

Fundamentals of User Perception and Interaction: Environmental Psychology applied in a study of web pages

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ABSTRACT

This paper explores the possibility of using theories and concepts from the field of environmental psychology as a framework for understanding perception of- and interaction with web pages. A qualitative pilot experiment has been conducted in order to investigate potential similarities in how people interact with, and perceive web pages and real world environments. This study indicates that perception of web pages is very similar to perception of natural environments. Many key factors that have proven to be important in perception of natural environments, such as complexity, spatial configuration and mystery, also appear to be relevant determinants in perception of web pages. Further, it also seems likely that interaction with web pages, to some extent can be described using a model based upon a conceptual framework depicting habitats selection.

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1. Introduction

Information technology is today connected to almost every single activity that humans in the modern world engage in. The efficiency but also the complexity of information systems and applications has increased dramatically during the last decades. Further, a widely spread usage of technology by people in general has also lead to a situation where many different types of user groups should be able to use the same application/system. One example of this development is constituted by the World Wide Web, which, as a global information resource has an enormous number of users. In such a context, designers and developers cannot assume that users will represent a homogenous group, or have reached a certain level of technological competence, but rather has to realize the diversity the situation presents. This condition calls for reflection regarding how to practice design in such a way that the same information system, in a reasonable way, can satisfy a large diversity of users. Thus, there is a

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need for an overarching understanding of why and how people interact with- and perceive information systems and applications. There are a number of different approaches available to handle situations like the one being outlined above, one of them being constituted by the Usability area. This paper has a somewhat different approach and explores the potential use of ideas and theories deriving from the field of environmental psychology as a framework for creating a deeper understanding of how people interact with, and perceives information systems and applications. More specifically the focus is set on perception of and interaction with web pages. The leading idea has been to investigate if there are similarities in perception of web pages and real world environments, and if so how these similarities might contribute to our understanding and practise of design.

2. Theoretical framework

The environment constitutes an important factor in the lives of humans. Some places are found inviting and appealing while others are dull and boring. Questions focusing why people prefer certain types of environments to others are thus interesting to investigate. Environmental psychology as a field deals with questions of this type, among many others. The field ranges from trying to understand the basic relationship between human behaviour and physical environment in terms of the spatial-physical dimension of the environment as constituting part of human actions and behaviour, to looking at social-psychological factors and a broader, more general theme of interplay between people and their contexts (Bonnes & Marino, 2002). Put differently, environmental psychology can be seen as the study of the molar relationships between behaviour and experience and the built and natural environments (Bell, Greene, Fischer & Baum, 2002).

Theories within the area of environmental psychology suggest that there might be both cultural as well as evolutionary factors affecting how people perceive different types of environments. As an example, Balling and Falk concludes that observed landscape preference could be a function of both innate landscape preference and environmental experience (Balling & Falk, 1982). Put differently, both environments that people have previous experiences from and a possible existing heritage from the shared history of humankind seem to affect perception. Further, one particular type of landscape that seem to attract people has turned out to be the savanna (Balling & Falk, 1982, Orians & Heerwagen, 1995). Research has been done trying to identify the type

of attributes in environments that appeal to people, that is, why a specific environment such as the savanna, is preferred before another (Synek, 2002). One set of suggestions builds on the concept of exploration and information gathering. In an article written by Orians and Heerwagen, the authors refer to research done by Steven and Rachel Kaplan (Kaplan, 1995) which suggest that:

"[...] preferred landscapes tend to be easier to 'read' than other landscapes, but not so easy that they are boring. Desirable landscapes contain moderate degrees of complexity, a sense of coherence, and a semi-open spatial configuration." (Orians & Heerwagen, 1995).

The quotation above indicates, although in a somewhat condensed way, that there seem to be a number of basic attributes that affect perception in a positive way. However, important to notice is also that some of the attributes vary along what can be seen as a scale. One obvious example is the attribute complexity.

Studies investigating preference of different environmental settings have also showed that an attribute named mystery often is positively related to preference. Mystery meaning that a specific environment has something more to offer than what is immediately perceived. An example of mystery could be a small hill in an open space, promising a better and more overarching view of the environment behind it than the current view offers. Further is noticeable that nonurban settings in general are preferred over urban settings (Herzog & Smith, 1988).

In an attempt to understand adaptive functioning in different environmental contexts, Orians and Heerwagen present a conceptual framework containing one spatial and one temporal frame of reference. The framework builds on theories of habitats selection. The spatial frame of reference is concerned with different stages of exploration that occur when an individual is confronted with an unfamiliar habitat. Three different stages are incorporated in the spatial frame of reference. The first stage includes the initial encounter with an environment. At this stage, the individual make instant judgements whether to explore the landscape or to move on. The decision making process at this stage occur according to the authors with almost no conscious interference. The rapid response from the individual at this stage is connected to general features of the environment such as spatial configuration, the degree of openness and the degree of complexity, as described for example by the Kaplans (see above). If the reactions at stage one are positive, the individual moves on to stage two. At stage two, the

individual engages in what the authors name information gathering. This is where a more thorough exploration of the current environment occurs. The authors divide important features of the environment at this stage into being either enticing to exploration (for example features such as mystery, novelty and suprisingness) or helping for orientation and wayfinding (for example a viewpoint from which one can see the environment as a whole). Finally, stage three concerns the long-term decision of whether to stay in the particular environment or to move on. Decisions made at this stage are believed to be closely connected to the specific purpose of the visit to that environment. The relation between the purpose and the overall impression of the environmental features is thus important. As I interpret the authors, all three stages in the spatial frame of reference are concerned with attributes in the environment that pertain a certain degree of stability and thus are inherent in the actual spatial configuration. Hence, even though there is a temporal aspect (in a strict sense) in the spatial frame of reference (given that an individual engages in three different stages), the main concern is how the attributes inherent in the environment affect the individual.

The temporal frame of reference on the other hand, is concerned with time and how different events in the environmental setting trigger a decision-making process. The authors divide this frame of reference into different sections depending on a time-scale; environmental cues that require immediate response, cues associated with seasonal changes and finally, cues influencing long-term behaviour. As an example, transitory cues such as weather and fire require swift responses, whilst seasonal changes are more predictable and thus do not call for immediate attention. (Orians & Heerwagen, 1995).

When trying to understand interaction with- and perception of web pages knowledge from the field of environmental psychology could be a useful resource, this by looking at web pages as being actual environments that a user interact with and “live” in. When considering web pages as being computer-based environments, the concept of exploration and information gathering as presented above becomes interesting to study. For example, is it possible and productive to view web pages as environments, and is it possible to think about adaptive functioning in different environmental settings (as described above) in the same way in connection to web pages? Considering the conceptual framework derived from habitat selection, one of the two frames of reference seems particularly interesting to investigate further, namely the spatial frame of reference. This part of the framework deals with features inherent in the actual spatial configuration of the environment, which then subsequently can be compared to

features inherent in a web page. However, as stated above, the spatial frame of reference can nevertheless be considered to include a temporal structure (in a strict sense) in that an individual actually moves through different stages in their relation to the specific environment. On the other hand, this does not present a problem since such a temporal aspect could be further explored in relation to web pages.

Besides the aesthetic part of environments, when looking at computer-based environments (i.e. web pages in this paper) the concept of functionality becomes relevant to consider as well. Thus, to study perception of- and interaction with web pages, also includes creating a basic understanding of the relation between aesthetics and functionality. Relating attributes that go with the concept of exploration and information gathering and the different stages of habitat selection, with functionality and aesthetics could perhaps also aid practitioners working with design and development of web pages by functioning as a ground for new design principles and guidelines. If nothing else, ideas from environmental psychology might at least serve as a ground for reflection.

3. The study

As a starting point for exploring the use of theories from environmental psychology in generating an overarching understanding on the subject of perception of- and interaction with web pages, a pilot experiment has been conducted. Being a pilot experiment, the research methodology has been somewhat explorative and consequently there is a need to discuss future potential (and perhaps different) methodological approaches. I will however return to that discussion in the concluding section of the paper.

The main objective of this pilot experiment has been set at trying to identify attributes that seem to have an impact on how people perceive web pages, and subsequently try to relate these attributes to more general attributes that have been found influencing perception of real world environments. A second purpose has also been to attempt to relate the respondents' interaction with the web pages to the three different stages included in the spatial frame of reference. Thus, this implies making use of the terms (1) *initial encounter with environment*, (2) *information gathering* and (3) *decision-making-process*. At each stage in the spatial frame of reference, certain main attributes in the environment are important (as presented in the account of the

spatial frame of reference above), and are thus interesting to look at in relation to web pages as well.

3.1. Participants

Eight individuals were involved in the experiment. When choosing which respondents would take part in the study, no other criterion was used but that they in some way would represent two different types of users. The two different user-types were defined as experienced and non-experienced users. This was achieved through preliminary interviews with the respondents. The experienced users were all familiar with browsing websites, whereas the non-experienced users only had sparse knowledge and experience of using computers and browsing websites. Each respondent subjectively described their own view on their knowledge and experience of browsing websites and using computers. Four respondents representing each group were selected.

Apparently, when conducting an experiment such as this, one could strive towards including a large amount of respondents in order to be able to work with statistical analysis. This particular experiment is however, as stated above, a pilot experiment where the main objective is focused more towards exploring the idea of environmental psychology applied to web pages, than finding statistically valid relations. Thus, this experiment should be considered as a first possible step towards a more comprehensive set of studies.

3.2. Web sites used in the study

Four web sites were used in the experiment. An attempt to include web pages that in some way differed regarding for example spatial configuration and the degree of complexity was made. Naturally, a selection such as this is dependent on the individual perspective of the person selecting the sites. Consequently, the perception of the sites is dependent on whoever perceives them. However, this does not necessarily constitute a major issue when the key objective is set at identifying attributes that have impact on perception *as such*. The four web sites included in the study were:

K10k.net

This web site was chosen because of the high amount of objects presented to the user. The first page of the site consists of a large number of different squares and rectangles, each containing information and/or links. In some cases, a separate scroll is included into the rectangles as well.



Fig. 1: Screenshot from k10k.net.

TheRemedProject.com

This web site differs from the rest in the study by using the whole computer screen actively. This means that the web page is not showed in a single window, but is maximized so that it covers the entire screen. The web site also uses a somewhat different style regarding navigation. Images and objects are movable and contain different types of functions and events. Hence, this website was primarily chosen because of its rather unusual style of interaction.



Fig. 2: Screenshot from theremedproject.com.

Spelbutiken.se

This web site represents a frequent way of structuring information. Navigation is handled by a main navigation list at the top of the page. Navigation is also possible by choosing from the menus to the left and to the right hand side of the page. This web page was chosen because of its, compared to some of the other sites, relatively small amount of objects presented to the user.



Fig. 3: Screenshot from spelbutiken.se

Vnunet.com

This web page uses the newspaper metaphor in its design. Navigation is handled by menus at the top of the page but sometimes also on the left hand side. This web page was primarily chosen because of the vast amount of information presented, but also because of the common way of structuring information. The page has many sub-levels within its navigation.



Fig. 4: Screenshot from vnunet.com

3.3. Procedure

Each individual was asked to browse through the four different web sites. There was no explicit time limit for this activity, however the user had to spend at least five minutes on each particular site. The browsing session took place in a room containing a desktop computer on which the respondent browsed the websites. Two people were present in the room at each session, the respondent and the researcher. After browsing through each site, an interview was carried out with the respondent. The interview was conducted as a semi-open interview in which the respondent was asked general questions as a form of support in order to be able to express his/her opinions, feelings and thoughts concerning the specific website. The interview was recorded and transcribed to simplify analysis of the material. The researcher also took notes during each session.

The procedure for extracting relevant attributes from the empirical material was to analyse the material in order to uncover concepts that were expressed (by the respondents) to have an influence on perception. Concepts that were closely connected were then condensed into single concepts by the researcher. For example, the use of the attribute “exciting” is in this text a generalisation that covers closely related concepts such as “thrilling” and “stimulating” as expressed by the respondents. Consequently, it is important to emphasise that the key attributes used below represent generalizations.

4. Results – central attributes

The overarching purpose of the study can be divided into two main parts. The first part is focusing on perception of web pages, specifically looking at attributes that seem to be central for perception. Interesting here is to investigate if a mapping between attributes the participants have given voice to, and the general attributes presented earlier in the paper, is possible. Put differently, are the same kind of attributes that are important in perception of natural environments also central in perception of web pages? The second part of the purpose is focusing on investigating if and how interaction with web pages can be described using a model inspired by the conceptual framework depicting habitats selection described by Orians and Heerwagen (Orians & Heerwagen, 1995). In other words, does interaction with web pages go through the three stages as presented in the spatial frame of reference?

The following list summarizes the *generalized* attributes derived from the expressions the participants gave voice to concerning the web sites they were confronted with. What is worth noticing though is that the list presents a somewhat simplified view of the attributes. As I will try to illustrate below, attributes seldom exist isolated, but are rather connected to each other in a complex web of relations. What is being considered as positive in one context can be perceived as negative in some other context. However, the list serves its purpose by giving a basic view of the central attributes expressed by the participants as influencing their perception of the web pages.

- Legible
- Simple
- Boring
- Nice looking
- Good structure
- Exciting
- Messy
- Confusing
- Lack of structure

4.1. Legibility, simplicity and boring

In general, legibility was considered a positive attribute. Often this concept was associated with both the structure of the web page and the actual text being presented. A web page containing a fairly small amount of objects was often considered having a high amount of legibility. When specifically related to the text that was presented on the web page, legibility was often related to (i) the amount of text being presented, (ii) the size of the text and (iii) the contrast between the text and the background. Not surprisingly, some respondents argued that a bad combination of colours regarding text and background made the entire web site hard to grasp and appreciate. A bad combination was often referred to as a lack of contrast. For example, one respondent said the following about this relation:

“The colours used on this web page makes understanding it hard. It’s almost impossible to see the text on that background.”

This specific statement was made concerning the web page k10k.net. The following figure gives an example of the use of colours on this site.



Fig. 5: Screenshot from k10k.net.

However, legibility was also connected to the attribute “simple”. A web page having a simple design was often considered having a high amount of legibility. Although this was often perceived as something good, the combination of these two attributes was not something solely positive. In some contexts, several of the respondents found the combination to be negative. One respondent said the following about the site spelbutiken.se:

“The design is very simple [...] which in this case fits the purpose of the site, but it’s boring, not enticing at all.”

What is interesting about this statement is that the respondent in some way thought the design of the web page to be good in relation to the content of the site, still the respondent also argued that the design was too boring. In other words, the design of a web page might be considered as fitting the purpose of the site, but still not appealing. The purpose of the respondents visit to the site might thus in this context play a very important role, which I will return to later on in this paper. As in the case of the general attributes, described in the theoretical framework, attributes in this study also seem to vary along a scale.

4.2. Nice looking

An interesting attribute is “nice looking”. Although this was a fairly frequently used concept for describing positive feelings toward the design of a web site, many of the respondents had problems explaining specifically what in the page constituted the “nice looking” part. However, one of the respondents had the following explanation to this concept regarding the site k10k.net:

“It (the web site) was, to speak in aesthetical terms, nice looking. That is to say, the use of colours, the constellation and the proportions between text and images.”

For this particular respondent, the most important feature of the web page considered nice looking, was the proportion between the different objects on the page. Referring back to the concept of information gathering and exploration described by the Kaplan's, this might be looked upon as corresponding to the moderate degree of complexity and the semi-open spatial configuration found to be positive factors in perception of natural environments.

4.3. Good structure

Good structure was considered something positive by all respondents included in the study. However, this concept seemed to be even more important for the non-experienced respondents than for the respondents familiar with computers and information technology. Good structure was often related to a design that the non-experienced user previously had been in contact with. One of the non-experienced respondents said the following about what he/she thought to be good in the site vnunet.com:

“... What is good about this web page is that I recognize the design from other sites I have been visiting. The menu – I like to feel ‘at home’.”

Thus, recognition of familiar patterns was central in this context. However, it is important to understand that the recognition of patterns does not have to do solely with patterns from computer-based environments, but can as well be connected to patterns found in other types of environments/media. As an example, one of the included web pages (vnunet.com) uses a common newspaper-metaphor in their design, which some respondents expressed helped them understanding the structure of the page. The following figure illustrates a section of the main navigation list on vnunet.com.



Fig. 6: Screenshot from vnunet.com.

Recognition of patterns might be looked upon as a form of environmental experience, described by Balling and Falk as one of two important factors of landscape preference (Balling & Falk, 1982).

4.4 Exciting

Though recognition of familiar patterns was considered as something positive, lack of recognition could also influence perception of a specific web page in a positive way. This phenomenon is illustrated by the attribute exciting. A good example of how this attribute was considered to be something positive regarding perception is illustrated by the following quote made about the site theremediproject.com:

“There were some sounds and funny colours [on the web page] which made me feel curious – what will come out of this? But then again, I had some difficulties in understanding what the web page was all about.”

The attribute exciting was in general connected to some kind of explorative feeling experienced by the respondents. This attribute can be seen to correspond well to the concept of mystery as described in the theoretical framework. One web page in particular (theremediproject.com) seemed to generate stronger feelings of exploration than the other web pages included in the study. This web page differs from the other three pages by actively using sounds in the design. As an example, sounds are being used both as effects when the user clicks on a link, and as a background component which means that the sound contribute to the overall impression and perception of the web page. However, theremediproject.com also differs by containing a movable navigation. The user can interact with the web page by moving pictures and blocks of text around. At some points different objects on the page partially covers other objects, which leads the user to a situation where he/she has to interact in some way to be able

to access the information located behind what is currently being presented. The following figure illustrates movable objects in theremedieproject.com.



Fig. 7: Screenshot from theremedieproject.com.

Many respondents thought the concept of actively interacting with the web page to be appealing, though in some cases the explorative features could also be considered negative when related to the purpose of the visit to the site. As one respondent put it:

"[...] I like the fact that it was interactive, I can move things around [...] But if you access the site for the first time and just want some quick information, that will be hard to find. You have to understand the site in some way to be able to use it."

Again, one might then consider the specific purpose of the visit to a web page as being important in how an individual experiences a particular site.

4.5. Messy

The attribute messy was primarily considered something negative. Judging by the answers given by the respondents, the attribute was used to describe both lack of structure on a general level and a too vast amount of objects being presented on the screen. Of the four web pages used in the study, one in particular (k10k.net) seemed to generate many similar reactions like the one outlined above. The main reason for this was according to several of the respondents the very high complexity of objects on the page. This is illustrated by the following figure, which is only a small section of the overall information being presented on the same page.



Fig. 8: Screen shot from k10k.net.

However, this is not the only factor that might be important in the perception of computer-based environments containing a high complexity. Vnunet.com also has a high amount of objects, but many of the respondents did not consider this page messy. The main difference between the two web pages is that vnunet.com uses a common way of presenting information on the web, the newspaper metaphor, whereas k10k.net presents information in a more experimental fashion. The fact that the respondents recognized the pattern of a newspaper, or at least were familiar with the navigation concepts of vnunet.com seemed to help many of them finding their way through the web site and understanding the structure. The attribute messy can also be seen as corresponding to the general attribute “complexity” deriving from environmental psychology.

4.6. Confusing and lack of structure

Closely connected to ‘messy’ is the attribute confusing. When using the word confusing to describe a web page, one can refer to many different aspects. These aspects can be both positive and negative. If a web page is perceived as confusing, it seems like the purpose of the visit to the site is highly important regarding whether this is perceived as positive or negative. One respondent argued:

“The purpose with my browsing serves as the starting point. The design of the web page gets more important the more I want to get entertained.”

Many respondents expressed that a web page could be enticingly confusing if he/she was not searching for a specific piece of information nor had some other

specific goal with the visit to the site. On the contrary, if there was a specific purpose with the visit, such as obtaining information, the confusing attribute solely was perceived as a highly negative factor. Once again, these arguments can be related to the discussion presented earlier in this paper regarding environmental experience versus innate landscape preference.

The concept confusing was also in some contexts perceived as lack of structure in the web page. For some respondents this expressed itself in a lack of recognition of familiar patterns and structures in the web page.

4.6. Central attributes – summary

Many of the attributes used by the respondents to describe an impact on their perception of a web page seem to correspond fairly well to attributes used to describe favorable/non-favorable features in natural environments. Thus, this may possibly indicate that the same kind of central attributes in perception of natural environments also might be relevant attributes in understanding perception of web pages. Hence, using a framework of experience and knowledge drawn from environmental psychology in order to describe how people perceive web pages is worth further investigation. Accordingly, I will in the forthcoming section use concepts (attributes) directly deriving from environmental psychology to describe the relation between central attributes and different levels of interaction. I will also introduce the two previously mentioned concepts “functionality” and “aesthetics” and discuss their respective place in the model.

5. Discussion - a model of interaction with web pages

The analysis of the material gathered from the study has resulted in the following model that aims to describe interaction between users and web pages as well as the previously described central attributes. The conceptual framework by Oriens and Heerwagen, presented earlier in this text, constitute the main part of the model, however the model is also extended with the two concepts “aesthetics” and “functionality” as discussed previously in this paper. It is thus a conclusion that the model to some extent can be used as a tool for describing interaction with web pages, however complementary comments are needed. A more comprehensive presentation of the model and its components follows.

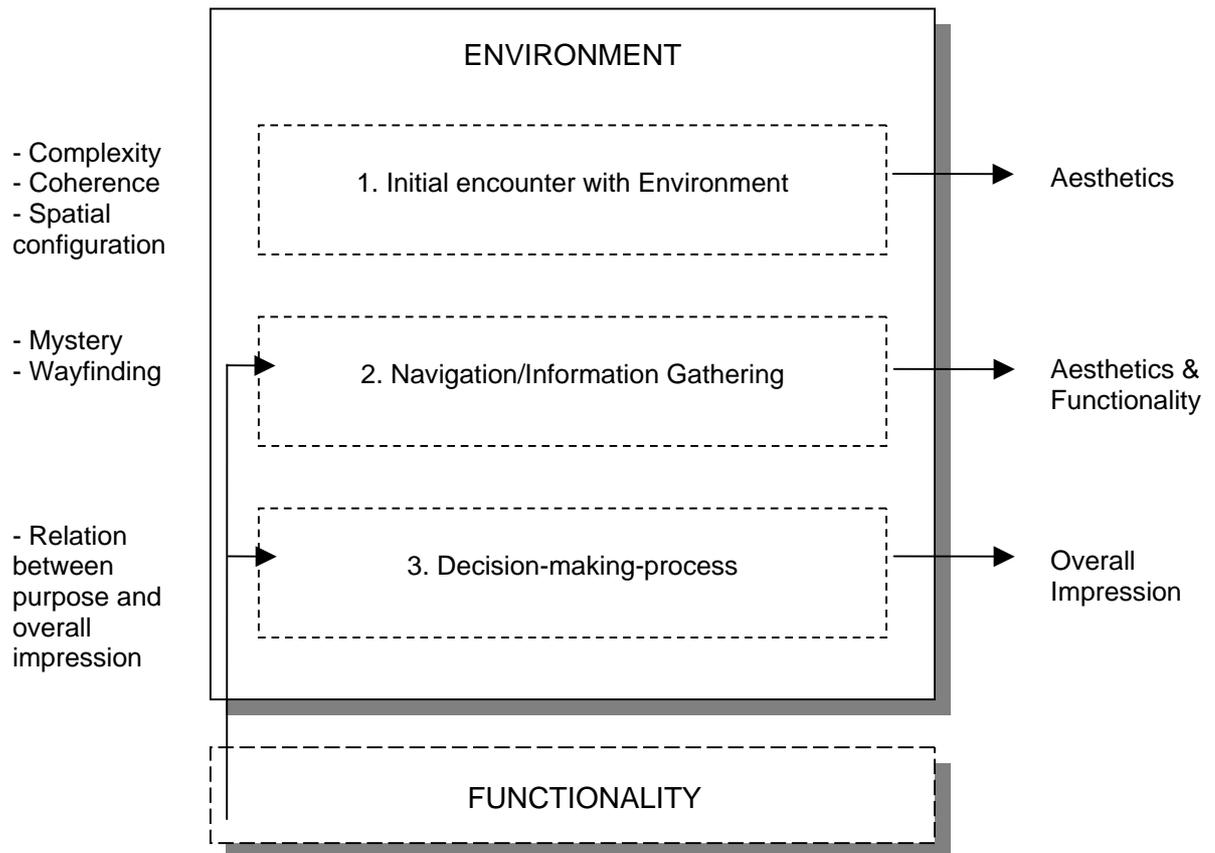


Fig. 9: General model of interaction with web pages.

The model illustrates the three different levels/stages in the perception of- and interaction with an environment. In this particular study, the surrounding computer-based environment (labelled environment in the model) has been consisted by web pages. At each stage in the model, certain attributes seem to be more important than others; these are showed on the left hand side of the model. These attributes correspond, as explained in the previous section, fairly well to the attributes described by the respondents. On the right hand side, the relation between aesthetics and functionality is illustrated. There is also however a relation between aesthetics and functionality, and the central attributes (presented on the left hand side), which I will return to shortly. In the following, I will give some comments on important features at each stage in the model.

5.1. Stage 1 – Initial encounter with environment

At this stage, the aesthetics of the web page being presented is in focus. Many respondents talked about getting a first feeling towards the site. Naturally, this first feeling is mostly dependent on the actual design/aesthetics of the web page due to the fact that interaction in the form of browsing through the different pages on the site yet has occurred. Going back to the list summarizing the central attributes, most of them can be said to be important at this stage. However, relating these attributes with the ones found to be relevant for perception of natural environments, they can be synthesized into (i) spatial configuration, (ii) complexity and (iii) coherence. These are all concepts that are important in how the aesthetic part of an environment is perceived in natural environments as well as in computer-based environments (i.e. web pages).

5.2. Stage 2 – Navigation/Information Gathering

Stage two includes the actual browsing/navigation through a specific web site. Thus, it is at this stage interaction in the form of actively making a way through the computer-based environment occur. At this stage not only the aesthetic features of the web page are important, but also the functionality that supports navigation and interaction. Functionality in this particular setting is constituted by features in a website that makes this possible, for example, hypertext links, JavaScript features and so forth. Thus, the relation between aesthetics and functionality is in focus. The central attributes at this stage are wayfinding and mystery, which have a lot to do with the previously mentioned attributes exciting, structure and confusing. Wayfinding in web sites concerns how navigation through the web pages is handled. Naturally, the structure of the web page affects the way in which an individual makes his/her way through it. The attributes confusing and exciting seem to relate in a good fashion with the concept of mystery. A web page being perceived as exciting or enticing might be looked upon as having a fairly high degree of mystery. In the same way, the attribute confusing in some contexts can contribute to the explorative feeling of mystery. As mentioned earlier in this text, these attributes are not solely positive, but can as well be experienced as negative features.

5.3. Stage 3 - Decision-making-process

When finished navigating through a computer-based environment (in this case, browsing through a web site) stage three occurs. This is where the decision making process of whether to stay in the specific environment or not, take place. The process of making this decision is highly dependent on the purpose of the visit to the environment. Thus, it seems that the purpose of a visit in many cases generate a specific set of preferences regarding both the aesthetics of an environment and the style of interaction. The purpose will then act as a *determiner* on the perception of the environment and on the way interaction is carried out. The model is, as previously stated, inspired by theories of habitat selection and therefore stage three concerns whether or not to actually inhabit a specific natural environment. In the case of web pages, no one in fact inhabits a website, so consequently, stage three might be looked upon as the decision of whether or not to return to the particular website in the future. This is thus a question of an evaluation of the overall impression. The overall impression is consequently dependent on the purpose of the visit, and the particular characteristics (attributes) of the website at each stage.

6. Conclusions and future research

The idea of using theories and knowledge from environmental psychology as a framework for generating an overarching understanding of how people interact with and perceive web pages seems fruitful. Although this first study has been relatively small in range, some useful information has been revealed. It is likely to believe that perception of web pages is similar to perception of natural environments. Many of the central concepts proved to be important in perception of natural environments, such as complexity, spatial configuration and mystery also seem like relevant determinants in computer-based environments. Further, it also seems likely that interaction with web pages to some extent can be described using a model based upon a conceptual framework depicting habitats selection. The model might then serve as a tool for understanding different stages of interaction with a web site. At each stage, different sets of attributes are relevant to consider. For example, at stage one, attributes like spatial configuration and coherency are very important for the individual experiencing the web site. Important in this context is also the relation at each level between aesthetics and functionality. The aesthetical part of a web page is closely linked to the

different concepts such as the previously mentioned coherency and spatial configuration. However, when actually interacting with a web page, the underlying functionality is equally important. The functionality provides the necessary tools for actually being able to navigate in the web site. Thus, coherence between aesthetics and functionality seems important as well and is in need of further exploration.

The use of ideas and experience from environmental psychology might have the ability to provide people working with design and development of web pages with a new set of tools. Tools that do not only focus on for example efficiency of a specific interface, but also focus on fundamental basic structures of human perception and interaction.

In retrospect, the explorative research approach used to conduct the experiment was fruitful and has, if nothing else, presented an interesting starting point for further studies. However, future research focusing on environmental psychology and computer-based environments should be more comprehensive in order to further establish a solid ground to stand on.

When looking at perception of web pages, an important feature that possibly affects perception is the relation between the written and the represented. A written word can naturally be looked upon as a representation of the meaning of that word. However in this case, it's the relation between the meanings of a written word on the one hand and a symbol or form on the other, that's in focus. For discussions about the character of information, form/content and word/image see for example Wysocki (2001) and Borgmann (1999).

In natural environments, information in the form of written instructions is not present, this is however not the case for web pages. Thus conducting studies that in some way try to investigate this relationship and the question if perception might differ between computer-based environments containing text and computer-based environments only containing representations, would be interesting. A study of this kind would perhaps also make it possible to uncover the central aspects of perception and interaction in a more comprehensible fashion.

With increasing speed and power in personal and portable computers, the use of 3D interfaces is growing. A natural continuation of the research presented in this paper would thus be to study 3D computer-based environments. Since many 3D environments actually try to map real world contexts, knowledge from environmental psychology might be of great importance in both the design process and the understanding of the actual interaction and perception.

Finally, trying to implement ideas and theories deriving from environmental psychology in designing different types of applications would be interesting from many standpoints. For example, this could perhaps generate more information regarding the possible use of such ideas and theories in practical design work.

7. References

- Balling, J.D & Falk, J.H (1982). Development of visual preference for natural environments. *Environment and Behavior*, 14(1), 5-28.
- Bell, P.A, Greene, T.C, Fisher, J.D & Baum, A (2001). *Environmental Psychology*. Orlando: Harcourt Inc.
- Bonnes, M & Bonaiuto, M (2002). Environmental Psychology: From Spatial-Physical Environment to Sustainable Development. In Bechtel, R.B & Churchman, A (Eds.). *Handbook of Environmental Psychology* (28-54). New York: John Wiley & Sons, Inc.
- Borgmann, A. (1999). *Holding On to Reality. The Nature of Information at the Turn of the Millennium*. Chicago: The University of Chicago Press.
- Herzog, T & Smith, G.A (1988). Danger, Mystery, and Environmental Preference. *Environment and Behavior*, vol. 20(30), 320-344.
- Kaliber. *The Designers Lunchbox*. Accessed at <http://www.k10k.net/>. (2004-01-12).
- Kaplan, S (1995). Environmental Preference in a Knowledge-Seeking, Knowledge-Using Organism. In Barkow, J.H, Cosmides, L & Tooby, J (Eds.). *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (581-598). New York: Oxford University Press.
- Orians, G.H & Heerwagen, J.H (1995). Evolved Responses to Landscapes. In Barkow, J.H, Cosmides, L & Tooby, J (Eds.). *The Adapted Mind: Evolutionary Psychology and the Generation of Culture* (555-579). New York: Oxford University Press.
- Spelbutiken.se. Accessed at <http://www.spelbutiken.com>. (2004-01-12)
- Synek, E. *Evolutionary Aesthetics: Visual Complexity and the Development of Human Landscape Preferences*.
<http://evolution.anthro.univie.ac.at/institutes/urbanethology/student/html/erich/synekpro.html>. (2004-01-06)
- The Remedi Project. Accessed at <http://www.theremediproject.com/>. (2004-01-12)
- Vnunet.com. Accessed at <http://www.vnunet.com/>. (2004-01-12)

Wysocki, F.A (2001). Impossibly distinct: On form/content and word/image in two pieces of computer-based interactive multimedia. *Computers and Composition*, (18), 209-234.