# Quality Approach of Web Documents by an Evaluation of Structure Relevance

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### *Abstract*

*In this paper we present a user approach to evaluate a commercial web site quality. Due to the difficulty to define a web site, the associated quality can be evaluated from different information. We chose to study the behavior of an observer during the exploration of the page and to convert it with a specific analysis of the document structure. In this paper we propose a definition of quality in relation with a retrieval information goal included designers' intentions and users' need. The visual scan-path studied with an eye-tracker. We will explain and show the link between the visual quality and gaze movement obtained from oculometric data. Finally, the structure of document will show its strong connection with the web site visual quality.*

## I – Introduction

The « world wide web » usually called web, is a powerful network. Acting people in this network are users and designers : web sites are created by designers for users. Both users and designers have common interests in terms of web sites quality. On the one hand, designers want to create attractive pages where people will stay and maybe will have a commercial transaction (on a commercial site). On the other hand, users are really influenced by the quality of web sites that they visit.

In this work, we define indicators to appreciate and evaluate the quality of a web site by the study of the observers' eyes movements and by the analysis of the structure of web documents. In that context, we consider the web site as a document that can be treated and analyzed with usual methods employed in that field. The definition and the determination of the quality of a web site is a complex task that depends on the definition of the site itself. Unfortunately, web sites have many way to be defined and studied. From geographical to technical through commercial points of view, all approaches are complementary but individually inefficient. The definition of a web site depends on the observer's point of view that is strongly correlated to the quality of the site. In this context, we choose to study s**tructured images of web documents** which will show how observers are looking at the web site and will allow us to extract an expression of quality. In that purpose, we have used an eye movements recorded device : the eye-tracker.

The eye-tracker device allows us to record the position of each eye of a subject during a scan on an image. With the information relative to the succession of gazing points, it's possible to study the gaze movements of observers on web sites images. As an example the figures 1 and 2 illustrate recorded scan-path obtained on a travel agency site; scares represent the eyes positions.

In this paper, the first part deals with the description of the web sites we chose for our study and the definition of the associated quality. In the second part, we introduce the experimentation and the measurement of the quality of web sites. In the last part, experimental results show how the quality is correlated with the visual exploration of the observers and with the documents structures.

## II - Web Sites and Quality

There is no unique answer to the question "What is a web site ?". The definition depends on what you want to study on it. According to economical and industrial standards, a web site is a product and a service :

- a product that is created by designers, published on the web and used by users
- a service that offers information or products that can be sold or given for free to consumers.

In the paper, we chose to look web sites as a user's service. This approach allows us to do a user analysis of the site, a visual, a structural and an ergonomic description. A web site is studied as an image through the scan-path description of the observer. Among the great set of internet sites, the corpus we picked up for our study had to correspond to the above definition. Commercial sites seemed to be the best ones. Among these commercial sites we reduced the corpus to only virtual online travel

agencies. In this experimental work, we have decided to study only the first (and most important) page of the selected web documents: it is the welcome page. This choice led to a visual and ergonomic description without taking into account all navigational problems.

The second basic point of this study deals with the quality on the web. It needs a good characterization, a robust method to help us to appreciate each tested web page. The total and absolute evaluation of a web page is too subjective and it depends for a great part on the observer's purposes. So, by fixing a goal to retrieve information in the page, it becomes possible to define a particular quality. This solution can be a possible answer to the question "In which way does the visual organization of the web pages help to lead the visual exploration for an information retrieval ?". An explicit goal can be formulated with respecting two characteristics :

- It must be compatible with the set of the designer's intentions.
- It must be compatible with the set of the user's potentials.

Our purpose is not to speak about beauty, graphics or art of the web, but to describe qualitatively a site by its capacity in answering a goal. This paper does not speak about an absolute quality of web document but about a quality within a referent system.

The evaluation of web site quality is a very recent domain of research. Most of the existing works concern the study of criteria grids. These grids are based on a set of questions where each question corresponds to a criteria to be tested. This set of indicators measures the different web objects and elements of the page but rarely their visual aspect. Furthermore, these grids are small or big, automatic or manual but they are generally not interested in users' intentions and reactions [1]. Moreover, the criteria are often generated by and for technician designers. New studies have now integrated usability, ergonomic criteria and users' approach. In this context, Bastien and Scapin [2] have developed a very interesting ergonomic grid based on general concepts of usability. Recently, Jakob Nielsen's book [3] was dedicated to web sites design in a way of usability. In this same way, we choose to evaluate web sites within a precise goal and an analysis of human visual behavior during a task of information retrieval.

Basically, a web site will be judged by its ability in answering a goal. Therefore, the web pages have been chosen carefully to be analyzed with an explicit and simple goal. Among all commercial web sites we have chosen a particular group : online travel agencies.

## III – The S.H.I.V.A. project

The evaluation of quality of web sites with users' intentions is strongly correlated with human visual perception and eyes movements. This work is a part of a great project : the S.H.I.V.A. project (Site Hypermédia et Inspection Visuelle Automatique) [4]. The experiments were realized with an eye-tracker device. This device allows to record online the position of each eye of a subject on a web document or on a picture (see figures 1 and 2).

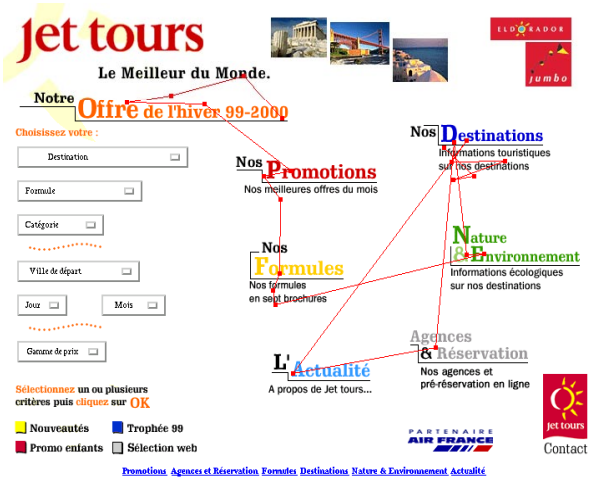


**Figure 1 : few fixation points on a visual and structural good quality web site**


**Figure 2 : many fixation points on a visual and structural bad quality web site**

For this experimentation, a precise protocol has been elaborated. In terms of result, the major recorded data were collected from two different methods.

The first collected data are the oculometric recordings of the set of eyes positions. All the different points recorded can be aggregated when they are close in space and in time. They become stable eyes movements points called fixation points. Those new points represent the parts of the document where the glance really stops and where the subjects have a true attention. They also allow us to

visualize the scan path on the page during the exploration, to determine relevant focused regions and to analyze the perception of the observer. Examples of this recording are presented in the figures 1 and 2. In those figures, fixation points are represented by squares and are chronologically linked.

The second collected data are the answers of a questionnaire. All subjects who have been recorded had to answer to some questions. They deal with the knowledge included in each web page and with the global exploration of the page. This questionnaire was done to allow subjects to formulate there appreciation and judgment. We made a simple and short questionnaire with nine essential questions. All asked questions came from usual evaluation and ergonomic grids. We selected only the elements in relation with the project concerning the visual perception and the mechanisms implied in selecting information. Therefore, the appreciation that is formulated by the observers represents his visual and ergonomic judgment for each tested page. The answers are presented by values (from 1 to 5) corresponding to a mark relative to the appreciation of the observer. The nine indicators can be summed up by general impression, links understanding, visibility of text, semantic understanding, pictures understanding, text - picture relation, conviviality, time spend on page and desire to buy.

## IV - Quality, Time and Structures

### III-1- Quality and Time

The first step of our work is to define an evaluation of quality of each selected and tested web site. This evaluation must reflect the purposes of the experiment : a relevant expression of the visual quality of a web site within a precise goal. The collected indicators are the representation of the quality of the web site. Indeed, the nine selected questions come from ergonomic standard grids and are all independent. They represent the different aspects of an ergonomic analysis. They correspond to an evaluation formulated by the subjects after the experience. Their interpretation is a good evaluation of the visual quality of a web site and reveals also a qualitative judgment for each goal connected web site.

Can one of all the above criteria simulates the quality of the page ? Does a mark exist that would be for the subjects the subjective expression of the ergonomic and visual quality of web pages. With a scale adaptation, statistical methods of comparison give an interesting result : one of the indicators is correlated to the visual quality. It is the "time spent to explore the page". This indication of time is given by the subjects after the experimentation and gives a subjective expression of the scan duration. The subjective time spent on the web site is a good representation of the quality evaluation of a web site in a context of information retrieval. The figure 3 illustrates the resulting link between the total number of fixations and the subjective evaluation of quality given by the observers.

Do the real data agree with this subjective formulation of quality ? From the oculometric recordings, two particular elements will answer this question. The global scan-path duration corresponding to the time spent to find the information and the number of fixation points can be compared to the subjective time given by the observer.

In the same way, numerical comparisons show that even if duration path and number of fixations aren't correlated by definition (a fixation is defined by a minus time in a maximal space, with no maximal time), they are correlated by fact. The duration time spent on a web document, and the number of fixations necessary to retrieve information represent a same indicator. Finally, the comparison between the subjective indicators (quality and subjective time) and the real indicators (real time and number of fixations) shows that all these data are correlated (show graph results on figure 3).

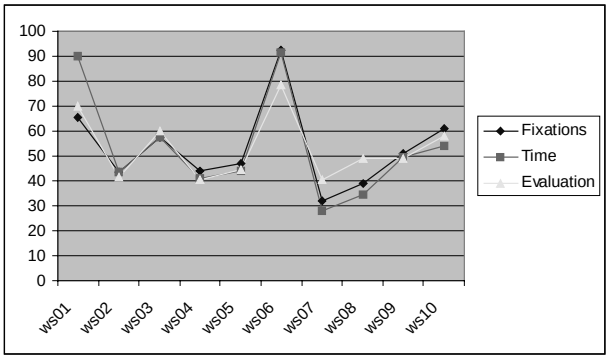


**Figure 3 : visual quality, time and fixations comparison graph on 10 web sites**

With this experiment, we show that the evaluation of the global visual quality of a web site can be defined and extracted from the answers to the questionnaire. This quality is defined by a set of criteria and in relation with a goal. This evaluation has other different ways to be expressed by subjects.

- Firstly, by the subjective time spent on the web site. This time can be obtained by the questionnaire.
- Secondly, by the real duration time of the eyes movements which comes from the recordings of the eye-tracker and can also be expressed by the number of fixation points that comes from a pre-analysis of the eyes positions.

With those experiments, we endeavored to prove that there is a strong link between the time spent to retrieve a precise information on a web page and its quality.

### III-2- Quality and Structures

Document analysis and document structures extraction is a rich domain. Many approaches already exist and today new ones appear. The characteristics of those new methods are based on the relations between documents, human perception, cognitive sciences and biology. The document is split up into two major common structures :

- The physical structure that expresses the organization into geometrical blocks done with homogeneous characteristics. This is the layout of the document.
- The logical structure that expresses the semantic description of the physical organization, that deals with the human interpretation of each blocks (line, section, title, paragraph...).

It has been previously shown that time is a representation of the quality of the web pages. The study of the existing relations between time and structure will allow us to establish a link between quality and structure of web document. It has been already proved that the number of fixation points and the location of those points in time and space are highly correlated with the document layout and structure [5]. According to our experiments, the fixation points are not fitted randomly but they are always connected with the structure. In our study, subjects had expressed the quality of the different web documents. On the one hand, "good" web pages (see figure 1) are characterized by a simple structure, a simple scan path, a low number of fixations, an heterogeneous distribution of fixations and an understandable physical structure on low level (during the pre-attentive vision). On the other hand, "bad" quality web documents (figure 2) is characterized by many fixations, an homogeneous distribution of fixations on the image, a rather high density of information and no logical path on the physical structure.

From these elements, we can notice that there is a strong relation between the quality and the structure of web documents. More especially, a simple and understandable logical and physical structure induces a positive quality judgment during the retrieval of information on a web page.

## V – Conclusion

In this paper we have developed an approach to evaluate visual quality of commercial web sites. We have also shown the existing link between the global scan-path and the complexity of structures (physical and logical). Due to the difficulty to represent a web site definition, the associated quality can be evaluated from different contexts. We chose to study the human visual perception and to link it with visual and ergonomic quality. The experimental information has shown that this quality was correlated to physical and logical document structures. This quality was defined in relation with a retrieval information goal included designers' intentions and users' needs. The eye-tracker device gave us a lot of results about the eyes positions and about the scan path on a web document image. Four indictors of quality were extracted; two come from the real recordings,

- the quality mark defined by the synthesis of ergonomic attributes
- the subjective time defined by the time spent on page to retrieve an information.
- the number of fixation points that represents the focused area on the web page
- the real duration time of scan-path spent to find the information on the web document.

The results show the correlation between the kind of fixations distribution, the visual quality and the real structures of web pages This important link underlines the need of simplicity to realize a web site. Users ask for visual simple scan path and effort reduction. In this way, the structures must be easily recognizable, perceptible on each physical level, the physical structure has to express the logical one with no ambiguities.

Those results express the needs to link visual quality and structure of web site documents. The links that exist between quality, duration of eye gaze, number of fixations and structure of the web documents allow us to study the visual organization and local complexity of the pages. Currently, a project of development of a tool that automatically evaluates the visual quality of a web site in the context of information retrieval goal is in progress. The project is based on the presented experiments and it is at the origin of the determination of a relevant expression of the visual quality from the analysis of logical and physical structures of web pages.

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