Visual Velocity: Content Font Effects and Incidental Online Ad Exposure

Francesca Baraggioli, Account Executive, Epsilon Inc.
S. Adam Brasel, Boston College

An eyetracker study explores how character spacing alters perceptions of reading speed and peripheral advertising fixations, and suggests content typography as a key method to increase peripheral online ad effectiveness. Subjective reading measures do not correlate with objective visual search patterns: consumers vary subjective readability ratings based on spacing changes but there are no objective differences in reading time. The increased time and distance between visual fixations for wide spacing offsets the decreased time spent within fixations. The larger movements in wide spacing conditions leads to increased visual attention on peripheral advertising banners without increasing conscious awareness during exposure.

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ABSTRACT
An eyetracker study explores how character spacing alters perceptions of reading speed and peripheral advertising fixations, and suggests content typography as a key method to increase peripheral online ad effectiveness. Subjective reading measures do not correlate with objective visual search patterns: consumers vary subjective readability ratings based on spacing changes but there are no objective differences in reading time. The increased time and distance between visual fixations for wide spacing offsets the decreased time spent within fixations. The larger movements in wide spacing conditions lead to increased visual attention on peripheral advertising banners without increasing conscious awareness during exposure.

INTRODUCTION
As the influence of interactive media has risen, the traditional standards of text display have become more flexible. No longer tied to strict rules of printed newspapers and magazines, typography and font effects have become a vital component of online communication and promotion (McCarthy & Mothersbaugh 2002). Limited prior research has explored the effects of typography on various items of interest to marketers, such as reading speed and retention, but the work exploring font effects online remains scarce. Recent research has suggested that the effects of typography on the printed page may not carry over into monitor-based reading. This issue has become increasingly important recently with the rise of web logs, also known as blogs, as a viable promotional medium. For example, over 29% of traffic to an Audi website during a recent campaign was generated by blog ads that were purchased with 0.5% of the marketing budget (Hall 2005). While blogs are currently a small portion of most media buys, blog advertising is predicted to grow to roughly $50 million in 2006, up from roughly $20 million in 2005 (Davis 2006). Companies themselves have also begun to launch promotional blogs as a method for communicating directly with their target markets.

The longer a person takes to read a particular blog, the more time that person has to be exposed to promotional messages either contained within the blog text itself or posted in the columns to the sides of the main post. At the same time, the blog must be perceived as easy to read in order to avoid mounting frustration in the reader. Given their primarily textual content, advanced graphical design elements will only play a partial role in blog readability metrics. Font and typography, on the other hand, are easily controlled and manipulated, and prior research on typographic effects suggests it will have an effect upon various metrics of interest to the consumer. In addition to increasing or decreasing the actual size of the webpage, font typography effects might engender changes in a consumer’s visual search pattern as they read the blog, and this could increase or decrease the likelihood of incidental fixations on advertising content. The purpose of this work, then, is to explore how two easily-changed aspects of typography affect subjective and objective readability and reading speed for online blogs, and explore the implications for visual attention to blog-based advertising.

Prior Work & Propositions
Two more easily controlled aspects of online typography is the space between characters, known as ‘tracking,’ and whether the font chosen for a webpage is serif or sans-serif. Prior research has shown that for physically printed material, serif fonts (such as Times New Roman or Garamond) are faster to read than sans-serif fonts (such as Arial or Verdana). However, this result has been called into question for reading on a computer monitor, with preliminary work showing an advantage for serif over sans-serif fonts (Wilson 2001), and experimental research showing mixed effects for serifs and reading speed (Arditi & Cho 2005).

Two key areas tracking is likely to affect are the number of letters contained within a single visual fixation, and the frequency of errors in letter or word identification. The effects of tracking on ease of reading and reading speed, however, has conflicting evidence within the literature. McCarthy & Mothersbaugh (2002) argue that tighter tracking will increase the number of letters in each perceptual span, thus increasing reading speed, and this effect is echoed in Overschelde & Healy (2005). It also follows that if the number of letters able to be processed in one fixation is not fixed, the reduction in letters per visual fixation when using wide tracking will require longer words to have two or three fixations, where only one fixation would have sufficed under tighter tracking, thus reducing reading speed. At the same time, the work on perceptual errors offers up the opposite finding. There is some evidence that very tight tracking creates crowding, which interferes with letter recognition (Chung et al 2001), and thus wide tracking should increase reading speed.

Running counter to both findings, however, is a series of papers exploring the perceptual span in reading (summarized in Rayner 1998) that suggests the number of letters we can effectively process in one visual fixation is relatively fixed at around 3 to 4 characters spaces to the left of the fixation point and 14 to 15 character spaces to the right. If this holds true, then tracking changes should have little effect upon reading speed as a section of text will require the same number of fixations to complete regardless of tracking level. Some recent work supports this position, with results showing mixed results for the effects of fonts on readability online (Ling & VanSchaik 2006), and other work suggesting typographic effects on readability might only be important under situations of low luminance or degraded visual signals (Yager et al 2005). In short, there is currently little consensus on the effect of tracking in perceptions of ease and speed of reading, little objective evidence of the visual search pattern itself, and a need for an exploration of these effects in an online context.

The ability to increase tracking without sacrificing ease or speed of reading might be preferable from a marketing perspective. Wider tracking would create more lines of text on the blog webpage, lengthening the overall page and creating increased space along either side of the entry to place promotional messages or advertising. Wider tracking should also increase the amount of space physically covered by the visual search and reading routine, potentially increasing the likelihood that the point-of-gaze will pass over promotional material irrespective of reading speed. Indeed, even incidental exposure to banner advertising without clickthrough can engender positive effects towards the brands being advertised (Mitchell and Valenzuela 2005). As there is a general bias towards the center of the screen when engaging in reading tasks (Vitú et al 2004), any effect that can increase the amount of screen space covered would be of value to marketers as advertising is traditionally placed on the perimeter of the webpage. This is of increasing
importance given story body text becomes ‘stickier’ with respect to visual fixations due to attentional inertia as users move deeper and deeper into a website (Wang and Day 2007), so incidental/accidental visual attention could be the only exposure many online ads receive.

An online study using eyetracker analysis was designed to offer insight into the conflicts within the literature outlined above, and explore typographic effects on readability. The visual search pattern measures created through eyetracker analysis allow for a detailed exploration of reading speed, errors, and fixation duration and location (Sheree 2005). Survey measures would capture subjective judgments of reading speed and ease of use and also illuminate whether any objective changes in the visual search pattern created by the typographic manipulations entered active cognition and memory for the media.

STUDY 1

Design

The stimuli designed for the study was that of a Tourism & Travel blog, similar to sites such as TripAdvisor.com or Gridskipper.com. The blog was three pages long, and each page detailed a tourist’s ‘trip report’ about his or her vacation to the island of Elba, off the coast of Italy. The comparatively unfamiliar island of Elba was chosen to ensure that all study participants had a similar level of familiarity with the subject matter prior to stimulus exposure. All three pages used 12-point font, single spaced, and the ordering of the three stories remained unchanged across subjects. The three trip reports shared many similar characteristics, such as similar word count (246 vs 268 vs 223), and each was bordered by three pictures of Elba on the left-hand side of the text (see Image 1). Two banner ads remained constant across the three blog pages, one banner for Travelocity on the left-hand side of the page, and one banner for Westin resorts on the right-hand side of the page.

Tracking and serifs were manipulated across all three blog stories. Tracking was varied by 15%, so the wide tracking condition had character spacing at 115% of the default font spacing while tight tracking had character spacing at 85% of default. The values were chosen because the differences were large enough to be noticeable when directly compared, yet still plausible enough when examined individually that the font would appear realistic and natural. Times New Roman was utilized as the serif font, and Arial was utilized as the sans-serif font. Each participant saw different combinations for the three trip reports so, for example, one subject would see the first story with wide tracking and serifs, the second story with tight tracking and sans-serif, and the third story with moderate tracking and serifs, while the next subject saw a different combination of typographic manipulations and story. Across the pool of participants, each combination of tracking (wide, moderate, tight) and serif (serif, sans-serif) occurred an equal number of times for each story. This within-subjects manipulation was necessary due to the limitations on sample size imposed by the need to run each participant individually in the eyetracker lab.

Twenty-four undergraduate students, mixed as to gender, were recruited from an east-coast private university and compensated with a $10 online gift certificate for their participation. Participants were run in two separate waves approximately nine months apart; a ‘wave’ covariate was included in analysis ANOVAs but had no effect upon results. Upon entering the lab, participants were briefly introduced to the eyetracker equipment and calibrated using a 9-point gaze chart so the system could map point-of-gaze onto screen images. The ASL 6000 system employed an infrared corneal-reflection technique to capture point-of-gaze data at sixty frames per second, accurate to within 1.5 degrees of the visual search field. GazeTracker software was then used to record all visuals on the display monitor and to map point-of-gaze information onto the stimulus post-exposure. The GazeTracker software also analyzed the point-of-gaze information and marked fixation points along the visual search pattern (see Image 2). These fixation points represent areas of visual attention, as the eye moves from fixation point to fixation point in a series of saccadic movements where visual processing is limited. The system used created a fixation for each collection of gaze points contained within one to five visual degrees that lasted more than 200 milliseconds.

Participants were instructed that they would be reading a travel blog and then asked questions about their experience, following which they were exposed to the three travel blog stimuli pages. Participants were free to read at their own pace and moved on to the next page in the travel blog by clicking on the large ‘NEXT’ button at the bottom of each page. During stimuli exposure, the eyetracker created and saved a video of the website with the point-of-gaze gazetrail and visual fixations overlaid on the image. The GazeTracker software also recorded the following variables, broken down by separate blog story, for each participant: Total Time Shown, Total Time Tracked, Percentage of Time Fixated Relative to Time Tracked, Number of Fixations, Number of Gaze Points, and Average Fixation Duration. Measures of average X/Y distance between gaze points (measured in pixels) and standard deviation of gaze location across exposure time (also measured in pixels) were computed as further measures of overall eye speed and movement intensity.

Following stimuli exposure, participants were first asked a series of multiple choice recall questions on blog content, then rated each story on “easy to read”, “useful”, “fast to read”, “visual”, “informative”, “interesting”, and “trustworthy” 7-point Likert scales. They were then asked a series of general computer- and internet-usage questions. Finally, participants were asked to free-response recall any banner ads they saw, and then were asked to circle the 2 brands advertised from a list of 15 travel brands. The overall procedure lasted roughly thirty minutes for each participant.

Results

Subjective Reading Measures: Not surprisingly, significant correlations were discovered between a participant’s rating of a blog as easy to read and their ratings of it as fast (r=.576, p<.01), interesting (r=.615, p<.01), and trustworthy (r=.412, p<.01). But does tracking affect the perception of a blog as easy to read? A one-way ANOVA of tracking on the ease of reading measure revealed a significant effect for the tracking manipulation on the easy-to-read measure (F=4.129, p<.05). Planned contrasts reveal that the moderate tracking condition had higher easy-to-read ratings compared to the tight (5.35 vs 3.82, p<.01) or wide tracking conditions (5.35 vs 4.47, p<.05). Including story as a covariate in the ANOVA (to control for any differences across the three story replications) did not change the pattern or significance of the results. While this inverted-U pattern of effects replicated for the effect of tracking on subjects measures of reading speed, trustworthiness, and interest, these patterns were only directional and not found to be significant. As for serifs, an ANOVA revealed a significant effect on subjective reading speed (F=5.195, p<.04), where the sans-serif font was rated as significantly faster to read than the serif font (5.06 vs 4.17), but the serif manipulation had no effect on ease of reading or trustworthiness and interest ratings.

Objective Reading Measures: Do these subjective reports of reading speed and ease of use correlate with more objective measures of the visual pattern? It would appear that people’s percep-
**IMAGE 1**

Sample stimulus page

**IMAGE 2**

Gazetrail and fixation points example
tions of reading speed are not accurately reflecting their experience, as there were no significant correlations between the subjective reading speed or ease of use measures from the survey and the objective measures of reading speed taken from the eyetracker (time spent on page, time spent in fixations on page, number of fixations on the page). Serifs, as well, had no significant effect on objective measures of the visual search pattern. So does tracking have an objective effect on the visual search pattern? An ANOVA analysis of the effects of the tracking and serif manipulations revealed a significant main effect of the tracking manipulation on the average fixation duration ($F=4.015, p<.05$). The mean fixation length was 385msec for the tight tracking pages, 345msec for the moderate tracking pages, and 310msec for the wide tracking pages (see figure 1).

This shows that participants spend longer in each fixation when the letters are closer together. From this one might assume that the wide tracking condition was faster to read, since each fixation took less time on average. A second ANOVA exploring the effects of the tracking manipulation on the percentage of overall time spent fixated, however, reveals a significant main effect of the tracking manipulation on the average fixation duration ($F=8839, p<.01$). Participants spent an average of 84% of their time within fixations for the tight tracking pages, compared to 79% for the moderate tracking pages and 75% for the wide tracking pages (see figure 2). Thus, while tight tracking makes the average fixation length longer, the participant spends less time non-fixated, with shorter and faster movements from fixation to fixation. Conversely, wide tracking decreases the amount of time each fixation takes, but increases the amount of time non-fixated as participants have to move their point-of-gaze further between fixations.

These two effects appear to ‘cancel out’ when looking at the overall time it takes to read a blog: an ANOVA of any of the time of gaze measures on tracking revealed no significant effect ($p>.50$). These results suggest that the number of letters able to be processed within a single fixation is indeed fixed at a relatively stable number for an individual (as per Rayner 1998). Readers then need to space their fixations further apart in wide-tracking conditions which increases the amount of time spent moving from fixation to fixation. Re-examining the video record, this pattern of results is supported by the evidence that the number of fixations per line of text appears no different between tight, moderate, and wide tracking conditions, instead participants vary the distance traveled between fixations to account for the differing width of words. Measures of visual search speed reinforce that wide-tracking readers are covering a wider area of the screen and moving their visual attention to a greater degree than tight or moderate tracking readers. They exhibit significantly higher standard deviations of X/Y position on-screen than either tight or moderate tracking participants (132 pixels vs 105 or 113 pixels, both $p<.05$), and measures of average X/Y distance from gazepoint to gazepoint are also significantly higher (10.7 pixels vs 7.6 or 9.1 pixels, both $p<.05$)

One concern with using tight tracking raised in the prior literature is that by placing letters closer together, more errors in letter and word identification will result, causing more repetition and backtracking within the visual search pattern. The experimenters also reviewed the videos of the participant’s visual search pattern on the stimuli blogs, counting the number of backtracks or repeat fixations on the same or earlier groups of text. While the pattern of results matched expectations, with tight tracking having the highest mean backtracks per page (8.3) compared to moderate (7.5) or wide tracking (6.4), the difference was only directional and not significant due to wide variance within condition. The number of backtracks also did not have a significant correlation with the

While it is no doubt possible to introduce tracking so wide that the traditional letter span would not fit within the range of focal/foveal vision and the number of fixations required for to process line of wide-tracking text would increase, it is unlikely that such a font environment would be used on body text within a blog.
participants subjective measures of ease or speed of reading, suggesting that the backtracks are taking place on an automatic or non-conscious level, and information may be frequently aggregated across backtracks in early perception before cognition comes into play. Backtracks also resulted in no additional fixations or visual attention on advertising content.

Advertising Effects: So if readers of wide-tracking text are moving their eyes further between fixations, does this make incidental fixations on advertising content surrounding the body text more likely? To explore this, incidental gazepoints and follow-up fixations on advertising content was explored on the first page only. Regardless of tracking condition, the banner ads receive initial fixations upon participant exposure to the first webpage, as they engage in a visual search across the entire page to establish a mental map of the screen and content format. An ANOVA exploring the effects of tracking on first-page ad fixations reveals no significant effect if fixations are viewed as a whole. If “follow-up” fixations (i.e. fixations that take place after the initial visual search of the page is completed and the participant is in the process of actively reading the blog entry) are used instead, a more pure measure of tracking effects a marginal effect of tracking appears (F=2.834, p<.09, see Figure 3).

The wide tracking condition has more follow-up fixations on advertising content (M=8.66) than moderate (M=7.06) or tight (M=5.98) tracking. Interestingly, while initial fixations show a directional bias towards the left banner ad (likely due to it’s occurrence in what is traditionally menu-bar location) follow-up fixations appear evenly divided between the two banners, and are not significantly different from each other.

Does tracking more strongly affect incidental gazepoints (i.e. isolated gazepoints along the visual search trail but not contained within a focal fixation) on advertising content? Incidental gazepoints were computed by filtering the gazetrail data so only frames where the gazepoint was within the X/Y boundaries of the two banner ads were included, followed by the removal of all frames within fixations. An ANOVA of the effect of tracking manipulation on incidental ad gazepoints reveals a significant effect of tracking (F=3.874, p<.05, see Figure 4).

Wide tracking readers had the highest incidental gazepoints on the banner ads (M=61.25) followed by moderate (M=55.63) and tight (M=46.88, see Figure 4) tracking. Here, incidental fixations were biased to the banner ad on the right, as the body text was separated from the left bumper by a series of Elba photographs. Thus, perceptual errors and ‘overshoots’ of visual fixations rarely made it all the way to the left bumper, whereas the right bumper abutted the text and received more incidental fixations as a result.

These results provide strong evidence that wide tracking on body text can be a beneficial tool for online advertising beyond the simple increase in adjoining space it can provide. Wider tracking actually increases the incidental fixations on advertising banners due to the increased movement within the visual search pattern, and does so without impacting objective reading speed or perceived interest in or trustworthiness of the source.

DISCUSSION

In summary, varying tracking seems to create offsetting effects on reading speed and usability. The increased time necessary to make larger movements between fixations for wide tracking offsets the decreased time spent within each fixation, so tracking overall has little effect on overall objective measures of reading speed. The objective measures of reading speed and ease of use seem also to have little correlation with subjective measures of the same, suggesting that typographic manipulations offer a unique route for exploring online promotional impact without impacting...
overall website perceptions. Indeed, wide tracking significantly increased incidental gazepoints on advertising content surrounding blog text and marginally increased follow-up focal fixations on ad banners.

It is important to note that tracking was not shown to have an effect on source trustworthiness in the current work; the exposure time to each tracking condition was somewhat limited. It would be interesting to extend the length of each blog entry as well as make the promotional nature of the target stimuli transparent, to better explicitly test for traditional marketing outcome measures such as attitude-towards-brand or purchase intent. Future work might also explore the boundary conditions of tracking as it relates to ease of reading. If tracking becomes too tight, letters begin to overlap and word recognition will suffer greatly. If tracking becomes too wide, a single visual fixation will not be able to take in as many letters as are possible to process at once, interfering with word recognition as individual words are split across multiple fixations. Finally, it should be noted that the banner ads used in this study were directly relevant to the travel blog content. While intuition suggests that incidental fixation differences based on tracking will not be af-
fected by varying the ad relevance, further work could explore interactions between ad relevance and tracking on follow-up fixations.

Overall, these results suggest that increasing tracking on a blog or webpage might offer promotional benefits with little cost in subjective ease of reading by the consumer. A website or blog using wide tracking will make the target article longer on the page, assuming column width is held constant. This allows more space along either side of the article in which to place advertising or promotional messages at no cost to the perceived ease of reading or trustworthiness of the site. In addition, wide tracking increases the amount of movement within the visual search and reading pattern, which increases incidental fixations on surrounding banner ads. While increasing tracking will not actually increase the time spent on the page, the extra visual space and visual attention on ad content comes without a significant negative impact on reading speed, trustworthiness, or interest in the piece.

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