

Commercial uses of eyetracking

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Position Paper

Name Linden J. Ball
Address Department of Psychology
Lancaster University
Lancaster LA1 4FY
Phone 01524 593470
Email L.Ball@lancaster.ac.uk

1. Current interests and use of eyetracking

Over the past five years at Lancaster University several eye-tracking studies have been conducted on the *MRes Design and Evaluation of Advanced Interactive Systems* course as collaborations between myself and Master's students pursuing their dissertation research. Much of this work has used eye-tracking as a method to evaluate the efficacy of web-based interfaces in the context of commercially-oriented websites (e.g., where revenue acquired through advertising or product sales is a key concern). The main eye-movement metrics that have been employed in our studies have related to fixation durations and fixation frequencies in defined areas of interests. We have sometimes, however, used other metrics such as spatial density (or distribution) of fixations as a measure of the extent of the interface inspected (cf. Goldberg & Kotval, 1998, 1999), and pupil size and blink rate (Jones, 2004) as a possible indices of cognitive workload (cf. Bruneau, Sasse, & McCarthy, 2002).

Eye-tracking projects that we have conducted have, for example:

- Compared different instantiations of the same commercial website (i.e., for Orange Personal Communications Services Ltd) to examine users' search efficiency to locate target information (e.g., concerning how to purchase a replacement phone). Our evidence (Cowen, Ball & Delin, 2002) indicated that eye-movement metrics were sensitive to the same patterns of difference across various websites as were other performance measures of usability (e.g., task completion times and response-accuracy scores).
- Examined whether the informational structure of bookmarks (i.e., top-down vs. bottom-up verbal organisations of cues), together with the number of informational cues present (i.e., one, two or three), influences their salience and recognisability. Eye-movement analyses of fixation duration on news-oriented bookmarks (Poole, Ball, & Phillips, 2004) revealed interactive effects between the experimental factors of informational structure and cue number, suggesting that the efficacy of bookmark recognition is crucially dependent on having an optimal combination of information quantity and information organisation.
- Assessed whether 'banner blindness' that has been found with static banner-shaped advertising images on websites could be overturned by using 'dynamic' banner advertisements (i.e., flashing or animated banners) in the context of on-line visual-search tasks. Analyses of the number of fixations on banners and total fixation duration provided only limited evidence that dynamic banner advertisements could eliminate banner blindness (Chan, 2003). People's memory for presented banners was also uniformly poor.

2. Specific areas or questions to discuss

There are a wealth of issues that we would be keen to discuss with fellow researchers who are also using eyetracking in usability evaluation, including the core ones that are often raised such as: (1) the validity of the 'eye-mind' assumption in the context of different interface tasks (e.g., browsing, searching, comprehension) with different types of stimuli (text, images or mixed representations); (2) the best interpretation of longer fixations and longer total fixation durations in areas of interest on websites (i.e., the 'engagement' vs. 'confusion' distinction); (3) the role of data triangulation and methodological triangulation in validating eyetracking results; (4) how best to interpret regressions in web-based interaction situations; and (5) the

optimal choice of eye-movement metrics for addressing different research questions relating to interface usability (cf. Poole & Ball, in press).

In addition to these core concerns, we would also welcome the opportunity to discuss three other issues that are especially pertinent to our immediate interests in the application of eye-tracking technology in usability research. These issues are as follows:

1. *How are individual differences in interaction processes and strategies (e.g., information search) correlated with different eye-movement patterns?* In previous research (Cowen et al., 2002) we proposed that it is important to be able to identify and classify the way in which different temporal and structural patterns evident in eye-movement recordings may be associated with different kinds of interaction strategies (both within and between individuals). Are others trying to tease out the temporal complexities of eye-movement analysis in usability contexts? How can a meaningful interpretation be given to eye-movement patterns across *stages* of interaction with interfaces such as websites?
2. *What are the best ways to design ecologically-valid studies that use eye-tracking to assess the efficacy of on-line advertising?* One finding that has arisen in a number of our experiments of web advertising (Chan, 2003; Gardener, 2004; Hesketh, 2004) is that interesting effects relating to the presence of adverts (e.g., on fixation times) occur on the *initial* one or two trials in multi-trial studies, but such effects rapidly drop off in subsequent trials. This observation suggests that responders are initially attending to adverts (e.g., showing no banner blindness) but are perhaps then strategically ignoring such adverts once they decide that they are irrelevant to task completion. This raises issues of how best to design ecologically-valid studies that also exhibit elements of sound experimental control (e.g., within-participant designs, effective counterbalancing of multiple stimulus trials etc). Are others grappling with such concerns in studying on-line and rich-media advertising?
3. *Can a person's eye-movement record of their web-based interaction be re-played to them in order to elicit a useful retrospective verbal protocol of task-based processing?* This issue stems from current research that is being conducted in collaboration with Nicola Eger (MRes student at Lancaster University) and Robert Stevens (Bunnyfoot). We are especially interested in the use of eye-movement 'playback' as a way to cue verbal accounts of *usability* problems encountered during interface use. It is well-established (e.g., Ericsson & Simon, 1993) that concurrent think-aloud requirements may have reactive effects on actual task processing (changing its nature and time-course) and that conventional retrospective reporting is subject to forgetting and post hoc rationalisation. But does eye-movement playback combined with retrospective reporting provide a more valid way of eliciting a verbal account of interaction problems? How might this method be validated? Have others used this technique, or a variant of it, in their usability research?

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