Sequential Model of User Browsing on Websites
Three Activities Defined: Scanning, Interaction and Reading

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Abstract: This paper presents a model of user browsing behaviour on websites. Main user activities on websites are suggested, discussed and supported by previous research. Proposed activities are then associated with three main aspects of the website - usability, aesthetics and information quality. Their role in each phase of user browsing on the website is discussed. Basic browsing model is then constructed on the basis of previous research´s conclusions, accompanied by new considerations. Model variations are taken into consideration and discussed in relevance to the mode of use.

1 INTRODUCTION

User browsing, interaction and generally behaviour on website are widely researched topics in human-computer interaction, which can be studied in various contexts and from many different angles. Many of research goals in this area eventually lead to user preference, which is very important in today´s competitive environment. User preference, user experience and evaluation in the scope of websites are often associated with constructs like usability and aesthetics.

Main goal of this paper is to connect these constructs or aspects with phases of interaction between a user and a website. According to authors, every phase has its prominent aspect, which has the biggest influence on user. Proposition of these activities is supported by review of relevant literature. Browsing model of user activities on the website is then constructed, on the basis of previous research and new considerations about expected course of actions.

2 ASPECTS OF THE WEBSITE

The use of a webpage is determined by several factors: the information provided, usability of the website and the impression given to the user (Schenkman and Jönsson, 2000). Web design attributes were defined as: content organization, visual organization, navigation system, colour and typography (McCracken and Wolfe, 2004). Websites can be evaluated by their usability, memorability, aesthetics, information quality and engagement, which result in overall preference (de Angeli, Sutcliffe and Hartmann, 2006).

Generally, three main aspects of websites emerge from previous research: usability, aesthetics and content (or information quality).

2.1 Aesthetics

Aesthetics of user interfaces is undoubtedly one of the most influential factors of their success with users. General concept of aesthetics comprises several similar constructs such as visual appeal, beauty or goodness.

Beauty is an important predictor of the overall impression and user judgment and therefore beauty of a webpage is an important factor determining how it will be experienced and judged (Schenkman and Jönsson, 2000). Another research showed an influence of aesthetics on credibility and trust, dependent mainly on first aesthetics impression of the website (Robins and Holmes, 2008). Other construct similar to aesthetics - perceived visual attractiveness of the website - was proven to influence usefulness and ease-of-use, i.e. usability (van der Heijden, 2003).

2.2 Usability

Usability can be taken as an objective construct (precise measurements of user performance) or subjective (perceived usability). This division is similar to another two concepts: pre-use usability, which is perceived usability of the interface before use, and user performance as a result of user´s activities on the site (Lee and Koubek, 2010). As specified in ISO 9241-11, we can also divide usability measures into these three groups: the measures of effectiveness, efficiency and satisfaction (Hornbæk, 2006).

There is not a conformity among various studies, which aspects are included in usability. One study presents as usability criteria: ease of use, readability, productivity, content quality, completeness or relevance (Spool et al., 1999). Other extensive research includes consistency, navigability, supportability, learnability, simplicity, interactivity, telepresence, credibility, content relevance and readability (Lee, Kozar, 2012).

According to authors´ opinion, content should create a separate category, along with its attributes such as content quality, content relevance or completeness. Usability aspect of websites should be limited to ease of use according to layout, navigation, affordances, readability and similar concepts.

2.3 Content

Finally, content or information quality is one of the key aspects in a website´s success (Lynch and Horton, 2001). Characteristics of content can be defined as quality and quantity of provided information (de Angeli et al., 2006). Content can be also taken as a subjective measure in form of perceived quality of content (Bartuskova and Krejcar, 2013).

Content is often presented as part of usability aspect, nevertheless it creates a whole different category. Content´s criteria relevant to textual form can be divided into quantity measures (e.g. completeness) and quality measures (e.g. relevance, accuracy or understandability).

It is however apparent, that these aspects - aesthetics, usability and content - can be taken separately only to a certain degree. They are all present together in the website, they have an influence on each other and they are all incorporated in overall user preference. Relation between usability and aesthetics in human-computer interactions generally is widely researched (Tuch,

Roth, Hornbæk, Opwis, Bargas-Avila, 2012). Previous studies have shown that subjective evaluations of usability and aesthetics are correlated (Hassenzahl, 2004).

3 ACTIVITIES ON WEBSITE

There is a large number of studies, which deal with browsing and interaction on websites. To the authors´ best knowledge, there is limited research on sequential modelling of user activity in scope of one website and one session, in association with website´s aspects. The approach presented in this paper aspires to bring a novel view on this matter.

Three essential user activities were identified in relation to browsing a website. These activities were labelled as: scanning, interaction and reading. Scanning comprises visual scan of a website, along with developing basic orientation on the website, scanning text and pictures and building first impression. Interaction includes searching for interaction possibilities and using them in actual interaction with the website. Reading activity involves more thorough scanning and actual reading of website content, as well as its understanding and evaluation. Suggested activities are based on review of related literature, which is further discussed in separate sections.

3.1 Scanning

Scanning had been used in literature as e.g. organizational scanning or browsing. Four scanning modes had been defined: undirected viewing, conditioned viewing, informal search and formal search (Choo et al., 2000). These strategies are divided according to mode in which user access internet. Scanning can be of different nature according to user´s mode of browsing. Users can either look up a certain web page for a particular piece of information or just surf the internet without any particular goal of their surfing (Schenkman and Jönsson, 2000). Scanning in this context indicates user behaviour across more websites. Scanning in the context of this article refers to brief survey of the website (one website) visually, also including basic text scanning and searching for affordances.

In a scenario of one website, user can either search for particular information within the website, or he can just browse through the website according to what catches his attention. Moving to another webpage is very easy if the current webpage does not appeal to the user, which is why the first

impression of websites is so important (Schenkman and Jönsson, 2000). It was proven that people form an opinion about website based on its visual appeal in a time interval as short as 50ms (Lindgaard et al., 2006).

Scanning is, according to authors´ opinion, the first activity performed by a user while entering a website and includes several continuously proceeding actions:

- gathering impression about visual appeal (usually mostly unaware)
- scanning graphics and pictures - according to their nature, pictures either contribute to visual appeal or help the user with scanning text or searching for affordances
- scanning text - searching for desired text fragments in headlines and paragraphs
- searching for affordances (action possibilities) - hyperlinks, menu items, and other interactions

Studies of how users read on websites found that they do not actually read, instead they scan the text, or they first scan the text before actually reading it (Morkes and Nielsen, 1997). Scanning text means not reading word by word, but e.g. only the first sentence of each paragraph to find the desired information. If the user finds scanned section of text satisfactory, reading activity takes place. If the user does not find desired information, he tries to interact with the website, usually in order to get to another set of information. Usually it requires at least several mouse clicks until the user finds what he is looking for. Interaction is therefore the next activity in proposed browsing model.

3.2 Interaction

Interaction in the context of this article means finding and using an affordance (action possibility) on the website, which is conditioned by quality of the information architecture and navigation of the website.

Affordances are not just about functional meanings and motor capabilities; they are also about emotional and cognitive processes that emerge through interaction (Overbeeke and Wensveen, 2003). Interaction aesthetics are one among other factors that allow users to enhance the detection of action possibilities and consequently, the detection of affordances (Xenakis and Arnellos, 2013). That is why searching for affordances is included also in scanning activity and it is therefore connected with aesthetics, even though interactions are mostly associated with usability.

Affordances include control areas of the website such as menu, hyperlinks in sections of text, additional functionality in the form of buttons etc. Interaction activity implies finding desired functionality and appropriately using associated affordance.

This interaction activity comprises several actions:

- searching for functionality (this originate from scanning activity)
- identifying desired affordance
- using the affordance correctly (e.g. hovering or clicking)

Successful search for functionality is dependent on purposeful navigation and logical information architecture. It also depends on design and therefore also aesthetics, or more specifically interaction aesthetics. Also successful identification of the affordance and using it correctly depends on appropriate design. Correct usage implies recognition of action - usually it is a mouse clicking, but it can be also e.g. hovering, dragging or scrolling.

3.3 Reading

Reading activity is proposed to follow after scanning activity, as users usually scan the text before actually reading it. Reading activity can be preceded by series of scanning and interaction activities, until the user reaches desired or just interesting section of text. Reading is expected to include two sequentially or interchangeably performed actions:

- more thorough scanning of headlines and paragraphs
- actual reading and understanding of the text
- retrieving desired information
- evaluation of read text and retrieved information

Successful reading depends on many factors associated with information quality and quantity but also usability, especially legibility. Content should be relevant, understandable and its arrangement should follow some basic design principles such as chunking or proximity.

All presented activities are performed by user sequentially, some of them are overlapping in specific actions.

4 BROWSING MODEL

User browsing cannot be entirely generalized, as every user has different background, abilities,

personality etc. which results in individual browsing style. Nevertheless general order of actions can be expected based on conclusions from previous sections and related literature with performed experiments on user testing.

The authors suppose, that in every sequential phase or activity, the different aspect of the website is primarily influencing user actions and also success of his actions.

It was demonstrated that visual appeal or aesthetics is likely to be detected first and it can influence subsequent experience with the webpage (Lindgaard, Fernandes, Dudek and Brown, 2006). Therefore scanning as the first activity is supposed to be mostly connected with aesthetics aspect. Aesthetics is then the most pronounced during the scanning activity.

Interaction activity includes searching for interaction possibilities and their usage. This activity is influenced especially by usability of user interface such as information architecture, navigation etc. Therefore, usability is expected to be the most pronounced aspect of interaction activity.

Reading activity is supposed to be experienced at the latest, as the user rarely finds what he is looking for on the first page. Information quality (or quality of content) is proposed as the most influential during reading activity.

Table 1: Suggested user activities on the website associated with most pronounced aspects.

User activity	The most pronounced aspect during the activity
Scanning	Aesthetics
Interaction	Usability
Reading	Content

4.1 Simulation of User Browsing

Development of activities in the presented simulation is an example of real situation, when the user starts actual reading or information retrieval after two clicks and then again and again after additional click. The magnitude of individual aspects signifies their participation on current activity, which is perceived by the user. Actual values are estimated according to previous research conclusions and also authors´ own presumptions, which are listed in the next section.

4.2 Entering Conditions

Previous simulation depicts expected influence of aesthetics, usability and content on user in different
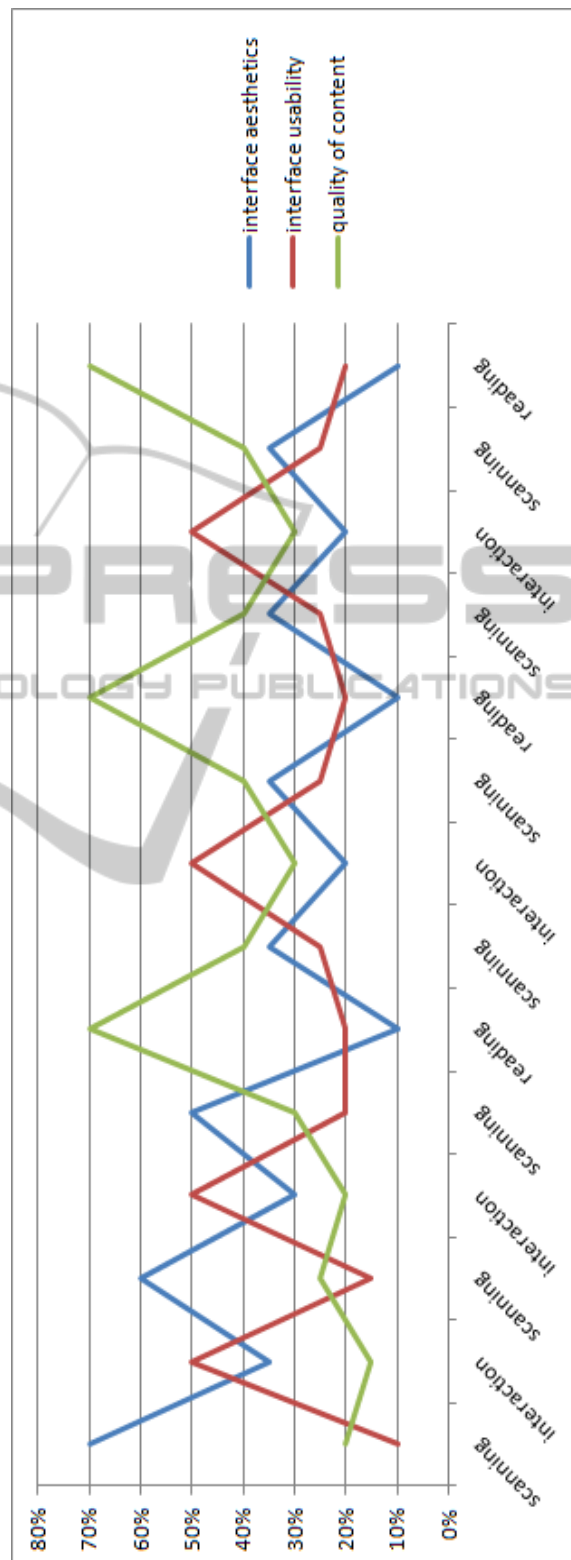

Figure 1: Simulation of user browsing on the website.

phases of working with the website. The conditions on which was constructed simulation of the browsing model are discussed in this section. These presumptions are:

- aesthetics is the most influential aspect in the scanning activity (see first aesthetics impression), but it is gradually losing its magnitude (only to a certain degree - feeling on visual appearance usually persists) with user´s increasing interest in content, which can be expected with further browsing on the website
- aesthetics, especially in a form of interaction aesthetics, is also significant during interaction activity, but its magnitude is again gradually decreasing (only to a certain degree)
- aesthetics during actual reading or information retrieval is quite insignificant on stable level
- usability is the most prominent aspect during the interaction activity and its share of influence is expected to be stable during all interactions
- influence of usability in scanning activity is low at first (aesthetics dominates), but is gradually increasing, as the usability issues such as visual organization and navigation are becoming more apparent during scanning
- participation of usability while actual reading is low but higher than of aesthetics, as organization and legibility are parts of usability aspect
- quality of content is of course most significant during reading activity
- quality of content in scanning and interaction activities is low at first but gradually increasing, as orientation on the website is already clearer for the user and visual impression is established, scanning is expected to become more content-oriented with more time spent on the website

Presented model and its development suggest, that influence of individual aspects and their participation on overall judgement is varying according to the time spent browsing on the website and distribution of performed activities in that time. It is expected, that with more time spent browsing the website, the overall judgement will be more influenced by information quality.

The aesthetics and usability aspects however are crucial for actual getting to the content. This usually corresponds with the real situation. Another study which was researching importance of quality dimensions to overall judgement also discovered that the most important component was content, then usability and finally aesthetics (Hartmann et al., 2007).

4.3 Mode of Use Variations

The overall judgement as well as perception of usability and aesthetics are highly dependent on context (de Angeli, Sutcliffe and Hartmann, 2006). They are also influenced by the mode in which the user approaches the interface (van Schaik and Ling, 2009). Information retrieval is different than surfing. When looking for information, users are more focused and content is the driving force. When users surf, they are just browsing and clicking at what looks most interesting (Spool et al., 1998).

Mode of use would certainly influence the browsing model. It is expected that aesthetics would be more influential during surfing. In the goal mode could be more significant usability and information quality even during scanning.

5 CONCLUSIONS

This paper presented the model of user browsing behaviour on the website. Main user activities during browsing on the website were proposed, discussed and supported by related literature. Suggested activities were associated with three main aspects of the website, which were identified as aesthetics, usability and information quality. Associated in the sense that they are primarily influencing user actions and also success of his actions during the relevant activity.

Browsing model was designed on the basis of previous research´s conclusions and new considerations. Simulation of user browsing on the website was presented. Variations of the model according to mode of use were discussed.

More factors can alter course of the browsing simulation. Proposed browsing model dealt only with the first visit on the website in one browsing session. The influence of individual aspects would be different in case of repeated visits. The model also did not take into consideration various types of websites. This should be covered in future research as well as supported with results from user testing.

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