readers with different professional backgrounds and genders display different scan paths and durations.

3.2   Image and Text Layout

Images and text are essential in the planning of visual layouts, but which is more eye-catching? It is generally agreed that vivid images attract more attention. Pieter and Wedel (2004) asserted that images have the advantage in drawing attention regardless of size and that text element best captures attention in direct proportion to its surface size.

As for the reading order of image and text, Rayner et al. (2001) believed that when viewers look at print advertisements, they spend more time on the text; some viewers may give the images an initial cursory scan before reading the heading and content before looking at the images. While reading, viewers often make cross-references between the images and the text for interpretation. Yeh (2007) studied textbooks used by younger elementary students, discovering that illustrations placed before the text are better able to attract the attention of learners and increase motivation. In contrast, illustrations that placed after the text are more effective in augmenting memory and review processes.

3.3   Implicit Memory and Explicit Memory

Memory includes the processes of encoding, storage, and retrieval. External information is received, processed, combined, stored, and then called back or extracted from storage. Researchers advocating the multi-store model have proposed three types of memory storage: (1) sensory stores, such as visual and auditory, which, when noticed, is placed in a (2) short-term stores; through rehearsal, the information is then passed on into (3) long-term stores (Eysenck, 2004).

Long-term memory is divided into implicit memory and explicit memory. The greatest difference between the two lies in conscious awareness. In other words, it depends on whether consciousness is involved in the state of the memory. As for the measurement of memories, procedures such as free recall, cued recall, and recognition can be used, involving direct instruction to retrieve information related to particular experiences. These are considered the measurements of explicit memory (Eysenck, 2000). However, memory is not restricted to environmental cues; beliefs and expectations can also influence what people see and hear (Nairne, 2000). In this study,

we employed questionnaires to measure explicit memory, hoping that the conscious recollections of test subjects could be used for control and testing.

3.4   Psychological Time

Aristotle proposed the "time of physics", while Augustine proposed the "time of the soul", demonstrating how subjective and objective views of time have long been argued over (Ricoeur Paul, 1984). In addition to conventional time, which encompasses the precision of clock speeds, the customary days, weeks, and months, and the socially designed segmentation of continuous time as periods, time is a conceptual existent in subjective experience. With time, a concrete form of duration, people experience the interlacing changes of events, the feelings of happiness or pain in their hearts, memories, and desires (Kramer, 1988; Pressing, 1993; Wu, 1966).

Psychological time refers to the framing of a moment of physical time in a unit of perceived time. While experiencing events, people generate perceptions of feelings and memories; the length of the time experienced is described using their feelings at the time. Hornik and Jacob (1992) mentioned time perception as the subjective judgment of consumers towards time, otherwise known as the subjective perception of time. Psychological time can be warped by psychological factors, in terms of which Levine (1997) divided influences to the psychological clock into five categories: pleasantness, the degree of urgency, the amount of activity, variety, and time-free tasks.

3.5   Summary

From the literature above, we can establish the following: Eye movement is associated with attention, high-level memory, and the processes of understanding and cognition. Eye tracking has shown that subjects with different professional backgrounds and genders display different scanning patterns. The layout influences attention and memory. Long term memory is divided into implicit memory and explicit memory; the recollection of one's behavior in a conscious state is explicit memory. Furthermore, in addition to clock units, years, and months, time is a subjective experience as well as a conceptual cognitive existence. Based on the literature above, we investigated whether gender or educational background influences browsing time and order when observing images and text in print advertisements. Moreover, we hoped to determine whether the results of scientific measurement instruments reflect those obtained from traditional questionnaires.

4   Methodology

We first employed the eye tracking method and then measured explicit memory (semi-open questionnaire). The results were subjected to tests of independence, tests of chi-square goodness of fit and chi-square test of independence.

4.1   Eye Tracking Method

Experimental Equipment and Environment. This study employed the Face Lab4 real-time face and fixation tracking device in conjunction with GazeTrail software analysis. The computer display was 38 cm in width and 30 cm in length with a resolution of 1280x1024 pixels. During the experiment, the device automatically and synchronously recorded scan paths, the time of the tests, and the time distribution involved in browsing various regions of the screen image. The experiment was implemented in an independent space; the participants were tested individually with no need for helmets or goggles, and were free to browse the screen as they normally would with other computers.

Participants. Number of participants: 36 people
Background: 18 participants with a background in design and 18 participants without a background in design (technological)
Gender: 22 males and 14 females, selected by random sampling

Experiment Samples. *Samples: Sample A was a print advertisement for Citibank.* The original copy was written in English, but for the sake of the participants, whose mother tongue was not English, and to avoid reading difficulties, we replaced the English text with Chinese text of the same meaning. Sample B contained the same content as Sample A except that it was horizontally flipped; the image was flipped so that the model in the image remained facing the center of the ad, but the heading was placed in the upper right corner rather than in the upper left corner (Fig. 1).

Sample A	Sample B

Fig. 1. Samples A and B, with the same image and text content flipped horizontally
Source: http://adsoftheworld.com/

Advertisement Heading: I don't cook. So I made my eat-in kitchen a fabulous walk-in closet.

Content: My name is Grace and I live in a small apartment in a big city. And since I enjoy a day of shopping far more than, say, cooking, I decided to do a bit of home remodeling. (inserted icons of high heels) so with my Citi card in hand, I set out to get some closet organizers. (inserted icon of organizer) I bought a shoe rack for the oven, sweater boxes (inserted icon of sweater box) for the lower cupboards, and some

12-inch baskets for handbags (inserted icon of handbag) up above, I saved room for plates, glasses, and silverware. And one large drawer stuffed with take-out menus. Whatever your story is, your Citi card can help you write it.

Experiment Procedure. Order of sample browsing: using the counterbalancing approach, we rotated the order in which the two groups of participants looked at the samples.

4.2   Measurement of Explicit Memory

The measurement of explicit memory is a form of memory retrieval in which an individual consciously acts to recall or to recognize particular information. After the participants completed the eye tracking procedure, we suggested they take a break (which most of the participants declined) before filling out the semi-open questionnaire (see Appendix 1). The questionnaire requested that the participants recall the time and order in which they browsed the image and text during the eye tracking procedure. Furthermore, it inquired as to which of the layouts looked smoother, whether the icons inserted in the text caused interference, and how soon they understood the nature of the advertising product from the image and text.

5   Results and Discussion

5.1   Eye Tracking Results

Following completion of the eye tracking procedure, we used GazeTrail software to analyze the results. Regions were marked on both of the samples in relation to the image, the right portion of the layout, the face of the female model, the heading, the text, the logo, and the icons inserted into the text. We performed independent samples t-tests on the time that the participants spent looking at these regions with respect to the background and gender of the participant. The results showed no significant differences. Participants with and without a background in design spent an average of 11.05 seconds and 7.57 seconds looking at the image on the left in Sample A, respectively. For the text on the right in Sample A, they spent 7.34 seconds and 16.96 seconds, respectively. Neither of the results reached the level of significance but conformed to the data derived in the pilot test of this study. In other words, individuals without a background in design spend more time looking at the text, while those with a background in design spend more time looking at the image.

Participants with and without a background in design respectively spent an average of 7.15 seconds and 7.52 seconds looking at the text on the left side of Sample B. They respectively spent 7.81 seconds and 6.21 seconds looking at the image on the right of Sample B. Again, the results did not reach the level of significance, but it is apparent that the participants with a background in design spent more time looking at the text in Sample B than they did on the text in Sample A. From the data above, we can infer that regardless of background or preference, an individual will spend more time looking at the content on the fore-end of their scan path (the left), in accordance with common reading habits.

5.2   Questionnaire Analysis

In terms of the first question, "Which one do I think looks smoother?", the results demonstrate that regardless of whether Sample A or Sample B was viewed first, participants with a background in design felt that Sample A looked smoother. The results of the chi-square goodness of fit test were statistically significant (test statistic: p value=.029). However, one of the participants felt that both samples looked the same in terms of smoothness, rendering the overall test results statistically insignificant (test statistic: p value=.063).

Questions 2 through 5 investigated whether the participants spent more time on the images or the text. The chi-square test of independence presented significant correlation (Pearson chi-square p value=.001), indicating that the individuals who looked at Sample A first felt that they had spent more time looking at the images. Individuals who looked at Sample B first felt that they had spent more time looking at the text.

Question 6 asked the participants whether the icons inserted in the text affected readability. The results of the chi-square test of independence indicated no significant correlation. However, participants with a background in design who looked at Sample B first tended to feel that the icons adversely affected readability.

Question 7 inquired as to when the participants realized the purpose of the advertisement, the speed at which they perceived the message, and the sample that they viewed first (A or B). These served as variables in the chi-square test of independence. In terms of the participants without a background in design, the speed at which they perceived the message was found to be significantly correlated to the in order in which they viewed the samples (chi-square value=0.037). For participants without a background in design, those that viewed Sample A first became aware of the product message early on, while those that viewed Sample B first became aware of the product message later. The data from the participants with a background in design did not present significant correlation. We infer that this is because participants without a background in design have a preference for reading the text, which helps them to naturally notice the logo in the lower right corner after reading the text on the right. Generally, this is where logos are placed in advertisements. In Sample B, however, the logo was situated on the left side, which is not a place that people customarily look. Consequently, the logo in Sample B was easily overlooked.

5.3   Analysis and Comparison of Eye Tracking and Questionnaire

This study revealed the following conclusions: 1. In terms of the time spent on images and text, three out of ten participants displayed perceptions (their own conscious memories) that differed from the time measured in the eye tracking experiment, indicating that there were indeed differences between implicit observation and explicit memory. 2. Among the participants that viewed Sample A (image on left, text on right) first, 61 % spent more time looking at the images, and 33 % displayed eye movements that were different from what they perceived. 3. Among the subjects that viewed Sample B (text on left, image on right) first, 56 % spent more time looking at the text, and 27% displayed eye movement durations that were different from what they perceived (Fig. 2).
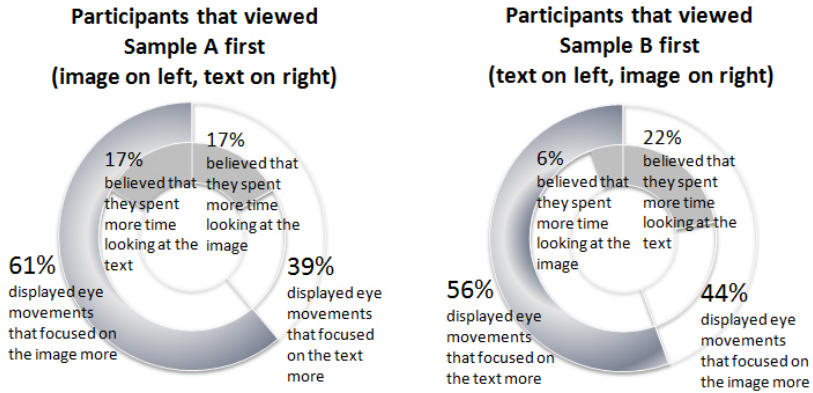
Participants that viewed Sample A first (image on left, text on right)

17%
believed that they spent more time looking at the text

17%
believed that they spent more time looking at the image

61%
displayed eye movements that focused on the image more

39%
displayed eye movements that focused on the text more

Participants that viewed Sample B first (text on left, image on right)

6%
believed that they spent more time looking at the image

22%
believed that they spent more time looking at the text

56%
displayed eye movements that focused on the text more

44%
displayed eye movements that focused on the image more

Fig. 2. The outer ring indicates the time recorded by the eye tracker, and the inner ring shows the results consciously recalled by the participants

6   Conclusion and Suggestions

This study administered eye tracking and a questionnaire to subjects with different backgrounds and genders using two samples with different layouts as to image and text. The results were compared and analyzed using chi-square tests of independence and goodness of fit tests. Our results indicate the following: 1) The measurements of time obtained from eye tracking differed from the subjectively perceived time of test participants. Three out of ten participants reported perceptions that differed from the time measured in the eye tracking experiment. 2) Participant preferences for image and text layout, browsing time, and scanning patterns showed no significant differences; however, the results presented a few trends in which most of the participants considered images on the left and text on the right to be smoother-looking. More time was spent reading text than looking at the image. 3. Participants without a background in design who looked at Sample A first noticed the product fairly quickly, indicating that the lower right corner is the optimal location for a logo. 4. Individuals with a background in design preferred images, while individuals without this training preferred text. In addition, females preferred images, and males preferred text.

This study has a number of limitations. Funding restrictions limited the number of participants in the eye tracking exercise. In addition, with only two sample types, we employed counterbalancing to switch the order in which the participants viewed the samples. Therefore, a portion of the data was split in half for analysis, creating greater difficulty in obtaining statistically significant results.

This study stressed the importance of combining research methods to investigate implicit and explicit memory in order to enhance reliability. Our results reveal the layout preferences of subjects with different backgrounds in terms of images, text, and logos, enabling advertisement designers to enhance message communication and brand information with strong narrative methods.

References

1. Eysenck, M.W.: Cognitive Psychology-A Student's Handbook, 4th edn. Wu-Nan Books, Taipei (2000); Li, S.-C.(trans.)
2. Eysenck, M.W.: Simple Psychology, 2nd edn. HungYeh Books, Taipei (2004); Wei, C.-F. (trans.)
3. Hornik, J.: Time Estimation and Orientation Mediated by Transient Mood. The Journal of Socio – Economics 21, 209–227 (1992)
4. Kramer, J.D.: The Time of Music. Schirmer, New York (1988)
5. Kress, G., Leeuwen, T.V.: Reading Images: The Grammar of Visual Design. AsiaPac Books, Taipei (1999); Ni, S. (trans.)
6. Levine, R.: A Geography of Time -The Temporal Misadventures of a Social Psychologist. Basic Books, New York (1998)
7. Nairne, J.S.: Psychology: The Adaptive Mind. Hurng-Chih Books, Taipei (2000); Li, M.-H., Chen, M.-Y. (trans.), Huang, S.-L., Kuo, C.-C. (revise)
8. Nodine, C.F., Locher, P.J., Krupinski, E.A.: The role of formal art training on perception and Aesthetics judgment of art composition. Leonardo 26, 219–227 (1993)
9. Pieters, R., Wedel, M.: Attention capture and transfer in advertising: Brand, pictorial and text-size effects. Journal of Marketing 68, 36–50 (2004)
10. Pressing, J.: Relations Between Musical and Scientific Properties of Time. Contemporary Music Review 7(2), 105–122 (1993)
11. Rayner, K., Rotello, C.M., Stewart, A.J., Keir, J., Duffy, S.A.: Integrating text and pictorial information: Eye movements when looking at print advertisements. Journal of Experimental Psychology: Applied 7(3), 219–226 (2001)
12. Ricoeur, P.: Time and Narrative. The University of Chicago Press, Chicago (1984); McLaughlin, K., Pellauer, D. (trans.)
13. Schiessl, M., Duda, S., Tholke, A., Fischer, R.: Eye Tracking and Its Application in Usability & Media Research. Humboldt University, Berlin (2002), `http://www.eye-square.com/fileadmin/docs/publications/user_experience/eye_square-eye_tracking_research_applications.pdf` (retrieved on February 25, 2012)
14. Tang, D.L., Jhuang, S.J.: Exploring Attentional Effect of Image Position on News Reading from Eye-tracking Method. The Journal of Advertising & Public Relations 24, 89–104 (2005)
15. Wedel, M., Pieters, R.: Eye fixations on advertisements and memory for brands: A model and findings. Marketing Science 19(4), 297–312 (2000)
16. Wu, K.: Henri Bergson. The Commercial Press, Taipei (1966)
17. Yeh, S.Y.: Effectiveness of Illustrations in Junior-Grade Elementary School Mandarin Textbooks under the Nine-year Integrated Curriculum (Master's thesis, National Taichung University of Education) (2007)

Appendix 1

*Background: ☐ Design: Dept of _____ ☐ Non-design: Dept of _____
*Gender: ☐Male ☐Female
*Age:_____
*Name (Nickname):_____

1. Which one do I think looks smoother? ☐Sample A ☐Sample B ☐They look the same

(Note: For those that looked at Sample A first, please answer Questions 2 and 3; for those that looked Sample B first, please skip to Question 4.)

2. When I looked at Sample A, I think I first looked at
☐the image on the left ☐the text on the right ☐I briefly scanned the image on the left first and then read the text on the right ☐I briefly scanned the text on the right first and then looked at the image on the left ☐other:
_____
_____

3. When I looked at Sample A, I think I spent more time looking at:
_____

(For those that looked at Sample A first, please skip to Question 6.)

4. When I looked at Sample B, I think I first looked at ☐the text on the left ☐the image on the right ☐I briefly scanned the text on the left first and then looked at the image on the right ☐I briefly scanned the image on the right first and then read the text on the left ☐other:
_____
_____

5. When I looked at Sample B, I think I spent more time looking at:
_____

6. I think that inserting small icons in multiple lines of text ☐interferes with my reading ☐somewhat interferes with my reading ☐ does not interfere with my reading

7. I knew that the advertisement was introducing a credit card ☐early on ☐later ☐just now

~ Thank you for your participation ~