

In Search of Information on Websites: A Question of Age?

Eugène Loos

University of Amsterdam, ASCoR, Kloveniersburgwal 48,
1012 CX Amsterdam, The Netherlands
e.f.loos@uva.nl

Abstract. To fight against info-exclusion in an aging society, it is important to make website information available to all generations. If we want to achieve this goal we need to know the impact of not only age but also gender, educational background and frequency of internet use. Therefore, this paper presents the results of an explorative Dutch eye-tracking case study, which focuses on information search behaviour (navigation patterns and use of the search box, effectiveness, efficiency and user satisfaction). 29 younger and 29 older participants completed a search task on three websites. It was found that the greatest factor impacting on information search behaviour is not always age. In one case, heatmaps showed clearly that the navigation patterns of older participants using internet daily were quite similar to those of younger ones. Finally, I present some implications for organisations wanting to (re)design their own website.

Keywords: eye-tracking, web design, usability, information search behaviour, navigation patterns, age differences, digital natives, digital immigrants, digital gap, digital spectrum.

1 Introduction

The number of older people is increasing quickly. The use of new media is also on the rise in our information society. The supply of digital information through new media, such as websites must be available to older users, so that they have guaranteed access to the digital information sources provided by public and private organisations offering products and services they need.

Some researchers argue that there is a widening generational ‘digital gap’ between those people who are able to use new media and those who are not. It was Prensky [1] who coined the notions of ‘digital natives’ and ‘digital immigrants’. Do they really exist, these ‘digital natives’, who have grown up with new media? And is there really an older generation of ‘digital immigrants’ playing catch-up by trying to learn how to use new media? Other researchers, e.g. Lenhart and Horrigan [2], take a different perspective. They introduced the notion of a ‘digital spectrum’, which acknowledges that people use new media to varying degrees.

If we want to fight against info-exclusion by making digital information through websites readily available to all generations, we need to know the impact of age on

information search behaviour. This paper therefore starts with a quick scan of the empirical studies that have examined the question of whether older people do indeed navigate websites differently from younger people. As we will see, these studies are based on a limited number of users and do not consider other factors than age. Therefore I will present the results of an eye-tracking study I conducted in the Netherlands, which is based on a larger number of participants and which focuses, not only on age, but also on factors such as gender, educational background and frequency of internet use. Finally, some implications for organisations wanting to (re)design their own website will be presented.

2 Information Search Behaviour and the Role of Age: A Quick Scan

At the 4th International Conference on Universal Access in Human-Computer Interaction at Beijing in July 2007, Tullis [3] presented empirical research results about differences between 10 younger and 10 older U.S. users in the way they scan web pages. The heatmaps from his eye-tracking study showed that older users need more time and follow a different navigation pattern. Another example with similar results is that of Houtepen [4], who conducted an eye-tracking study in the Netherlands with 13 younger users and 7 older users. He concluded that the older users need more time to complete search tasks (almost 6 minutes, compared to the 2.5 minutes the younger users spent fulfilling their task) and that older users read more and make less use of the website's search box facility.

More facts about the ways younger and older people navigate websites to find information can be found in overviews offered by Chisnell and Redish [5] and Andrew [6]. Their overviews of empirical studies (which made use of methods such as observation, reading aloud and self assessment) give us insight into how information search behaviour affects e.g. efficiency of different users (older people are on the average slower than younger ones) but they do not give us insight into the navigation patterns themselves.

I therefore decided to conduct an explorative case study focused on the effects of information search behaviour, including navigation patterns.

3 An Explorative Case Study: Research Design

It should be borne in mind that the studies mentioned above involved a limited number of participants, which would point to the need for more research on more users. The studies also only focused on age, omitting to take into account the role of factors such as gender, educational background and frequency of internet use. It is for this reason that I carried out an explorative eye-tracking study among 29 younger and 29 older users (aged, respectively, 21 or thereabouts, and 65 and older). This number of participants far exceeds the minimum of 8 participants per user type in usability tests as specified by the NIST CIF [7]. They fulfilled a search task (related to health information) on three websites in the Netherlands: an association for older people (I asked the younger participants to fulfil a search task for their grandparents), a municipality

and a health insurance company. To offset learning or fatigue effects, the order in which the three websites were presented was alternated during the 6 days the eye-tracking study was carried out (participants who fulfilled their search task on day 1: 1 → 2 → 3; day 2: 1 → 3 → 2; day 3: 2 → 1 → 3; day 4: 2 → 3 → 1; day 5: 3 → 1 → 2, day 6: 3 → 2 → 1).

Table 1. User groups

User groups	N
All users	58
All older users	29
All younger users	29
All female users	28
All male users	30
All younger female users	14
All younger male users	15
All older female users	14
All older male users	15
All older users with higher education	19
All older users without higher education	10
All older users using internet daily	18
All older user not using internet daily	11

The information search behaviour (navigation patterns and use of the search box) of the participants was then analysed, paying specific attention to effectiveness (search task completed successfully or not within 5 minutes), efficiency (the time they needed to fulfil their search task) and user satisfaction (ranking usability). For more information about the focus on effectiveness, efficiency and user satisfaction in usability tests, I refer to Frøkjær, Herzum and Hornbaek [8] and Johnson and Kent [9].

To gain insight into the navigation patterns and use of the search box, I used the heatmaps of the eye-tracking study. These heatmaps were colour coded (red, yellow and green: respectively very intense, moderate and low intensity) to show how intensely navigation areas are visited, based on the number of fixations of individual users or groups of users. The detailed results of this explorative case study can be found in Loos and Mante-Meijer [10].

In the next section of this paper, I will present the most important differences related to the information search behaviour of the participants to see if age or other factors such as gender, educational background and frequency of internet use have the biggest impact on navigation patterns, the use of the search box, effectiveness, efficiency and user satisfaction. I was *not* concerned with comparing these aspects of *the three websites* to one another, as they differed in overall structure. I compared the information search behaviour of *different groups of website users* exhibited on different websites. Identifying differences in the information search behaviour of younger users compared to that of older users is particularly important for public and private organisations seeking to attract older people who are willing and able to use

the internet to their site. Website designers, too, can thus gain information on how to build better, user-friendlier websites for old and young (see also section 5.2).

Compared to previous empirical (eye-tracking) studies conducted in this area, the number of participants in my eye-tracking study was relatively large. Nonetheless, the groups were still not huge and the risk of bias remains. It is therefore an exploratory case study in which, instead of significant relations, I merely present trends. For this reason, I have confined myself to examining only the major differences between these groups of website users showing up on more than one website. If, despite the different structure of the websites, salient differences are then seen in the use of the search box, effectiveness, efficiency and user satisfaction, the chance that this is a trustworthy finding is much higher than in the case of a search task on one website.

4 Results: Younger and Older Users' Information Search Behaviour

4.1 Younger and Older Users: Different Worlds?

Older users were less likely to make use of the search box than younger users on the websites of the municipality and the health insurance company. The same phenomenon was found in Houtepen's eye-tracking study. Younger users generally managed to accomplish the search task successfully more often than the older users, on all three sites. The same held for the amount of time needed to successfully complete the search task. The younger users were much faster than their older counterparts; a finding that corresponds with the results of the eye-tracking study conducted by Houtepen and Tullis. The older users moreover assigned higher marks to the website of the association for older people and that of the municipality than did the younger group. Hence, there is some difference between older and younger users where use of the *search box*, *effectiveness*, *efficiency* and *user satisfaction* are concerned. No noteworthy differences could be found regarding gender, educational background and frequency of internet use.

Can we now, therefore, on the basis of the eye-tracking studies carried out by Houtepen and Tullis and by myself, declare age to be the true explanatory variable? Some caution is warranted, as before making a statement of this kind we must first take a look at the role of age in *navigation patterns*. The navigation patterns on the homepage of the website of the association for older people are illustrative in this respect, showing apparent differences for younger and older users. Though many of the participants in both the younger and the older group looked at the correct place to click (the upper part of the third column) to arrive at the web page containing the information they were looking for, the red (dark coloured in this book) area on the older users' heatmap 1 is much larger than on the younger users' heatmap 2. This confirms Tullis' finding that older people examine navigation areas more intensely than do younger people. Another difference is that older users look longer at the wrong place to click, i.e. the second column, than younger users. This is shown by the red (dark coloured in this book) zone seen in that navigation area on heatmap 1, which is absent on heatmap 2. So, at first glance, the navigation patterns of older people appear to differ from those of younger people:



Fig. 1. Heatmap 1: All older users

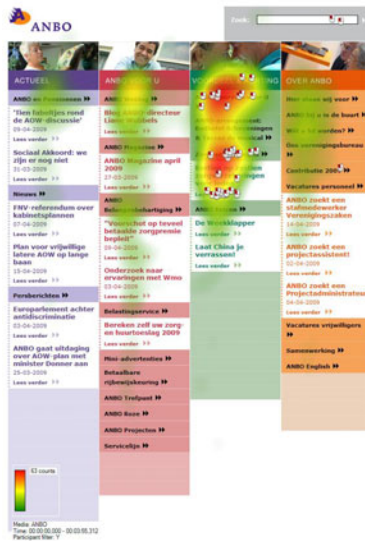


Fig. 2. Heatmap 2: All younger users

However, if we compare the navigation patterns of older people *using the internet daily* (heatmap 3) with those of the younger age group (heatmap 2), these patterns are, in fact, not as dissimilar as first thought.

This would seem to imply that the frequency of internet use impacts more heavily on our navigation patterns than does age. Chisnell and Redish (2004: 62) refer to Hawthorn [11] en Zajicek and Morrissey [12], who argue that the lack of internet experience strongly affects the capability of older people to use PCs and websites.



Fig. 3. Heatmap 3: All older users making use of internet daily

Sections 4.2 and 4.3 will now focus on the role of gender, educational background and frequency of internet use within the group of younger users and within the group of older users.

4.2 A Homogeneous Group of Younger Users?

To determine any possible variation in the group of younger website users, I also looked at gender differences within this group. As all participants in the younger group were highly educated and daily users of internet, the factors educational background and frequency of internet use could not serve to determine any possible variation within this group. A greater number of young men than young women succeeded in successfully completing the search task on the websites of the association for older people and that of the municipality. Young men rated the user friendliness of the websites of the association for older people and that of the health insurance company more highly than the young women did. Hence, as far as effectiveness and user satisfaction is concerned, some variation turned up within the younger group of website users.

4.3 A Homogeneous Group of Older Users?

Gender. On all three websites it was found that older men used the search box significantly less often than older women. The search tasks performed by the older men on the websites of the association for older people and of the municipality were more often successfully completed, compared to the older female participants. In the case of the municipality and the health insurance company, the older men who successfully completed their search task were, on average, faster than the older women.

Educational background. Some variation in the older group of website users as regards the successful completion of the search task was found to be caused by

the factor educational attainment. The percentage of older users who successfully managed to accomplish the search task was higher among those with a high level of education than among those without such a background.

Frequency of internet use. Older people who daily surfed the internet utilised the search box to execute the search task on the site of the health insurance company considerably more often than did the older people who did not make daily use of the internet. Over a fifth of the older participants going daily on the internet made use of the search box on the website of the association for older people, but no one of the older participants not using the internet daily made use of the search box. The older participants who utilised the internet daily and who successfully fulfilled the search tasks on the websites of the association for older people and the municipality were also, on average, faster than the group of older participants who succeeded in completing the search task, but who did not use the internet on a daily basis. With respect to user satisfaction, the websites of the municipality and the health insurance company received a lower rating from older users navigating the internet on a daily basis than from the group of older users who did not visit the internet daily.

5 The Role of Age Revisited

5.1 Conclusions

From this explorative case study the following conclusions can be drawn:

1. Younger and older users differ to a certain extent in *the use of the search box, effectiveness, efficiency and user satisfaction*, but gender, educational background and frequency of internet use played no important role (see section 4.1).
2. At first glance, the *navigations patterns* of older people appear to differ from those of younger people, but in the case of the website of the association for older people, the navigation patterns of older people using the internet daily compared to those of the younger age group are, in fact, not as dissimilar as first thought. The frequency of internet use also has its impact on navigation patterns (see section 4.1).
3. Within both the group of younger users and the group of older users, differences in information search behaviour can be distinguished (see sections 4.2 and 4.3).

We can conclude that in this explorative case study, the black-and-white distinction between Prensky's 'digital natives' and 'digital immigrants' was absent. Instead, what emerged was something far more resembling a 'digital spectrum' (Lenhart and Horri-gan), rather than a 'digital gap'. If future empirical research confirms the findings of this explorative eye-tracking study, the implication for web designers (who often belong to a younger generation) might be that they should take into account diversity between and within generations by designing for dynamic diversity [13].

5.2 Designing for Dynamic Diversity: Implications for Web Designers

Finally, I would like to mention a few implications of this explorative case study for those who want to (re)design their own website:

1. Assume that the user group is a diverse one.
2. Be wary of the assumption that age is the most important criterion. Frequency of internet use may, at the very least, be just as relevant as age.
3. 'Intra-age variability' is a good guiding principle (Dannefer [14]).
4. This does not imply that it may be taken for granted that everyone can 'just like that' make sense of a website. Therefore, test a (new) website on different types of users, and do so in several rounds, each time on different users (Krug [15]).
5. Do not be concerned that modifications made to the website for a specific group could undermine the user-friendliness of the site for another group. Research performed by Johnson and Kent into the design of user-friendly websites has shown that younger website users, as well as website users with a functional limitation and older people using the internet all had the most appreciation for the user-friendly websites (also see Chadwick-Dias [16], McNulty and Tullis [16]).

References

1. Prensky, M.: Digital Natives, Digital Immigrants. *On the Horizon* 9(5), 1–6 (2001)
2. Lenhart, A., Horrigan, J.B.: Re-visualizing the Digital Divide as a Digital Spectrum. *IT & Society* 5, 23–59 (2003)
3. Tullis, T.: Older Adults and the Web: Lessons Learned from Eye-Tracking. In: Stephanidis, C. (ed.) *Universal Access in Human Computer Interaction. Coping with Diversity*. LNCS, pp. 1030–1039. Springer, New York (2007)
4. Houtepen, L.: *Op Zoek naar inFormatie. Onderzoek naar het Vinden en Beoordelen van Informatie op de Websites van de Vijf Grootste Zorgverzekeraars*. (unpublished master thesis). Utrecht University / Utrecht School of Governance, Utrecht (2007)
5. Chisnell, D., Redish, J.: *Designing Websites for Older Adults: A Review of Recent Research*. Prepared for AARP (2004), <http://www.aarp.org/olderwiserwired>
6. Andrew, A.: *Web Accessibility for Older Users: A Literature Review*. W3C Working draft (May 14, 2008), <http://www.w3.org/TR/wai-age-literature>
7. Wichansky, A.M.: Usability Testing in 2000 and Beyond. *Ergonomics* 43(7), 998–1006 (2000)
8. Frøkjær, E., Herzum, M., Hornbaek, K.: Measuring Usability: Are Effectiveness, Efficiency, and Satisfaction correlated? In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, Den Haag (2000)
9. Johnson, R., Kent, S.: *Designing Universal Access: Web Application for the Elderly and Disabled*. *Cogn. Tech. Work* 9, 209–218 (2007)
10. Loos, E.F., Mante-Meijer, E.A.: *Navigatie van Ouderen en Jongeren in Beeld. Explorierend Onderzoek naar de Rol van Leeftijd voor het Informatiezoekgedrag van Websitegebruikers*. Lemma, Den Haag (2009)
11. Hawthorn, D.: How Universal is Good Design for Older Users? In: *Conference paper, ACM SIGCAPH Computers and the Physically Handicapped, Proceedings of the 2003 Conference on Universal Usability*, vol. (73-74) (2003)
12. Zajicek, M., Morissey, W.: Multimodality and Interactional Differences in Older Adults. In: Carbonell, N. (ed.) *Multimodality: A Step Towards Universal Access, Special Issue of Universal Access in the Information Society*, vol. 2(2), pp. 125–133 (2003)

13. Gregor, P., Newell, A.F., Zajicek, M.: Designing for Dynamic Diversity - Interfaces for Older People. In: ASSETS 2002, pp. 151–156 (2002)
14. Dannefer, D.: What's in a Name? An Account of the Neglect of Variability in the Study of Aging. In: Birren, J.E., Bengtson, V.L. (eds.) *Emergent Theories of Aging*. Springer, New York (1988)
15. Krug, S.: *Don't Make Me Think! A Common Sense Approach to Web Usability*. New Riders, Berkeley (2006)
16. Chadwick-Dias, A., McNulty, M., Tullis, T.S.: Web Usability and Age: How Design Changes Can Improve Performance. In: CUU 2003, Vancouver, British Columbia, Canada, November 10-11 (2003), http://www.bentley.edu/events/agingbydesign2004/presentations/tedesco_chadwickdias_tullis_webusabilityandage.pdf