REVEALING USER BEHAVIOUR ON THE WORLD-WIDE WEB

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Abstract: This paper presents the results of a qualitative study of user behaviour on the World-Wide Web. Eight participants were filmed whilst performing user-defined tasks and then asked to review the video-taped session during prompted recall. This data forms the basis for a series of descriptions of user behaviour and the postulation of a number of underlying cognitive mechanisms.

Our results indicate that people: lack ready made search strategies, prefer alternatives that are visible, immediately available and familiar, choose the path of least resistance, exhibit social forms of behaviour, engage in parallel activities, object to misleadingly presented information, have trouble orienting, are late in using appropriate strategies, are sensitive to matters of time, and are emotionally involved in the activity.

The paper ends with a discussion of how these results can contribute to our understanding of hypermedia.

Keywords: Internet, World-Wide Web, Browsing Strategies, Hypertext Navigation, Qualitative Methodology, User-Defined Tasks, Cognitive Mechanisms.

INTRODUCTION

When thinking about the Internet, there seem to be two prominent sets of ideas and problems that we are inclined to gravitate towards. Pulling on us from one side are questions regarding the social significance of modern information technology: the ways in which it has and will alter the nature of society. On the other side are questions pertaining to the technology itself: its future forms and possibilities. Somewhere in between, we find the users themselves, engaged in the daily and ordinary activity of employing the Internet for everyday purposes. This user is as far away from the dreams, utopias and nightmare visions of speculative theories of social change, as he is oblivious to the details of the evolution of the technology itself. In this middle zone there are at least two types of questions we might pose: one of these asks for the kinds of activities users engage in, such as sending E-mail, shopping, browsing, etc., the other asks how, on a more fine-grained level, these activities are carried out. In this paper we present the results of an inquiry inspired by the second sort of question.

To begin, we asked eight people to let us film them for half an hour whilst they used the Internet, and to talk to us about these films afterwards. The notes we took on these conversations, as well as on our own observations, served as the basis for the analysis to be presented in this paper.

The range of behaviours that our set-up was geared to capture was mostly a mix of searching and browsing in unfamiliar hypertext, but we were also interested in uncovering other activities not anticipated by this categorisation. One of our aims then, was simply to describe these behaviours. Another aim was to try to understand some of the underlying rationale and motivation of the behaviours thus described. To achieve this second aim we decided that a qualitative approach was appropriate, since the usual quantitative methods (see Pitkow, 1997, for a review of available methods) fail to penetrate beyond surface behaviours to the reasons for behaviour.

A study of user behaviour based on a statistical analysis of client-side log files has been performed by Catledge and Pitkow (1995). Although they were able to identify naturally occurring, and relatively

stable, action patterns, their method did not allow any substantial insight into underlying mechanisms. Tauscher and Greenberg (1997) employed a broader method, combining a quantitative approach with post-study interviews. However, their interviews were aimed at evaluating the design of current history mechanisms and revolved around a narrow range of questions focused on page visitation and revisitation.

It is our hope that the present explorative study might inspire others to perform further studies and experiments, and also that it might serve as a source of inspiration for those readers directly involved in designing for the Internet.

PROCEDURE

All of the people who took part in this study used the Internet on a fairly regular basis and, with the exception of two people, were all post-graduate students. All but one of the participants were male. Ages ranged between 21–38.

Instead of setting our participants a standard task, which would defeat the exploratory nature of our study, or sitting them down with sparse instructions to "just do it," we first interviewed our participants on their areas of interest. Together with our participants, we then decided on a suitable topic for them to focus on, our only demand being that it be something they were interested in but which they had not previously explored on the net. We also tried to ensure that the topics chosen were sufficiently broad to encourage more than just simple searches. Allowing our participants to choose their own topics made it more likely that they were motivated in performing the task and that these sessions resembled our participants' normal use of the Internet. We also hoped that they would enjoy the experience and that they might discover something useful to them along the way.

The topics finally chosen by our participants were as follows:

- Swedish cat-owner societies
- Anti-gravity motors
- Good places in France for skiing
- Restaurants in Scandinavia with at least one star in the Michelin Guide
- Swedish role-playing game clubs
- The works of the composer Gregorio Allegri, in particular the work Miserere
- Information and tips on herbal gardening
- Male choirs in Sweden

After the topics had been chosen and the participants had been properly briefed, they were left alone at a computer for half an hour with version 2.01 of Netscape Navigator and a fast connection to the Internet. No bookmarks were available at the onset of the sessions. With just one exception, the locale chosen for this study was familiar to all of the participants. A video camera, placed to the side, was aimed at the screen, but leaving the participant out of frame. It was thought that knowing that their faces would not be filmed would help our participants to relax during the session. Although the resolution of the resulting films was poor it was of sufficient quality for the participants to later identify their own actions. After the half hour was up (or later when there was something specific the participant wished to finish) we watched the video tape together, asking questions and taking notes of the hyperlinks chosen. We also transcribed answers to our questions and any spontaneous comments made. The interview was concluded by asking our participant what they would like to have done differently in the light of their recent experience. The resultant notes were cross checked between us and later served as the basis for our analysis. An audio recording of the interview was made for future reference.

This procedure was preferred to the use of think-aloud protocols (Ericsson & Simon, 1984) as it imposed less of a cognitive burden on the participant and, most importantly, since it did not alter the activity that we wanted to study. It also allowed us to ask our participants leading questions, for example, about the things they did not do, as well as questions about what they had in fact done. In a few cases we, in turn, were able to answer specific questions from our participants and to provide them with more successful strategies for future use.

Although this will not be visible in the analysis below, the study was conducted in two phases. In the first of these, we recorded the activities of just four of our participants. By the time that we decided to expand the study, we had already started to form a number of hypothesis on the basis of the material already gathered. In the second phase, we were to some extent looking for corroboration, as well as falsification, of the preliminary conclusions we had already begun to draw.

THE ANALYSIS

In our analysis we have relied on the notes taken during the interviews. These include:

- A sequential list of the links chosen during the session

- Details of other actions performed (high and mid-level tasks, and low level actions)
- The participant's spontaneous comments
- Answers to our direct questions

In handling these several kinds of data we have tried to be sensitive to their different natures and to the immediate context. In particular, we have been careful to note whether a comment was spontaneously given, elicited by our questions, or part of the summary and evaluation made at the end of the session. When these utterances concerned activities in the session, we have also taken pains to refer back to our own record of the activities performed. We have indicated in the analysis whether a particular behaviour was generally observed or peculiar to one person only. The quotes and examples given in these sections should be seen as illustrations of the point that we are making, and not as a listing of evidence. In view of this, we have permitted ourselves to be rather liberal in our translations from the Swedish original.

The order in which the observations are presented is meant to partly reflect the overall pattern in the unfolding of a typical session. To some extent then, the earlier observations belong to the beginning of a session and later observations to the end. However, some observations have been placed towards the end of our analysis simply because they do not follow this pattern, often being of a more global nature.

OBSERVED BEHAVIOURS

1) Our participants seemed to lack ready-made strategies at the outset of their sessions.

With only one or two exceptions, our participants, who were experienced users of the Internet, did not spend much time at the beginning, planning their session. Instead they would often let chance determine their activities, being heavily influenced by the visible structures presented to them, or they would work for a long time with a single idea and approach, even when this proved roundabout and counterproductive. One person who reported an initial intention to plan the session, had to give up due to the lack of any clearly formed procedure.

Perhaps we should not be surprised that people do not plan their sessions, the absence of plans guiding action having elsewhere been suggested (Suchman, 1987) to be a phenomenon of far greater generality. It is also questionable whether the structure of the World-Wide Web permits planning or that previously successful strategies can be reused.

It was only after some time, when our participants realised that they were not getting what they wanted, that they switched to more demanding cognitive strategies (see section 9). Those who failed to switch strategy would instead abandon the original topic, as one person said: "Gave up finding any serious information. After this, I clicked aimlessly. Didn't find a good way."

Since most participants seemed to lack a ready approach, as was also confirmed by some of the participants, there was a number of other factors which governed their actions. These factors will be discussed in detail below.

2) Our participants tended to prefer the visible and immediately available alternatives.

One factor which strongly influenced our participants was the visible structure of the pages and the browser. The mere presence of certain graphic elements seemed to invite our participants to action (cf. Norman, 1988, on visibility and affordances). For example, when browsing through web pages, our participants would click on pictures or icons, regardless of whether these were actual links. In choosing search engines, some of our participants would tend to choose the prominently visible Net Search button and then use whichever search engine they happened to be presented with. Some of them even reported that their choice of search engine was simply governed by availability (see the discussion in section 9 however). Even though the extent of external influence on the participants might be downplayed by interpreting the behaviour as exploratory, it is interesting to note which sorts of features invite this kind of activity.

3) Our participants tended to prefer alternatives they were already familiar with.

When several options were available, the participants would tend to choose the ones they were already familiar with, either the ones that they had previously used, heard about, or even just encountered several times earlier in the session. This is congruous with Tauscher and Greenberg's results (1997) which indicate a 58% probability of a current page having been previously visited and a 40% probability of a page having been visited within the last six URL accesses. It should be noted that certain navigational actions, such as traversing a page to reach another previously visited page, contribute to these recurrence rates. In some cases, the choice of search engine was primarily motivated by familiarity based on previous experience, "This one is not so good, but it's one that I know," "I use AltaVista since I am accustomed to it." Although this preference for previously encountered material may limit access

to new information, sticking to familiar locations and choosing familiar alternatives may actually be advantageous to the user. This way the user can know what he is getting without having to expend much effort.

Not only would our participants choose familiar alternatives over unfamiliar ones, but they would also actively seek to confirm what they already knew. As one person remarked: “Fun to see the kinds of information one gets. I compare it to what I already know.” It should be noted that corroborating previous knowledge may be one of the few means available on the Web of validating the reliability of information.

When there were no familiar alternatives, this was remarked upon: “There were no bookmarks that I recognised.” Familiarity in the form of hearsay not only seems to guide certain choices, but also provides a kind of surrogate judgement in the absence of personal experience. The participants also seemed to rely on personal references as a guarantee of the quality of a source. For instance, those participants who looked for a search engine among the bookmarks, would usually pick one, remarking such things as “AltaVista is supposed to be good.”

Encountering the familiar was also a source of satisfaction (see section 11). In contrast, when encountering an unexpected alteration in what had been previously familiar, our participants would seem uncomfortable, puzzled, and at a loss what actions to take next. As one person complained: “The page has been changed, don’t know what to do.”

4) Our participants would usually choose the path of least resistance.

Faced with a choice between several alternatives our participants frequently selected the least cognitively demanding ones. Although time consuming, many participants preferred to repeatedly press the back button when returning to a desired location. As one of them commented: “I use the back button so that I don’t have to think.” Reidentifying the location in a historical list is experienced as more difficult. The use of the back button as a preferred means of navigation is supported by Tauscher and Greenberg's study (1997) in which this action constituted 30% of all logged navigational events. They point to the considerable recency of revisits as an explanation of the abundant use of this function. We would like to note that the correlation does not assure a unidirectional relationship, with the following possibility that the cognitive ease of use of the back function is contributing to the recency effect.

Kirsh and Maglio's (1992) study of Tetris (a real time interactive computer game) demonstrates that some cognitive problems may be more quickly and reliably solved by performing actions in the world, as opposed to working things out in one's head. Likewise, using the back button to retrace a path in hypertext may turn out to be an optimal strategy for relocating a desired item.

Similarly, our participants would also choose the less cognitively demanding alternatives available whilst traversing new areas. As one of them explained “I choose interesting links and continue forwards as long as I can remain within my area of interest. I prefer the path of least resistance.” This comment supports our previous observation (see section 1) that most participants would improvise their paths through hypertext, rather than devote efforts to more complex strategies. The effort that is expended is used for remaining within a certain area of interest. This last observation is likely to be a partial effect of our original set-up, which encouraged exploration of a single topic. However, the above comment was spontaneously given and would seem to reflect a general experience of the participant.

5) One participant, in particular, exhibited several different forms of social behaviour.

Although only one of our participants unmistakably engaged in what might be termed social activity, this pervaded the whole of this one session. Once this participant had located a particular site maintained by a group of his fellow musicians and acquaintances, he used this as his point of departure for the remainder of the session. Not only was a large part of the session taken up examining the materials at the site itself, but the site also formed the navigational hub to which he repeatedly returned from his various excursions. This is a very clear instance of the general hub and spokes pattern identified in Catledge & Pitkow (1995). We have already seen how several participants seemed to rely on personal references as a guarantee of the quality of accessed materials. Some of this participant’s other social activities included reading about acquaintances and comparing their efforts to his own. For instance: he looked for information on a specific friend, tried to find out more about the ensemble’s graduating performance at the music academy, and tried to confirm a rumour about a change in the line up of the group: “there should be a new singer since the previous one is pregnant.” On reading about their practice schedule, their concerts, and the songs on the repertoire, he would compare their efforts and skills to his own. “I’m curious about their repertoire, want to see how many of the songs I know.” He was also impressed by their efficiency recording “How do they manage to

record a CD in just two days?" Furthermore, reading about his acquaintances led him to reminisce about their past meetings: "I remember those pleasant parties in Åbo." His emotional involvement recounting these events reveals an additional dimension to the feelings of satisfaction and amusement to be discussed below.

6) The attention of most of our participants was captured by things that resulted in a temporary alteration in their main activity.

Against the background of the whole of a session, some parts, in retrospect, seemed to lie outside the main area of concern. Although we have not chosen to determine which parts of a session belong to the main track and which parts can be viewed as side tracks, our participants themselves would make such ascriptions. There seemed to be two chief types of activities that deviated from the main flow of a session: deviation from the main topic and deviation in the nature of activity.

Deviations from the main topic were usually caused by our participants' curiosity and by the allure of humours ingredients. For instance, the participant who had Swedish cat-owner societies as a topic was attracted by the caption "My cat is a Maoist Black Panther." On viewing the tape of the session this participant felt obliged to comment that she couldn't resist investigating this link. Even if this confession was socially motivated, it must still be grounded in our participant's own interpretation of the event as extraneous to the main subject of her session. A factor which probably contributes to our participants' tendency to make entertaining excursions is the wish to enjoy the session and to feel satisfied with it at the end (see also section 11).

An example of a deviation in the nature of activity was the participant who interrupted his search for skiing resorts to take part in a competition, spending some time filling in an entry form. Another participant temporarily switched focus from the content of a page to its structure and functionality. After first having commented on the content of this page he explained his subsequent actions as an attempt to systematically determine the relationship between a set of icons and an index, in order to satisfy his curiosity.

7) Our participants objected to misleadingly presented information.

Our participants didn't seem to mind the presence of advertisements or commercial sites per se, or the fact that they would sometimes be distracted by these. Rather, it was when the commercial nature of this kind of information was difficult to determine that they objected, especially when the information appeared to have been purposely disguised. An example of this kind of insidious advertisement was the page on cats' health, showing how the wellbeing of cats was totally dependent on them eating a certain well known brand of cat food.

One participant explicitly expressed an appreciation for pages with a clear division into commercial and non-commercial information. Such a division would most likely be an improvement, but probably not sufficient to alleviate the problem of judging the quality of information, which was generally experienced as difficult.

8) Our participants had trouble orienting themselves in the media.

Our participants experienced several kinds of difficulties navigating the Internet. We have already covered some of the factors governing the forward passage through new areas. The main trouble for participants occurred when they tried to return to places already visited. The most common navigational tools used for this purpose are history lists and the back function. Using the history list was problematic, because it was hard to recognise the desired place from the list of page titles presented. As a consequence, many participants would end up in the wrong place.

The participant's representation of a desired location most probably did not include the title of the page, but rather its structural and graphical features. The title of the page was thus not something that could be recognised, since it had not been memorised in the first place. There is too large a gap between what the participant wants to do and the means available for this purpose (see Hutchins, Hollan & Norman, 1986). The advantage for the user employing the back button to revisit a desired location is that each step can be more easily recognised. However, our participants would complain of the difficulties retracing a longer path using this function.

One factor which contributes to the problems of orienting is the fact that it is difficult for the users to know the result of a certain move. An illustration of these difficulties is the participant who compared the links available on a page with the titles of already visited pages on the history list, in order to avoid places previously visited.

This problem is aggravated by the fact that our participants did not seem to sufficiently differentiate between what might be called subjective and objective structures. The subjective structure is the path taken by the user through the media and is what the user is aware of, whilst the objective structure is the factual underlying structures

irrespective of user activity. We believe that a substantial part of the problems users have orienting is caused by the fact that they mistakenly conceive of the subjective structure as being the objective one. Just one single participant showed a clear awareness of the objective information structure by cutting parts of the URL, so as to "go one step higher in the hierarchy."

The present tools offer no global overview of the places visited or of the underlying structures, and clearly, the user is unable to form an adequate representation of these.

9) Our participants would employ more cognitively demanding strategies only after first having experienced prolonged dissatisfaction with less taxing means.

The beginnings of our participants' sessions were characterised by less cognitively demanding strategies, as previously noted. Many participants would spend considerable time unable to find wanted information before switching to more demanding cognitive strategies, such as: refining the search phrase, changing the language of the search, or switching to another search engine. Changing the language of the search phrase to Swedish was a strategy eventually hit upon by most of the participants looking for information likely to be in Swedish. Those who did so would also comment that they should have done so from the start of the session.

Although it might generally be effective to try easier strategies first (if they succeed, less effort and time have been expended), our participants persisted with less effective means even when it was clear to them that this was not forwarding their aims. What appears to trigger the change to more cognitively demanding strategies is not simply the recognition that a particular strategy is being ineffectual, but rather a period of frustration. We should, however, keep the alternative interpretation open, that the latency is accounted for by the fact that it takes time to formulate an appropriate strategy.

10) Our participants were sensitive to matters of time.

Catledge and Pitkow (1995) report that only 1% of the user events they recorded using client-side log files involved interrupts during file transfer. They concluded that this indicates an insensitivity of the population as a whole to retrieval latency. However, their method, necessarily, only permits the recording of actions actually undertaken and provides no information on the actions and options *avoided* by the user. In contrast, several instances of behaviour captured in our own study seem to indicate choices made in order to avoid slow downloads. One example is the participant who ceased downloading alpine maps on the grounds that this "took too long." This user would also keep a constant eye on the throughput. The majority of our users complained explicitly about downloading time. As one participant observed: "It's too slow, the brain is quicker." Several participants also used the stop button to interrupt slow transfers. If a particular link took a long time to connect, this was sometimes taken as an indication that the connection was unlikely to succeed and would therefore be stopped: "It's usually hopeless anyway when it takes longer that 10 seconds."

Although our participants were sensitive to long downloading times or connecting latencies, they would often spend a great deal of time on a number of other activities, such as systematically reading through lists of search results. On the surface, these two behavioural patterns would seem to be inconsistent, but can in fact be explained by assuming a difference between activities that require the user's involvement and those in which the use remains passive. Simply put, the user is bored when inactive and therefore more sensitive to duration, whilst time is experienced as passing more quickly when the user is engaged in some activity. One participant forced into passivity, waiting for a page to download, compensated by making the pointer arrow dance in small circles.

11) Our participants expressed their satisfaction with regard to successful choices made during the session, as well as to the session as a whole.

During the viewing of the video recorded session, most participants spontaneously expressed satisfaction with certain parts, such as deciding on a fitting search phrase or finding interesting links: "Finally found something exciting," "I'm pleased, I succeeded in my assignment." The participants also showed satisfaction and seemed to find pleasure in talking about the successful and funny parts of their session. Satisfaction was also expressed in the summarising phase of the session: "I was satisfied for real," "It was fun. I'll go home and try to do the same search again."

DISCUSSION

We feel that these observations taken collectively might serve several different though related functions. The first and most obvious of these is that they contribute to our understanding of user behaviour on the Internet. As such, they form a partial document of user behaviour in its present shape, but also suggest several avenues for completing this

document through a mixture of qualitative and quantitative methods. The observations taken individually and in combination suggest a whole range of possible further research.

As well as capturing several aspects of user behaviour, these observations also reflect the nature of this relatively new medium. To be able to understand the nature of any medium we have to consider the context of use: how it is used and for what purposes. This is even more true for hypermedia in which interaction constitutes such a large part.

Traditionally, this medium has been characterised by its property as an enormous information structure. The significance of this structure is believed to be constituted by its capacity to convey and store new information in ways previously not possible. Our perception of these properties stem from how we would like the media to be used and is grounded in an analysis of the functionality of the technology.

However, users' interaction with the media does not correspond to these expectations. The suitability of the medium for distributing new information is partially contradicted by actual user behaviour. As we have seen, users are more inclined to confirm what they already know than to seek out new information. New information is hard to find: navigation is difficult and users lack the necessary strategies. In those cases when users do encounter new information they are hampered by the problem of judging the quality of the source. Moreover, we cannot even be certain that information that is retrieved is also acquired by the user. The medium encourages the user to store information, or even just the location of information. As one of our participants confessed, he was perfectly satisfied with the act of finding and keeping interesting links: "I am a person suffering from information sickness. I'm satisfied as long as I know that I can access information." This is noteworthy in light of recent discussions of the impact of current technological change on cognition (e.g. Donald, 1991, 1997). Since there is a possible discontinuity between individual cognition and externally stored information this impact may well be far less than expected.

The third, and perhaps most important function that we hope that these observations might serve, is to contribute to the continuous development and improvement of this new medium. Thus, we hope that those of our readers involved in designing for the Internet, whether it be applications or web page design, might find these observations to be of some use. Rather than just being something that the designer keeps at the back of his or her mind, these observations might act as a direct source of inspiration for new ideas and solutions.

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REFERENCES

Catledge, L. & Pitkow, J. (1995) "Characterizing Browsing Strategies in the World-Wide Web," *Proceedings of the third Conference on the World Wide Web*, Darmstadt. [http://www.igd.fhg.de/www/www95/papers/80/userpatterns/UserPatterns.Paper4.formatted.html].

Donald, M. (1991) *Origins of the Modern Mind*, Harvard University Press, Cambridge, MA.

Donald, M. (1997) "The Mind Considered from a Historical Perspective: Human Cognitive Phylogenesis and the Possibility of Continuing Cognitive Evolution," in (eds) D. M. Johnson & C. E. Erneling, *The Future of the cognitive Revolution*, Oxford University Press, Oxford.

Ericsson, K. A. & Simon, H. A. (1984) *Protocol Analysis: Verbal reports as data*, MIT Press, Cambridge, MA.

Hutchins, E., Hollan, J. & Norman, D. (1986) "Direct manipulation Interfaces," in (eds) D. Norman & S. Draper, *User Centered System Design*, Lawrence Erlbaum, Hillsdale, New Jersey, London.

Kirsh, D. & Maglio, P. (1992) "Some epistemic benefits of action: Tetris, a case study," in *Proceedings of the Fourteenth Annual Conference of the Cognitive Science Society*. Hillsdale, NJ, Lawrence Erlbaum. [http://cogsci.ucsd.edu/~maglio/some.ps].

Norman, D. (1988) *The Design of Everyday Things*, Basic Books, New York.

Pitkow, J. (1997) "In Search of Reliable Usage Data on the WWW," *Hyper Proceedings of the sixth International World Wide Web Conference*. [http://www6.nttlabs.com/HyperNews/get/PAPER126.html].

Suchman, L. (1987) *Plans and Situated Actions*, Cambridge University Press, Cambridge.

Tauscher, L. & Greenberg, S. (1997) "Revisitation Patterns in World Wide Web Navigation," in *ACM SIGCHI '97 Proceedings of the Conference on Human Factors in Computing Systems*, ACM Press. [http://www.acm.org/sigchi/chi97/proceedings/paper/sg.htm].