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BASE – Fundamentals of Web System Design

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Abstract

Internet has experienced an exponential growth in the 1990s. The use of the web interface to present information to users and customers has become an increasingly more popular way of doing business. Different ways of segmenting the Internet population have been developed for commercial and academic reasons. This paper explains our motivation for developing Opaque Web User Segmentation (OWUS), which is part of a larger system we have called BASE – Bipolar Attribute Segmentation Environment. BASE handles both content segmentation and presentation method segmentation. The latter is based on the theory of **flow**, and is designed to let web site owners give the visitors the possibility of an **optimal experience**. In this paper we concentrate on presentation method segmentation. OWUS is a new way of segmenting, based on the web user's actions on web sites. OWUS performs a dynamic segmentation that calculates a unique **profile** for every web user. This user profile contains information on the **presentation methods** that the user prefers, and that enables flow for that particular individual.

1 INTRODUCTION

A popular market strategy on the Internet is segmentation. Until now, the focus has been on content segmentation, that is to present different content to different users, in order to narrow down the audience to the most interested group of people and eliminate wasted time for uninterested consumers, as well as wasted money for the information suppliers.

Information Systems in the WWW Environment C. Rolland, Y. Chen & M. Fang (Eds.)

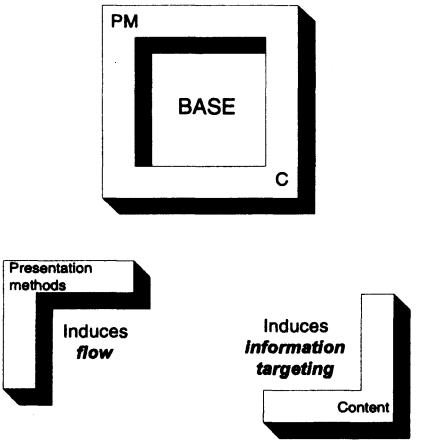

Figure 1 - The bipolar segmentation environment.

We believe that to achieve maximum effect of segmentation, not only content should be user dependent, but **presentation methods** as well. We have designed a system that takes the user's actions into consideration, and selects appropriate presentation methods accordingly. Web sites that offer extensive information, and expect returning visitors will gain from building user specific profiles and segment the data offered based on these profiles. Our system is called BASE, Bipolar Attribute Segmentation Environment, see Figure 1.

A web system is a complex, multi-faceted communication channel that includes a vast variety of interaction possibilities. When it comes to clearly defined, goal directed tasks, such as loan calculations, standard interfaces that are intuitive and efficient to use is preferable. A high level of recognition as in Microsoft's products is also gainful. But for explorative activities, such as entertainment as a part of value-adding, differentiation in presentation methods can contribute significantly to user satisfaction.

The **method** of segmentation on which BASE relies is OWUS, Opaque Web User Segmentation.

Our motivation for introducing BASE is the realisation that too much is left to chance when it comes to the design of web systems, as supposed to all the effort being done in the traditional HCI area. Gigabytes of poorly designed web pages – completely inefficient as sales channels – proves this point. In worst case, companies hire programmers to handle their web presence. A better approach is using specialized interactive media consultants. However they too produce 'one size fits all' solutions, with little or no regard for the Internet's unique option as a medium; to tailor products individually, for optimal experience. A scientifically

based foundation on effective web design is needed, if we are to move from 'gut feelings' and 'good taste' as basis for web system design.

1.1 Web Life

Internet is becoming a part of our daily lives. But a common mistake businesses make, is believing that off-line life can be mapped directly onto the web. This is not so. The optimal way to handle matters is not the same on-line as off-line. There are particulars of web life that must be considered, if a business is going to be successful on the Internet.

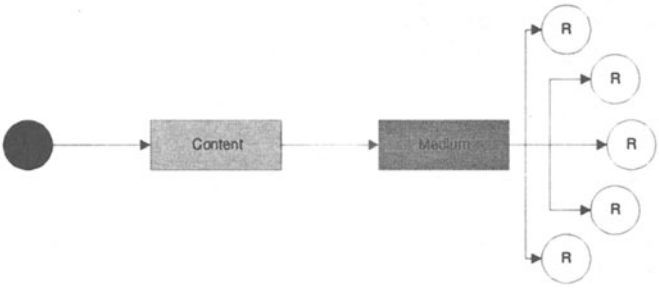

Figure 2 - The one-to-many communication model (Hoffman et.al., 1996).

The one-to-many model, see Figure 2, depicts the traditional marketing approach. The supplier of information uses television, radio, billboards and so on to reach as many potential customers as possible. The same content reaches every person looking or listening. There is little or no reverse communication between the supplier and the consumer.

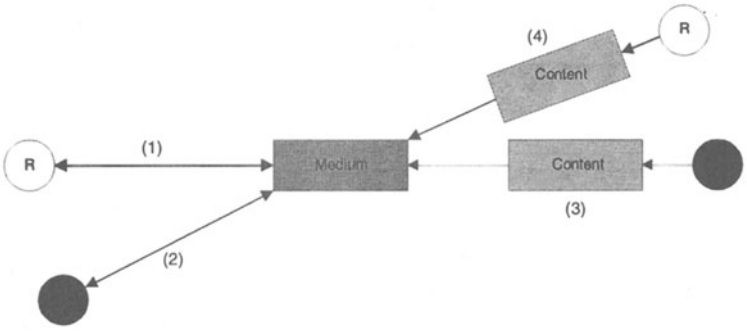

Figure 3 - The many-to-many communication model (Hoffman96 et.al., 1996).

Figure 3 shows the new communication model. The receiver (R) can surf the net (1), the same can the suppliers (S) do (2). The suppliers can deliver content on the

Internet (Medium) through a web site (3), and both receivers and other suppliers can visit that site to obtain some kind of information. Finally, many web users maintain their own home pages, in addition to participating on chat boards and news groups (4). This opportunity to supply their own content leads to new power for the receivers.

A consumer now has the opportunity to respond to the information quickly, and share her opinions with others in the efficient grapevine telegraph of the Internet. The result of this is a shift in control, from the supplier to the individual receivers of the content. Consumers are no longer passive receivers, but active participants. Symmetrical control, and power, is also a new scenario for the suppliers. It is essential to realize this shift in control to achieve success on the Internet, and also to know how to respond to and use it advantageously.

Businesses have to constantly maintain a dialogue with the consumers. The consumers will be much more demanding and will expect more from suppliers, as a result of their newly gained control and power. They will expect to be treated individually (Sterne, 1996). If a site owner has succeeded in bringing the customer to the web site, he or she has only covered a few meters of the marathon towards a sale, and certainly come a lot shorter than were it a physical store. The reason for this is the tranquil ease with which the customer might exit the site. A simple click on a button, and she could be lost forever. The web sites need something to keep the customers from leaving the site – something that spellbinds them enough to engage in an exploration of the site, and even return for new visits. The concept of **flow** on the web can show us the way to meet this demand.

Combining natural and psychological sciences, in this case computer engineering and the psychology, is challenging, as the research methods are not always compatible. Web research, in accordance with HCI theory, must consider the human's perspective together with the possibilities of technology. Application of both qualitative and quantitative research will more often result in the best usefulness for the web visitors.

2 FLOW

Csikszentmihalyi constructed the concept of flow in the early seventies (Csikszentmihalyi, 1988, Csikszentmihalyi and Csikszentmihalyi, 1990). Flow is a state of mind that gives the user an experience of flowing with the medium, and a feeling of inner contentment. The user feels in control and is completely captivated by her activities.

A user that experiences flow has focused attention on her interaction, which she finds cognitively stimulating (Webster et.al., 1993), and is not distracted by any external influences. There is generally a transformation of time. The sense of the

self might be lost during the flow experience, only to emerge strengthened when it is over.

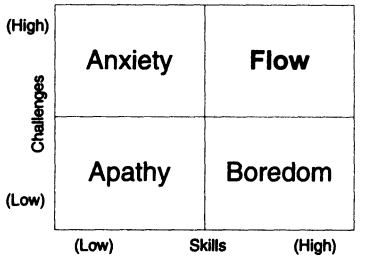

Figure 4 - Four Channel Flow Model.

Flow can be achieved when a sufficiently motivated user experiences a balance in the control characteristics skills and challenges, see Figure 4, an established flow model (Csikszentmihalyi, 1990). Any activity can lead to flow, but practically nothing can sustain it for long unless the challenges continuously become more complex. The more time a user spends on a particular activity, the more the skills improve, and thus the need for challenges to increase, if we are to keep the balance between the two – the balance which is the prerequisite to flow. This means that we need mechanisms for gradually increasing the challenges. Not only do we need to know the skill level of any given user of the system; we need to **forecast** the expected development of that user's skills.

2.1 Models of flow

Hoffman and Novak in Project 2000, at the Vanderbilt University, are engaged in combining the idea of flow with the web. We base our research partly on their work. We focus on how web system designers can use the phenomenon of flow, or optimal experience, to attract and keep customers on web sites, and thereby increase product loyalty. Sites must offer an **opportunity** for browsing individuals to achieve the feeling of flow. There are several positive effects of a flow experience. Hoffman and Novak have developed a model of flow that identifies **increased learning, feeling of control, explorative mindset and a positive, subjective experience** (Hoffman and Novak, 1995). We argue that these positive effects can be used with respect to marketing objectives. Flow will lead to increased time spent on the web site, and that users will learn more about a product or the company.

The Hoffman and Novak model identifies three characteristics that are of importance if you are to enter a state of flow: **Content, motivational** and **control** characteristics. Content characteristics, i.e. interactivity and vividness, will attract a

user's attention and might lead to telepresence,[1] which in turn enhances the flow experience. Motivational characteristics are the users' reasons for visiting the web site. Motivation can be extrinsic, corresponding to goal directed activities, or intrinsic, corresponding to self-satisfying activities. Control characteristics reflect the user's feeling of control on the site – whether she perceives a congruence of the web site's challenges and her own skills. In Hoffman and Novak's model, satisfaction of **either one** of these three characteristics can lead to flow on it's own.

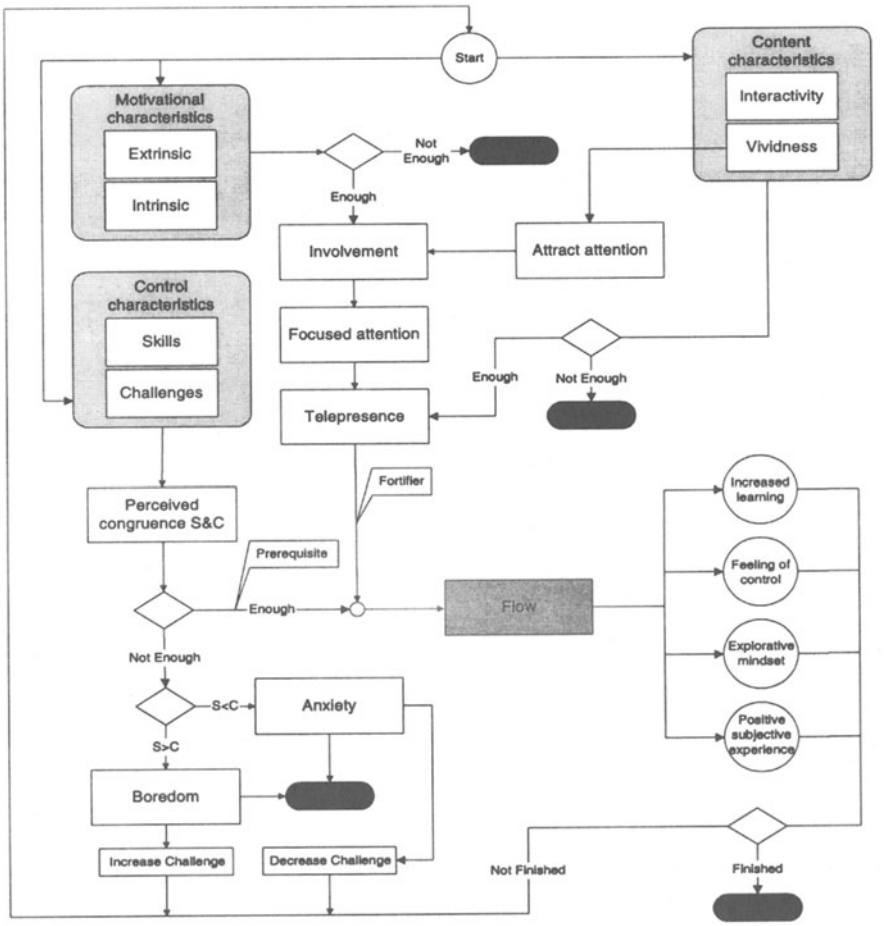

Figure 5 - Model of web interaction and flow.

[1] Telepresence is the mediated perception of an environment, that is a person can feel that she or he is present in the Internet medium, they feel part of the web (Steuer, 1992).

We have modified Hoffman & Novak's flow model, and present a new model of flow, see Figure 5.

Our new model contains the same elements as Hoffman and Novak's, but with a somewhat altered logic and with different characteristics emphasized. From our point of view, there is a fundamental difference between the control characteristics on one hand, and content and motivational characteristics on the other. While the two latter can contribute to flow, serving as fortifiers, they **can not by themselves ensure** flow. These characteristics, if present, lead to involvement, focused attention and telepresence – all of which may contribute to strengthen an experience of flow. Motivational and content characteristics are truly central factors in the game of flow, as they might foil flow. Without motivation the web visitor will end her stay on the site and exit, correspondingly without interactivity and/or vividness the visitor exits as well. Still, regardless of how motivated the user is, and regardless of how well the site supports interactivity and vividness, there can not be flow without balance in the control characteristics.

Control characteristics are not only important, as the other two characteristics are, they are **prerequisites** to flow. This is the main difference between the two flow models. If there is a perceived congruence between skills and challenges, the user may experience flow, as long as they both are above a certain threshold. If the skills are less than the challenges, the user experiences anxiety. If the challenges do not decrease, she will exit the site. If her skills exceed the challenges provided by the site, she will feel bored and exits, unless the challenges are increased.

As a consequence of the flow theory, web systems must segment users on skills. But the system must also be able to forecast skill development in order to ensure that the user's skills evolve.

This leads to the intricate question of how. How can a web system adjust to an arbitrary user's skill level, and forecast the user's development? In order to answer this, we need to identify what skill on the web is. What particulars do we have on web that differentiate between a skilled user and one that is not? If we are to segment web users based on their skills, these questions must be addressed.

3 SEGMENTATION

Segmentation done previously is based on which content the user is believed to be interested in on the web page. However content and web skills are orthogonal measures, and thus traditional approaches are not appropriate when it comes to segmenting based on web skills.

3.1 Skills on the web

Discussing skills on the web leads us to the idea of cognitive seamlessness (Ishii et. al., 1994). The challenge of commencing on use of new technology is the need for acquiring new skills. If one could make use of the technology equipped only with the skills one has from one's extra-technological, everyday life, then the barrier of making use of that new technology would be significantly reduced. If such an employment were possible, we would have cognitive seamlessness, that is no need for further cognitive training.

In the realms of web, a site that offers only text and images, none of which include links to other nodes, would not require attainment of new skills.[2] The user is presumed to handle let us say a newspaper, with text and some pictures. The described web site is in principle no different. As soon as you add links to the text, you have taken one step further on the skill-requiring spectrum. If you add a link to an image, the challenges increase again, and if you add several links to an image, as in an imagemap, the site begins to get challenging. What we are discussing here is information **presentation methods**. Some are more challenging than others, and to complicate matters, some are more challenging to one person than to another, while with a different presentation method, the case might be reversed.

What we need to do, is find a way to examine a given user's skill level, and present her with information using the kind of presentation method - with intrinsic challenges - that best balances her skills. We need to group users somehow, and serve them with 'their' kind of presentation methods.

A major question is how to perform a proper segmentation of the market, based on the user's web skills. Until now, big surveys and questionnaires have been used in market segmentation. The drawback of these techniques is that the participants have to spend time and effort answering questions and filling out forms. Time is the new currency on the net, and one cannot assume that web users will take the time to feed site owners or market investigators with this information. Self reports like questionnaires are therefore not fit as the only or main source of information. Few customers have the time or interest to answer questions every time they enter a store, and certainly not every time they enter a web site, where the escape is just a mouse click away. They want the store to already know what they want to buy and what they are interested in.

Even if we got the customers to answer polls on their skill levels, the validity of these would be questionable. Self-assessment schemes have flaws; respondents try to be something they are not - competent, social acceptable, eagerness to please or **not** to please (Arnold et.al., 1995, p. 169). In our case, they probably do not even know how to answer truthfully, because they are not aware of their own skill level.

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[2] Apart from the use of a mouse and a browser.

So how can customer information on skill level be gathered effectively and economically?

3.2 Attribute oriented segmentation

We suggest a different type of segmentation that is **attribute oriented**, by identifying different attributes, and measure the user's skill in these attributes. Examples of attributes that might be identified when it comes to presentation methods are: Text, icons, images, imagemaps, icon-animations, image-animations, MPEG-movies, fill-in-forms, vertical and horizontal scrolls and advanced presentation methods utilizing Java applets, like multi-layer menus. This attribute oriented segmentation will lead to unique presentation method profiles. Thus we avoid placing a user in rough classified groups that often are the result of other segmentation approaches, such as those based on geographical or demographical data. These crude constellations may not correspond fully to the user's wishes and expectations of the human-computer-interaction.

4 OPAQUE WEB USER SEGMENTATION

Our proposition of a framework to identify web users' interests and skills, so that the site owner can offer content and presentation methods accordingly, is **Opaque Web User Segmentation**.

Opaque Web User Segmentation, OWUS, is based on attribute oriented segmentation. With OWUS, tests are performed in the background to determine the skill of the user. **Different skill levels will result in different ways to present the site information.** The users will not be disturbed by the background testing, thereby the name Opaque, and the users do not have to interact with the testing. The user's skill in web use, as analyzed by the system, will affect how to optimally present information to that particular user. OWUS offers support for skill-dependent presentation methods, which is important if we want to shorten the user's road to a flow experience.

4.1 Skill development

We need appurtenant tests to decide which presentation methods are optimal for the user. Future presentation methods will depend on the user's previous actions on the web page, and the system will try to forecast what the user might like next. The theory of flow indicates the importance of balance between skills and challenges, thus new and more demanding presentation methods must appear as the user's skills increase.

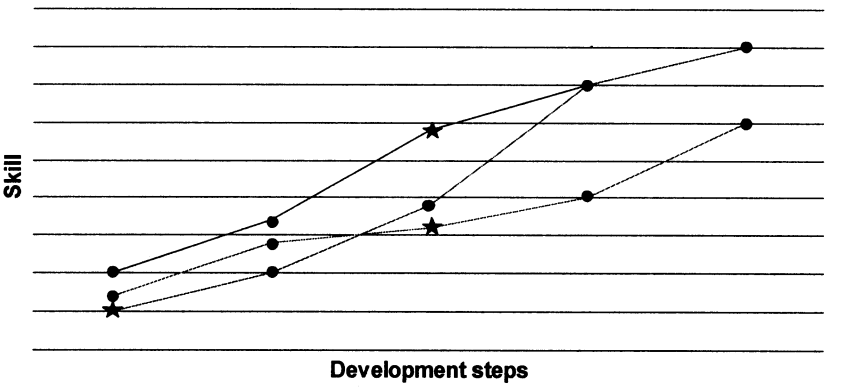

Figure 6 - Possible paths of skill development for a given user.

Figure 6 shows, symbolically, possible paths of skill development. Each dot (●) denotes a presentation method, while the stars (★) denote the presentation methods estimated, by calculations, to offer a given user the best chance of experiencing flow. The upper path might represent the development from images through a series of increasingly more complex imagemaps, while the initially lowermost path might represent the development from icons through icon- and image-animations towards intersecting the former path at complex imagemaps.

The paths are suggested development routes. The stars indicate which presentation methods that are preferred by the user at one particular point in time, and the succeeding dots are identified as the stars' 'seniors'. When a user indicates interest in a certain presentation method, the system records this interest, but in order to predict which presentation method to offer next, the system also assumes some interest in the senior, on the user's behalf. The senior is a related presentation method that is more complex and challenging than the junior with which it is paired.

The effect of this is that when the profile is built click by click, certain presentation methods crystallize as the preferred ones, **and** a set of seniors are identified as well. These seniors will be used as a mean to improve the user's skills, as well as being the presentation methods the user is gradually exposed to.

An alternative to strict junior-senior definitions is **propulsion** plans. These would be valuable if the path definitions are not exhaustive. That is, there are presentation methods that are neither innate juniors nor can they be made seniors to some other presentation method, leaving them in principle like unreachable islands. A propulsion plan can be defined as mathematical distributions and typically includes groupings of presentation methods, other than direct junior-senior relationships, that will be gradually introduced to the user.

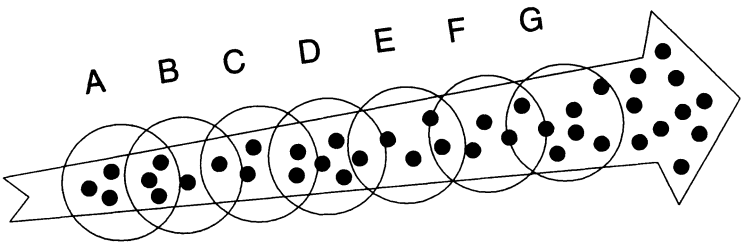

Figure 7 – Propulsion plan.

In Figure 7 the dots (•) represent presentation methods, and the arrow indicates how the different presentation methods are considered appropriate as time goes by, and the user becomes more experienced. The propulsion plan describes the set of available presentation methods, and which of those have the highest probability of getting selected. The circles, A-G, in Figure 7 represent the groups of presentation methods that are considered suitable to the users belonging to that circle or segment. At a given point in time, a user belongs to one segment. The general idea of juniors and seniors is kept, as circle B might be considered the senior of circle A, only now the seniors and juniors comprises groups of presentation methods.

4.2 System overview

A new user will be given a preliminary generic profile on assumed preferred presentation methods, as the user has no history to be used in the forecasting. As the user performs actions, these actions will be monitored and used to calculate and develop a user profile. The user profile will determine how the information is presented, by analysis of previous behavior and assumptions on the user's reactions to senior presentation methods. To exemplify: If a user likes images, we assume that the user to some degree will appreciate imagemaps as well. These assumptions are important factors when it comes to increasing challenges in order to sustain the balance with user skills, to ensure flow possibilities.

A web site holds information on user profiles. When a user identifies himself, the user specific site information will appear using the preferred presentation method. Every move the user makes will contribute to change or maintain this profile, in order to constantly be in touch with the user's preferences, and in the long run develop the user's web skills.

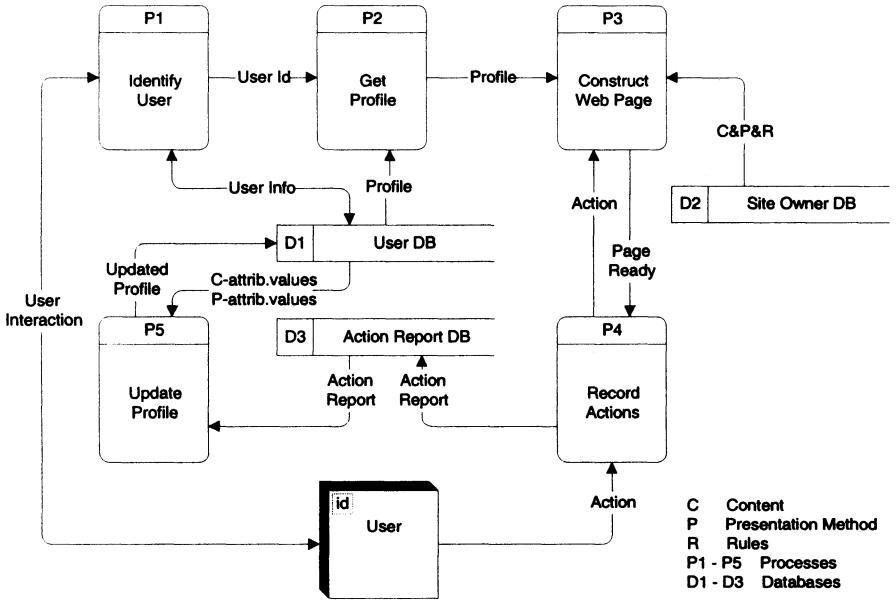

Figure 8 - System overview.

The system overview is shown in Figure 8. First the user must be identified (P1). When the user is identified, the user's profile is read from the User Database (P2). If the user is not registered, a generic profile will be read.

Now the time has come to display the web page according to the user's profile (P3). Information from site owner is read. Analysis of this information and the user's profile will result in a web page optimally adjusted, based on user preferences. From the database D2 both content (C) and presentation method preferences (P) will be read. Site owners might also have preferences on how they want their information to be presented to the web user. A match of user and site owner preferences will be made, following predefined rules (R). An example of this can be a site owner that would like to use a Java menu to present certain information. But if the user profile shows that the user is not acquainted with this method, and thus likely to feel anxiety (i.e. the challenges exceeds the skills), the information provider would probably benefit from choosing another way to present his or her data. On the other hand, if the user profile shows that the user is capable of handling a complex menu, the provider gets to present a lot of information to the user, in a very compact way.

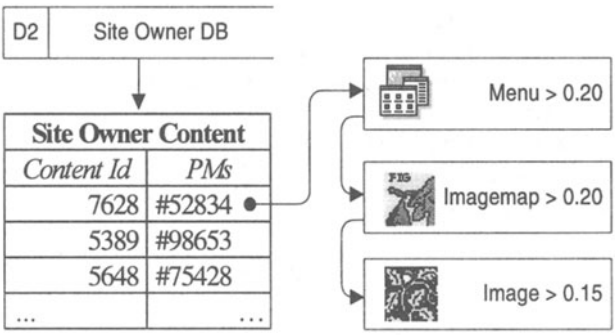

Figure 9 - Selection of presentation method for some given content.

Assume some piece of content in the site owner's database D2 is to be presented on the web page. The preferred presentation methods are a Java menu, an Imagemap and an Image, in prioritized order. The user's profile is compared to the rules in D2, see Figure 9. If the menu is to be selected, the user needs to have a menu attribute value greater than 0.20. If the user can not meet that demand, the system examines the next presentation method in line, and checks if the user has an imagemap attribute value greater than 0.20. If the user can meet this demand, the imagemap presentation method is selected. If on the other hand, the user can not, then the system keeps on scrutinizing the presentation method rules to make a match. If the user can not meet any of the demands, some sort of easily accessible, less challenging presentation method is chosen.

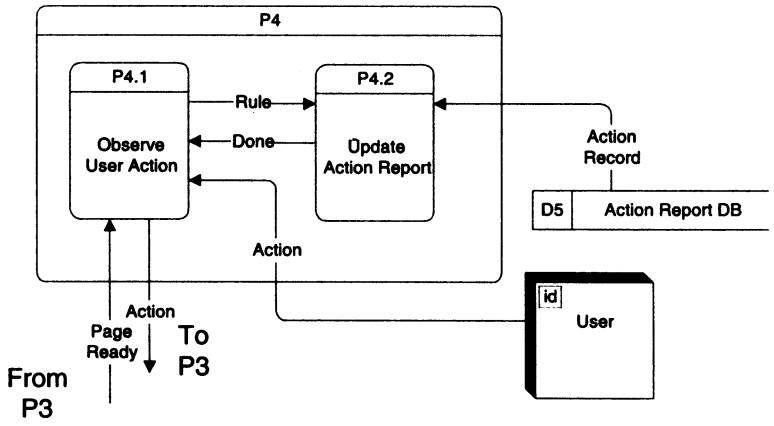

Figure 10 - P4: Record Actions.

The user's actions on the page will be recorded (P4) in an Action Report Database (D3), see Figure 10, and these actions will be used to calculate the new user profile (P5), see Figure 8. The profile will be more and more refined as the system analyzes user actions to build the new profile of preferred presentation methods. The result is that the user will feel stimulated and satisfied, because the web page challenges are accommodated to the user's skills. In the complete BASE system content will be adjusted similarly.

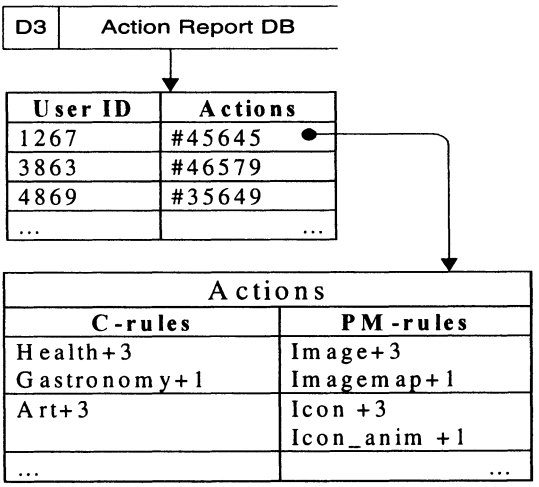

Figure 11 - Rules in the Action Report.

Every action performed by the user, leads to updates in the Action Report, according to content and presentation method rules, see Figure 11. The first item selected by the user, was an Image, in this case. Thereby that presentation method is favored with 3 points. Imagemap is its senior partner, and it thus receives a senior point. Likewise the next action is a selection of an Icon, and points are handed out again. Based on the Action Report, the new user profile is calculated.

5 PROTOTYPE SIMULATIONS

We have implemented a prototype of our suggested OWUS system. Rather than letting human beings interact with our prototype, we simulate user interactions. The simulations reflect user behavior based on a predefined user type, with some effects left to chance for the purpose of reflecting the unpredictability of humankind.

5.1 Profile computation theory

$$P_{i+1} = F(P_i) = \{p_{i+1,Text}, p_{i+1,Icon}, \ldots, p_{i+1,Menu}\} \quad (1)$$

$$PM = \{Text, Icon, .., Menu\}$$
$$C = c(PM) = \{pm_{chosen}\}$$
$$S = s(C) = \{pm_{senior_1}, pm_{senior_2}, \ldots, pm_{senior_n}\} \quad (2)$$
$$NC = PM \setminus (C \cup S)$$

$$p_{i+1,j} = \begin{cases} f_C(p_{i,j}), j \in C \\ f_S(p_{i,j}), j \in NC \\ f_{NC}(p_{i,j}), j \in S \end{cases} \quad (3)$$
$$j \in PM$$

$$f_C(p_{i,j}) = (((p_{i,j} \times (10 \cdot n)) + q_C)/((10 \cdot n) + \sum_{j=Text}^{Menu} q_j))$$
$$f_{NC}(p_{i,j}) = (((p_{i,j} \times (10 \cdot n)) + q_{NC})/((10 \cdot n) + \sum_{j=Text}^{Menu} q_j)) \quad (4)$$
$$f_S(p_{i,j}) = (((p_{i,j} \times (10 \cdot n)) + q_S)/((10 \cdot n) + \sum_{j=Text}^{Menu} q_j))$$

The new profile P_{i+1} is a function F of the old one, P_i (1).

PM is the set of presentation methods, C is the set of the chosen presentation method, S is the set of seniors of the chosen presentation method, and NC is the set of the remaining methods (2).

f_C calculates the new attribute value of the chosen presentation method. f_S calculates the new attribute values of the chosen method's seniors. f_{NC} calculates the new attribute values of the methods that are neither the chosen one nor senior of the chosen one (3).

n is the number of available presentation methods, q_C is the points handed out to a chosen method, q_{NC} is the points handed out to a method that is not chosen and q_S

is the points handed out to a senior method (4). q_C, q_S and q_{NC} have values of 3, 1 and 0 respectively in our example, but can be adjusted as preferred, allowing versatility.

5.2 Simulation

We wanted to simulate how the profile of one given user changes from the initial generic profile to an adjusted profile mirroring the user's skills. The initial generic user profile assumes interest and skill in three presentation methods. These methods are innate juniors, that is to say they do not act as seniors to any other presentation methods, and thus can not receive senior points. Their only source of points is from direct user interaction.

	Presentation methods	*Generic profile*	*User type*	*Calculated user profile*
Primary	Text	0,333	0,000	0,011
	Icon	0,333	0,500	0,328
	Image	0,333	0,500	0,312
Secondary	Icon_anim	0,000	0,000	0,112
	Image_anim	0,000	0,000	0,104
	Imagemap	0,000	0,000	0,109
	Scroll	0,000	0,000	0,000
	Menu	0,000	0,000	0,000

Table 1 - Presentation method profiles.

We have chosen a total of eight available presentation methods, which we divide into groups. We have the three primary methods from the generic profile, and the remaining five are secondary methods. The primary methods are the ones presented to the user initially, see Table 1. Depending on the user's reactions to the methods - whether she shows interest in them or not – some will be deemed favorable to her and others will not. In our simulation two of the three primary presentation methods fit the user's skill – they are thus preferred methods - whilst the last one does not – it is an avoided method.

In the groups of secondary methods, we find the ones that are not shown until they have indirectly gained enough points from being a primary method's senior. Three of the secondary methods are seniors to some of the two preferred primary methods. When their paired juniors receive points, they receive senior points. Two of the secondary methods are not seniors of any of the preferred primary methods, and as their juniors probably will not receive points – the user does not show interest in them – they will not receive senior points either.

What we want to see, is how the system handles the differentiated interest in the primary methods and their senior partners. The three primary presentation methods are Text, Icon and Image, see Table 1. In the generic profile they are equally likely to be selected as the presentation method to be used, with a probability (attribute value) of 0,333 each, second column of Table 1. The user, however, does not enjoy the text method as she gets bored with it, so she does not show any interest in the links presented with text. Text is her avoided primary method. The user profile that would best fit her type - as it is at the moment – is one that would choose icons and images with a probability of 0,5 each, third column of Table 1.

The last column of Table 1 shows the profile calculated during the simulation, after 100 actions were made. As we can see, the probabilities of selecting Icon and Image remains high, while the Text method drops to a probability of 0,011. The calculated profile is not equal to the user type. If it had been, it would, by all means, perfectly mach the user's skills, but **only** as they are right now. As our intention is not just to match the user's current skills, but to forecast future skill development, the seniors need to have some probability of getting selected as well. Icon-animation is the senior of Icon, and Image-animation and Imagemap are seniors of Image. These seniors have calculated probabilities of 0,112, 0,104 and 0,109 respectively. Scroll and Menu are not seniors of any of the preferred primary methods, and the probability of those methods being selected stays zero throughout our simulation. Scroll, for instance, might be considered a senior of Icon-animations, so that if the user starts responding to Icons-animations, the senior Scroll will receive senior points, and thus its probability will increase from zero to some positive decimal number.

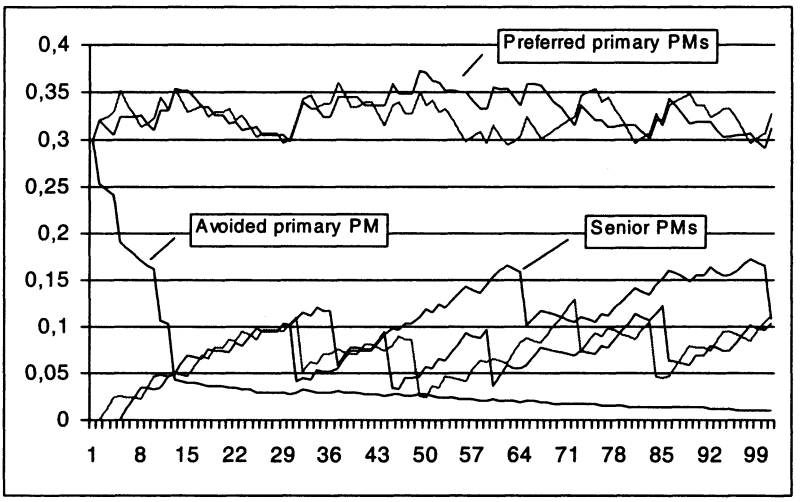

Figure 12 - Presentation method development.

Figure 12 shows graphically how the profile changes over time. The x-axis represents user interactions and the y-axis represents the probability of the presentation methods getting selected. The start values in the graph are the generic profile in Table 1, while the end values are the calculated profile. The probability of the two preferred primary presentation methods remains high from beginning to end, while the probability of the avoided method falls drastically. The three seniors receive points, and as a result, their probabilities rise. The two final presentation methods have probabilities steadily on zero, and are thus not visible on the graph.

The simulation shows how a profile **gradually** evolves from a generic one into one that accommodates the user's characteristics, which shows the computational applicability. But in order to support our theory of BASE **empirically** we will set up an experiment involving human participants.

6 EXPERIMENT DESIGN PROPOSAL

BASE is, as mentioned previously, a bipolar environment - the poles being segmentation on **content** and on **presentation methods**.

Running a test on the complete system would involve classifications of content attributes as well as a set of different, logically related presentation methods for each content item. As described earlier, paths of presentation methods must be defined in order to be able to forecast the next presentation method to offer the customer, or a propulsion plan could be used.

A complex, two variable experiment like this, would be quite comprehensive, and would not let us focus on the real essence of our work, i.e. the theory of flow and web design. The experiment design is thus sought to test exclusively the pole of **presentation methods**, introducing of course, sources of error regarding content, if this is not adequately accounted for. The test sites are constructed to handle this.

Consider the following statements:

> **S0: The use of BASE, because of the support for experiencing flow by the user dependent presentation methods, will lead to more satisfied customers and strengthened relationships between them and the supplier. In turn this will serve as an important foundation for returned visits and increased sales.**

Our main proposition is that user specific presentation methods give the user better possibilities for experiencing flow:

S1: A better balance between perceived skills and challenges for the user can be achieved in a web environment with user specific presentation methods.

Hoffman et al. states that 'skills and challenges are perceived to be congruent and above a critical threshold' as a condition for flow to be experienced (Hoffman and Novak, 1995, p. 16):

S2: To experience flow, there must be a perceived balance between skills and challenges.

There are several positive effects of flow (Hoffman and Novak, 1995, p. 23). Consumers that experience flow will spend more quality time on the web site and keep a positive attitude towards the site:

S3: Flow leads to more satisfied customers and increased sales.

The relationship between the skills and challenges and the search and purchase behavior of customers have been described in an empirical study, where the hypotheses of a positive correlation between flow and online search and purchase were largely supported (Novak and Hoffman 1997, p. 37).

S1 & S2 & S3 → S0

If user specific presentation methods will give the user a better congruence between the skills and the challenges, then flow can easier be experienced. If flow can be experienced at a web site, the visitor will be more content and satisfied. If presentation method segmentation eases the road to flow, and flow increases user satisfaction and time spent on the site, then the use of BASE will let the visitors experience flow more easily and increase sales thereby.

Both S2 and S3 have been empirically tested (Novak and Hoffman, 1997). The remaining issue is to find a way of balancing the skills of the user and the challenges of the web site, without which flow cannot be experienced. We believe that our user specific presentation method is a tool to obtain such a balance, and we would like to test the reliability of our statement, S1. If S1 is supported, then S0 is considered to be true.

6.1 Experiment settings

To be able to carry out a complete experiment, we need to design a testsite that make use of different presentation methods in accordance with the underlying algorithm that analyses the user's actions on the site and builds a unique user profile, please refer to the prototype in chapter 5. We would then investigate user

satisfaction at several moments in time, to check the user's skills and how she copes with the site's challenges.

Such an experiment includes one test group that interacts with a site having the presentation method part of BASE implemented, and one control group that interacts with a non BASE site. We then would have to measure the possible differences in the users' perceptions of the two sites. The control group interacts with a site without presentation method paths, for instance a site with random or fixed presentation method selection. It would be necessary to let the test users visit the BASE site repeatedly in order to build the unique user profile.

In order to measure such a difference in user perceptions, we need to identify what these differences consist of. Our claim is that the users that interact with the BASE site with the presentation method part enhanced, easier will reach a state of flow than the users that interact with the non BASE site. The differences thus are to which degree flow is experienced with the different sites, or to which degree the users feel satisfaction, not boredom or anxiety. Our flow measurement methodology is the similar to the one Hoffman and Novak describe in (Novak and Hoffman, 1997), an activity survey, where the users are asked to perform a task and then evaluate the experience using a questionnaire. The experiment should show differences in the users' perceptions of the two sites. The BASE users should feel that the site was continuously adjusted to their skill level, and that they were comfortable with the challenges, i.e. the presentation methods. This should facilitate the flow feeling, compared to the users that were presented to the ordinary web site, without presentation method segmentation.

The differences in the users' perceptions could be measured using questionnaires. Hoffman et al have used questionnaires immediately following the web interaction, whilst another commonly used method is interrupting the session, capturing the mood of the moment. There are several issues to be considered; if the user must stop and fill in a form during the session, feelings of flow will be interrupted, and the method has a tendency to only reflect a snapshot of the complete session. On the other hand, if the user waits until after the session, in can be difficult to give statements on feelings during the web interaction (Novak and Hoffman, 1997, p. 7). Questionnaires could be given to the user by web interface or on paper. We have chosen to present the questionnaire in the same environment in which the experiment took place, in order to best preserve the user's state of mind on the web, and avoid the impediment of media change that a pen and paper based questionnaire would entail.

If the user's perceptions of the site should not be influenced by the content, as content is not included in the experiment setting, the users' interest - and thereby their motivation for visiting the site - must be above a certain level. As the flow model shows, see Figure 5, too little or lacking motivation foils flow. The test site's content must allow the assumption that the user is to some degree interested

in the site's content. Both the test site and the control site should contain the same content, so the information would be approximately the same.

As the presentation methods is a central part of our theory, the design of the test sites need to be carefully considered. The presentation methods are the very instrument to satisfy the balance between skills and challenges, and if these are poorly designed, this will be a source of error. The test site requires many different presentation methods that must be able to compete with state of the art web sites on the Internet. The paths of these presentation methods must be defined, or a propulsion plan must be configured. The test users should have many different skill levels ranging from novice to expert.

As presentation methods are so closely related to skills, we are in danger of the users feeling biased as to which presentation methods they should, want to or are expected to prefer. For the purpose of eliminating these reactive effects, information on the skill levels are not given to the users (Ilstad, 1992, p. 301).

As the above described longitudinal experiment is very demanding on both time as well as resources, we will run a less comprehensive experiment.

6.2 Dual point experiment setting

Rather than testing users on the complete range of skill levels, they will be tested on dual points. Two sites are designed with different essential features. The first site, A, is designed with traditional HCI fundamentals, where functionality, intuitiveness and effectiveness are important design traits. The interface itself implies few challenges for the user, allowing her to focus on the task at hand; i.e. manipulation of data.

The second site, B, offers entertainment beyond that which lies implicitly in the site content itself. It is designed to embrace the explorative mindset, with elements embedded in the site, that attract investigative behavior. Entertainment in an interactive medium invariably involves challenges for the user.

Basically there are four major scenarios:

1. Site A is preferred by all kinds of users due to its compliance with HCI theory, functionality, intuitiveness and effectiveness. People do not seek entertainment and challenge in the presentation methods themselves.
2. Site B is preferred by all kinds of users due to its added entertainment value. Even though some find it complex and too much of a challenge, they still appreciate the added amusement offered by the presentation methods.
3. Some users prefer site A and some prefer site B, but no specific pattern can be observed. The users' reasons are not explained at length on basis of the questionnaire.

4. Some users prefer site A, because this site best comply with their skill level, some users prefer site B for the same reason and some users are not satisfied with either one, as the skill level is somewhere in between the levels required by the sites.

A set of users will interact with both sites, and will subsequently be asked to fill in a questionnaire. The questionnaire deals with the user's skill levels and their perception of the different sites. The users are divided into groups based on their skill level. Qualitative and quantitative analysis of this statistical material, will show which of the three scenarios occurs. Should it be scenario 4, then segmenting the users on skills, in order to optimally adjust the sites' presentation methods, is purposeful and S1 is true, and thus S0 is true.

7 CONCLUSIONS AND FUTURE WORK

We have in this paper presented BASE and OWUS, a different approach to web population segmentation. By developing unique user profiles on skills that are functions of previous user actions, the site owners have the opportunity to utilize optimal adjusted presentation methods. This will again result in increased **flow possibilities** for the individual user. OWUS satisfies the demand of user profiles being continuously developed and maintained over time. A static profile will not reflect the user's increased skills, and therefore not be able to sustain the balance between the user's evolving skills and the web site's challenges.

Currently we are working on the experiment design involving actual human interaction, in order to show to which degree flow **possibilities** initiates **genuine** flow experiences, and more specifically to obtain empirical support for our BASE theory. A detailed description and the analyzed results of our experiment are due this summer.

As future work, we would focus on human-computer-interaction and to which degree different presentation methods are challenging. In this paper we have assumed that for instance images are more easily handled than imagemaps. The relations between presentation methods must be elaborated on further. Storing techniques that allow fast selection and retrieval of content and presentation method, and web display formatting 'on the fly' is important when it comes to system response times. The system must not cause delays that will disturb the user.

The work on BASE is still in progress. The bipolar attribute segmentation on content and presentation methods will give the users better targeted information, and optimal complexity of presentation methods.

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