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TOWARDS PSYCHOLOGICAL CUSTOMIZATION OF INFORMATION FOR INDIVIDUALS AND SOCIAL GROUPS

1. INTRODUCTION

When perceiving information via media and communications technologies, the mind is psychologically transported into a quasi-natural experience of the events described. This is called presence. In presence, information becomes the focused object of perception, while the immediate, external context, including the technological device, fades into the background (Biocca and Levy, 1995; Lombard and Ditton, 1997; Lombard et al, 2000).

Various empirical studies show that information experienced in presence has real psychological effects on perceivers, such as emotion based on the events described or cognition of making sense of the events and learning about them (Reeves and Nass, 1996). When using collaborative technology for computer-mediated social interaction, the users experience a state called social presence during which users may, for instance, experience intimacy of interaction or feeling of togetherness in virtual space (Lombard and Ditton, 1997; Lombard et al, 2000). During social presence users also experience various other types of emotional and cognitive effects, such as interpersonal emotion, emotion based on being successful at the task at hand and learning from shared activities or shared information. However, in the context of HCI the psychological effects occurring in computer mediated social interaction have not been thoroughly researched. Moreover, there is a need to integrate and implement the mind-based individual-centric and social interaction-centric approaches to emotional and cognitive effects at the level of system design.

Communication systems may be considered as consisting of three layers (Benkler, 2000). At the bottom is a *physical* layer that includes the physical technological device and the connection channel that is used to transmit communication signals. In the middle is a *code* layer that consists of the protocols and software that make the physical layer run. At the top is a *content* layer, that consists of multimodal information. The content layer includes both the substance and the form of multimedia content (Billmann, 1998; Saari, 2001). Substance refers

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to the core message of the information. Form implies aesthetic and expressive ways of organizing the substance, such as using different modalities and structures of information (Saari, 2001).

There are six basic ways of seeing technology. First, technology may be seen as instrumentation that extends human activity and capability (Olson, 1974). Second, technology may be seen as a device and method for generating, processing and delivering information. This involves the fact that there are authors of information (both human and machine) and receivers of information and the information describes imaginary or factual states of the world (Saari, 2001). Third aspect of technology is that by generating and delivering information, technologies become a way to know of the events of the world (Rogers, 1986). Fourth, communication technology also creates a ´way of being´ as it penetrates everyday life. When people use communication technologies they become a part of everyday life (Sobchack, 1994). Fifth, technology may be thought of as tools. This is the most common way of thinking of technology, as a hammer or a saw to accomplish a task with (Miller, 1978). Sixth, technology may be thought of as something capable of emerging beyond its original purpose. People may use technologies creatively and invent surprising uses for them (Chesebro and Bertelsen, 1996).

Technologies may be considered Mind-Based because they simultaneously take into account the interaction of three different key components: i) the individual differences and social similarities of perceptual processing and sense making of different segments of perceivers, ii) the elements and factors inherent in information and technology that produce psychological effects (physical, code and content layers), iii) and the consequent transient psychological effects emerging based on perception and processing of information at the level of each individual.

For instance, with Mind-Based Technologies one may vary the form of information per user profile, which may systematically produce, amplify, or shade different psychological effects (Saari, 2001; Saari, 2002; Saari, 2003a, Saari, 2003b). In a way, Mind-Based Technologies are more sensitive to the information they deliver, to the user of technology and especially to the psychological states of the user when processing the information. In this way, such technologies share much in common with the six basic ways of seeing technology presented above; but at the same time they involve a meta-understanding of an interactive and fluid relationship between technology, information, the user and the effects of using technology at the psychological level per each individual. This type of system design approach may be of practical use, as it is known that individual differences in processing information may produce sometimes quite large variance in the intensity or type of psychological effects, such as depth of learning, positive emotion, persuasion, presence and other types of psychological states and effects (Saari, 2001; Saari, 2002; Saari, 2003a; Saari, 2003b).

Consequently, information presented to individual users or a group of users may be customized on the basis of the types of immediate psychological effects it is likely to enable or create in certain individuals or groups. Psychological Customization may be used for controlling social interaction-centric and individual-centric influence of the substance and form of information on emotional and

cognitive effects during and shortly after presence and social presence (Saari, 2003a; Saari, 2003b; Saari and Turpeinen, 2003; Turpeinen and Saari, 2004).

Psychological Customization may be considered an operationalization and technique of implementing the concept of Mind-based Media and Communications Technologies (Saari, 2001; Saari, 2002; Saari, 2003) in system design. Initially Psychological Customization involves i) a given pool of information to be presented to different users within a certain task, ii) a database of desired psychological effects per each user or user segment, such as positive emotion, set by the users themselves or the service provider, iii) a database of user profiles, iv) a database of metad-escriptions of the substance and form of the information to be delivered to users, v) a database of design rules of how the elements of information, such as form, will probably influence the transient psychological states of the different users, and vi) an AI-component that monitors the realization of psychological effects and provides the necessary intelligence for the system to function.

One basic example is a recommendation system. The system knows the user´s profile and the desired psychological effect is set to positive emotion in as many pageviews of the recommendations as possible. The user starts using the system and finds an interesting product that the system recommends to her. The form of the recommendation information is tailored to the user´s profile and desired psychological effect in real-time when the page uploads to make the realization of positive emotion as probable as possible. The system may select the modality of recommendation from text to audio, or from audio to animation; the system may change the background colours of the page and modify the shape and colour of the navigation buttons, for instance. In this case, the system will try to do everything possible to facilitate positive emotion but change the substance of the recommendation itself. Naturally in some cases depending on type of user and the type of recommendation, the available databases of recommendation information and the available means of Psychological Customization of form of recommendation information, the effect to be achieved is more or less likely to occur. However, even effects that provide some percentages or tens of percents of more targeted positive emotion may make a difference in attitudes towards the product and buying behavior. This is especially true if the recommendation system website has masses of users and hence even a slight increase in sales effectiveness may add up to significant amounts of income.

It should be noted that to build a smoothly functioning Psychological Customization system one should do much more research and gain more evidence of the systematic relationships of user profiles, information forms and psychological effects than what is currently reported in scientific experiments with available methods of acquiring such complex information. Hence, the full description of the detailed design guidelines for Psychological Customization is well beyond the scope of this single chapter.

As it may be that personalization will turn out to be an important value driver for future commercial applications and services in a one-to-one world, in addition to practical case-studies it may be important to take a broader top-down view on the phenomenon. The critical success factor of personalization systems will be to be able to answer the question: “What is good and desirable personalization?” This

chapter will sketch a preliminary broad view informed by psychological theory to shed light on the issue of "good personalization". More specifically the chapter will provide a preliminary framework for Psychological Customization of information for individuals and social groups and discuss some conceptual implications for system design as well as aid in forming a more detailed research agenda on Mind-Based Technologies.

2. MODEL OF EMOTIONAL AND COGNITIVE EFFECTS

2.1 Modeling Transient Psychological Effects

When a user is interpreting information, a complex set of interrelated "gateway variables" may influence the "outcome variables" like his psychological states, such as presence, and experience of the information, including learning and emotion (Saari, 1998; Saari, 2001). These gateway variables may be clustered as *Mind* (individual differences and social similarities of perceivers), *Content* (information substance and form embedded in technology with certain ways of interaction) and *Context* (social and physical context of reception) (Saari, 1998; Saari, 2001). Being able to systematically and reliably predict the relationships of the gateway variables is the key to Mind-Based Media and Communications Technologies and Psychological Customization. This is complex and it may be sensible to concentrate only on the most robust psychological effects with certain tasks.

With the possibility of real-time customization and adaptation of information for different perceivers it is hypothesized that one may vary the form of information within some limits per the same substance of information. For instance, the same substance can be expressed in different modalities, or with different ways of interaction with the user and technology. This may produce a certain psychological effect in some perceivers; or shade or amplify a certain effect. This approach may also be suitable for creating psychological effects during computer mediated social interaction.

Mind-Based Technologies can serve as a framework for producing personalized, rule-based psychological effects. In Figure 1 the interaction of media and communications technology and the user in context with certain types of tasks is seen as producing transient psychological effects. Media and communication technology is divided into the physical, code and content layers. The user is seen as consisting of various different psychological profiles, such as individual differences related to cognitive style, personality, mental models and other differences. Certain contexts and tasks may be more or less open to some types of psychological effects to emerge than others.

The key is to be able to model and capture the systematic relationships of technology, user and psychological effects. If this can be done, one may claim that it is possible to build various types of technologies that are based on the probable and systematic control of various psychological effects.

One may discuss transient psychological effects. These may range from immediate millisecond-level reactions to tens of minutes of effects. One key focus is that Psychological Customization takes place within one particular session of using a particular technology and content. This is because long-term psychological effects may be beyond the horizon of prediction. Even in transient psychological effects it may be difficult to capture the real-time psychological states of a user.

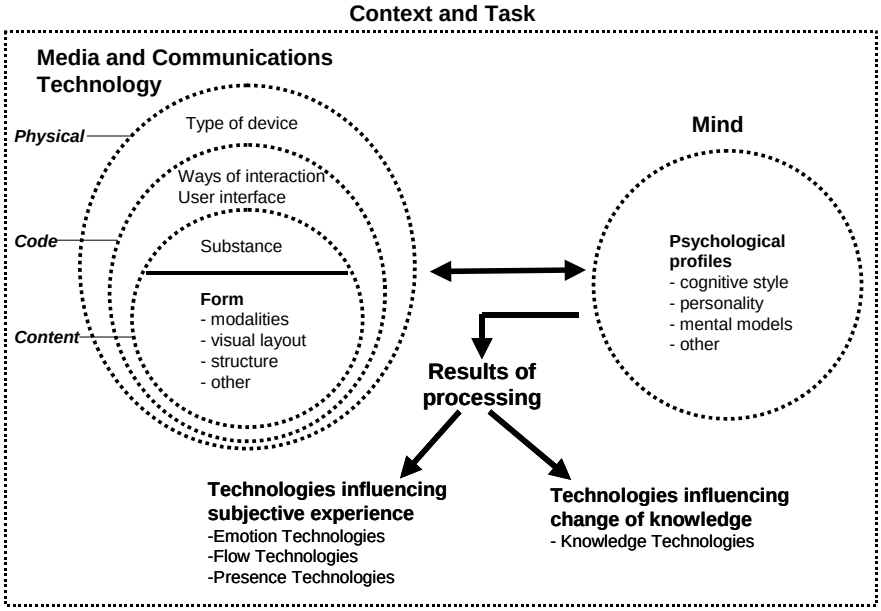

Figure 1. *Mind-Based Technologies as a framework for producing psychological effects. Adapted from Saari (2001).*

Mind-Content-Context- gateway variables are also fluid; they form new types of relationships and acquire new values as the different layers of technology change. Here one may focus on the reasonable temporal resolution of capturing user´s psychological states and adapting content to the user within a single session of using an information system. From the point of view of user´s psychological states, it may be reasonable not to concentrate on creating too many simultaneous effects, but concentrating on some key effect area, such as intensity and valence of emotions or efficiency of cognition. Also, one may wish to keep an emotional effect stable for some time as the user is using a system, rather than trying to change it constantly. Hence, the system will not try to create chaotic and over-complex psychological states, rather it should concentrate on providing and guiding desired types of "streams" of user experiences and psychological effects.

Obviously it is a highly complex task to model and capture user´s psychological effects, such as efficiency of cognition, emotional states and moods or depth of presence or involvement and even more difficult to do so in real-time. However, using psychophysiological signals, such as heart rate and its indexes, EMG, EEG, GSR and also micro events of the visual system, such as eye-movement, may be of help here. For instance, psychophysiological signals may be considered as revealing the conscious and non-conscious emotional states of the user as well as the amount of workload on cognitive processing and level of attention. Similarly, patterns of eye-movements and other eye-related measures may be used for detecting changes in cognitive processing.

Hence, one possible realization for capturing user´s psychological effects is to have the user linked to a sufficient number of measurement channels of various psychophysiological signals. These signals then would verify to the system whether a desired psychological effect has been realized. Another approach would be to conduct a large number of user studies on certain tasks and contexts with certain user groups, psychological profiles and content-form variations and measure various psychological effects as objectively as possible. Here, psychophysiological signals or eye-tracking methods may be used as well as questionnaires and interviews. This would constitute a database of design-rules for automatic adaptations of information per user profile to create similar effects in highly similar situations with real applications. Naturally, a hybrid approach would combine both of these methods for capturing and facilitating the user´s likely psychological state.

However, even though with specific focus areas one may achieve results concerning for instance positive emotion and individual differences in processing information, to build a more comprehensive database of results covering more types of psychological states and effects remains a laborious and also expensive task requiring a lot of research resources. It may be also that with current scientific methods it is possible to achieve quite satisfactory results predicting the phenomenon, but there is a challenge of integrating the various methods of experimental psychology together to cover psychological effects in a more multisided manner. Another challenge is to test the feasibility of achieved laboratory results in real-life tasks and field conditions. To do this one may need tools such as ambulatory psychophysiology and mobile eye-tracking devices.

2.2 Customizing for Psychological Effects

Traditional mass media channels have not been amenable to efficient customization. At best, these media have been able to tailor content to reflect perspectives of a local community within the parameters used in market segmentation strategies. Internet-based technologies for content management and personalization introduce a new set of tools for serving individuals and communities of much wider variation sizes and types (Erickson, 1995; Riecken, 2000). Based on the principle of variability, many potential versions of the same media product or a particular collection of information may be available for different perceivers (Manovich, 2001).

Layer of technology	Key factors
Physical	**Hardware** - large or small vs. human scale - mobile or immobile - close or far from body (intimate-personal-social distance)
Code	**Interaction** - degree of user vs. system control and proactivity through user interface
	Visual-functional aspects - way of presenting controls in an interface visually and functionally
Content	**Substance** - the essence of the event described - type of substance (factual/imaginary; genre, other) - narrative techniques used by authors
	Form 1. Modalities - text, video, audio, graphics, animation, etc. 2. Visual layout - ways of presenting various shapes, colours, font types, groupings and other relationships or expressive properties of visual representations - ways of integrating modalities into the user interface 3. Structure - ways of presenting modalities, visual layout and other elements of form and their relationships over time - linear and/or non-linear structure (sequential vs. parallel; narrative techniques, hypertextuality)

Table 1. *Key factors influencing individual-centric emotional and cognitive effects of technology, adapted from (Saari,2001).*

One may discuss the "packaging" of information, which means how the different dimensions of information are put together into a certain type of package, including form and substance. The content can be selected and organized in different ways and the presentation of content can be tailored to suit the needs and preferences of the

individual. This may include personal preferences for layouts or color schemes. This tailoring may result in different looking products based on the display device or publication style (Weitzman and Wittenburg, 1994).

Table 1 addresses the key factors, which may influence psychological effects of information. For instance, a user may wish to have certain substance of information with as much video material as possible and have the system completely take over the control and present a personalized tv-newscast-type of information flow. Another example would be that the user has a profile that indicates it is beneficial for him to receive information in textual modality and the system may try to alter the information flows presented to him accordingly.

The view of the authors is that psychological effects occurring during social presence when in social computer mediated interaction have not been sufficiently researched. It can be hypothesized, however, that at least roughly similar psychological influences can be created via personalizing substance and form of information during social interaction as with individual-centric human-computer interaction. Thus the idea of gateway variables could be extended to tasks involving social interaction in the light of the factors presented in Table 1.

Mind-Based Media and Communications Technologies are created via real-time variations of i) substance, ii) form and iii) code layer (interaction and controls) within a certain technological device per certain user profiles. These elements interact in complex ways when producing psychological effects. The role of hardware should not be neglected. A device with a large screen or a portable device with smaller screen with user-changeable covers may also influence the emerging effects. The relevance of this framework to personalization research and HCI is evident as it may provide an approach to gaining access to and partly controlling the psychological states of the users of information systems.

2.3 Validating the Need for Psychological Customization

Even though no actual system has been implemented yet for Psychological Customization, empirical evidence supports the feasibility and validity of the idea of Psychological Customization. The key idea is that there seem to be several cognitive and emotional effects that are moderated by individual differences, for instance. This suggests the need for Psychological Customization Systems that optimize the presentation of information to different target groups having different psychological profiles. There is considerable evidence in literature that varying the form of information creates for instance emotional and cognitive effects. The design rules for Psychological Customization may be divided into two main groups: I) those concerning social interaction and ii) those concerning individual-level human-computer-interaction.

In the area of social interaction, Reeves and Nass (1996) have conducted research revealing that people respond to information technology in ways behaviourally similar to human-human interaction in the areas of flattery, team-building, credibility, persuasion, frustration and a range of other areas. In the area of individual-level human-computer interaction there are various sources for effects

that have to do with how the form of information may influence psychological effects in conjunction with key individual differences. Specifically there is some recent experimental research supporting the idea, concept and need for Mind-Based Technologies.

For instance, Ravaja (2002) examined the moderating influence of dispositional Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS) sensitivities, Negative Affect, and Positive Affect on the relationship between a small moving vs. static facial image and autonomic responses when viewing/listening to news messages read by a newscaster with 36 subjects displayed on a PDA. Autonomic parameters measured were respiratory sinus arrhythmia (RSA), low-frequency component of heart rate variability, electrodermal activity (EDA), and pulse transit time (PTT). The results showed that dispositional BAS sensitivity, particularly BAS Fun Seeking, and Negative Affect interacted with facial image motion in predicting autonomic nervous system activity. A moving facial image was related to lower RSA and EDA and shorter PTTs as compared to a static facial image among high fun seekers, while there was no, or an inverse, relationship between these variables among low fun seekers. Facial image motion may contribute to sustained attention particularly among high fun seekers, given that it may increase the so-called sense of presence and act as a positive incentive for high fun seekers, partly because of their higher need for stimulation.

Ravaja et al (2003) indicated the influence of subliminally presented emotional facial pictures on news presented on a PDA consisting of video material on emotion, attention and memory performance. Kallinen (2001) found that the use of headphones vs. speaker listening of audio news presented on a PDA influences evaluation and emotional responses to news. Kallinen and Ravaja (2002) found that playing raising and falling chromatic background melodies when reading and listening to news presented on a PDA influences emotional responses to news.

In media studies it has been found that different modalities, such as visual and auditory, may lead to different kinds of psychological influences and the valence of a preceding subliminal stimulus influences the subsequent evaluation of a person evaluated (Cuperfrain and Clarke, 1985; Krosnick et al, 1992). In educational studies it has been shown that different ways of processing information influence learning and emotion of stimuli with certain modality (Riding and Rayner, 1998). Research concerning emotional influences on the cognitive processing of information has often concentrated on how different emotions related to information change the way users pay attention to, evaluate and remember the mediated message. This research has results on the influence of emotional information as increasing the user's self-reported emotion (Lang et al, 1996); attention (physiological and self-reported) (Lang et al, 1995) and memory for mediated messages, particularly arousing messages (Lang, 1990; Lang et al 1995; Lang et al, 1996). Studies in experimental psychology have shown that recognition and memory can be influenced or even enhanced by previous exposure to subliminal visual or auditory images of which the subjects are not consciously aware (Kihlström et al, 1992). Some of these effects are produced in interaction with individual differences, such as cognitive style, personality, age and gender.

There is little research conducted in the area of psychological effects in the context of customized computer mediated social interaction. However, one may apply the approach of gateway variables to social interaction also. The interaction of two users may be seen as based on the mutual interaction of two sets of Mind, Content and Context- variable clusters (Saari, 1998). The content is the substance and form of social interaction, for instance a text used in a real-time messaging system. The other user within his Context sends information that is Content for the other user to receive. The other user makes sense of the Content sent to him and experiences various psychological effects during social presence with the other user. He may construct a reply to the message and send it to the other person. The interaction continues as the participants construct and make sense of the messages exchanged.

3. MODELING INDIVIDUALS, GROUPS AND COMMUNITIES

To be able to conduct Psychological Customization the system needs a model of the user or users. In fact, customization is always based on some type of model of an individual, a group or a community. These three can be considered separately:

- *user modeling*, which includes a profile of an individual user,
- *group modeling*, which is based on similarities between user profiles and forming a user cluster using some form of automated technique, and
- *community modeling*, which includes a profile about the community as a whole, not as the sum or the average of its individual member's profiles.

A user model is computer-accessible presentation of information about an individual regarding specified domains of use. This user model can consist of data explicitly given by the user for the purposes of modeling, implicit observations of user's behavior. The personalization can also be based on inferred data about the user, that is stored in the user model. For example, based on user behavior, the user can be assigned with some probability to belong to an identified segment. The actual personalization is then done on a segment-by-segment basis.

Recommendation systems using *collaborative filtering* techniques categorize users automatically into groups or 'neighborhoods' based on similarities between user profiles. The tools use these neighborhoods to recommend new items to similar users, or to recommend users to each other (Shardanand and Maes, 1995).

Community modeling can be used to model the collective group, especially in a case of joint activity. Although communities have been profiled from several perspectives - for example psychological sense of a community (Chavis et al., 1986) or socio-economic profiles of local communities - there is not much literature on methods regarding community modeling from the point of view of their joint practice.

Community is not static – new members can arrive and existing members can leave at any time, but there is a sense of belonging to a group of individuals, and the group is relatively stable (Wenger, 1998). Instead of communities defined solely by geographic region or by joint interest, the web-enabled communities are often communities of practice that engage in a joint enterprise via mutual engagement

(Wenger, 1998). Most communities engage in some degree of collective cognition – the interactions through which they learn from one another's experiences, set common strategies, develop a shared vocabulary, evolve common norms and means, and evolve a distinctive and shared way of thinking (Agre, 1998).

User modeling, group modeling and community modeling may be used simultaneously in customization (Turpeinen, 2000). Our approach is to promote this hybrid usage of individual and social modeling in the context of psychological customization.

4. PSYCHOLOGICAL CUSTOMIZATION FOR INDIVIDUALS AND SOCIAL GROUPS

Basic principles of Mind-Based Media and Communications Technologies in producing psychological effects for individuals and groups may be utilized with Psychological Customization. For instance, if one wishes to produce more or less emotion with certain form of information embedded in a particular device with a certain user interface, one would have to know which types of variations of form may cause which types of qualities of emotion for the different perceivers. The same principle may apply to other psychological effects, such as presence, learning, persuasion or so. One may then hypothesize of individualized information products, such as Knowledge Media (Saari, 1998; Saari , 2001) that would enhance in-depth learning, or Emotion Media (Saari, 2001), which would produce certain types of emotions. One may also think of Presence Media (Saari, 2002) that may produce desired types of presence or Flow Media that may facilitate flow-states (Saari, 2001). These concepts may be extended to include also social interaction in producing group- or community-based emotion, cognition and presence.

Emotional and cognitive effects of information are related to communication within social networks as follows: one may manipulate manually or with automated systems the substance and the form of information. It is obvious that in social interaction the users may construct the substance and form of for instance MMS-messages exchanged manually. However, the form of the message may also be varied with automated systems. The information needed to conduct these automated manipulations can be accessed via individual and social modeling and profiling of the users.

For instance, a user with an intention to create positive emotion in the other user with the way of presenting his textual message may utilize a background color predicted to induce a mild positive emotional state in the receiving user based on his profile.

Psychological Customization includes modeling of individuals, groups, and communities to create psychological profiles based on which customization may be conducted. In addition, a database of design rules is needed to define the desired cognitive and emotional effects for different types of profiles. Once these components are in place, content management technologies can be extended to cover

variations of form and substance of information based on psychological profiles and design rules to create the desired psychological effects.

This approach differs from present content management systems that are often based on filtering substance of information for individuals. It also differs from computer supported collaborative work (CSCW) approach in that it does not concentrate on enabling work on shared objects and tasks. In essence, Psychological Customization goes beyond the mere technical or task-based approach to content management technologies. It poses the question: how to utilize these technologies to create desired optimal psychological effects, such as positive emotion and efficiency of cognition with certain substance or within certain collaborative tasks?

Privacy is one of the main social and technical challenges underlying any system that customizes media content for individual users. Considering the intimacy of psychological effects and user profiles the role of privacy protection is essential. The privacy issues in personalization are dependent on the physical storage location and modes of access to personal information. Also, there are technical mechanisms for providing pseudonymous service in which the user has persistent and verified digital identity and profile, but the actual identity of the individual is not known (Brands, 2000).

5. APPLICATION AREAS FOR PSYCHOLOGICAL CUSTOMIZATION

Psychological Customization can be applied to various areas of HCI, such as Augmentation Systems, Notification Systems, Affective Computing, Collaborative Filtering, Persuasive Technology and Messaging Systems.

It is hypothesized that the selection and manipulation of substance of information takes place through the technologies of the various application areas of Psychological Customization. Underlying the application areas is a basic technology layer for customizing design. This implies that within some limits one may automatically vary the form of information per a certain category of substance of information. The design space for Psychological Customization is formed in the interaction of a particular application area and the possibilities of the technical implementation of automated design variation.

For instance, Augmentation System refers to a system, which may enhance cognitive processing and understanding of a particular substance of information. In news services, a particular piece of information may be surrounded by articles related to the base-article selected on the basis of a user profile. Displaying related articles or other additional information to the user may enhance the understanding of the basic story (Turpeinen, 2000). Augmentation may be varied for instance for experts and novices. Adding the possibilities of real-time variation of design may produce applications in the both the substance and form of information is varied for maximum cognitive efficiency. This means that the augmentations may be altered by modality or some other means per user profile. Information Filtering refers to a system in which a software program filters the substance of information according to the user profile. Also here one may automatically vary the design within some limits

per user. Notification System implies a way for the computer to alert the user of some noteworthy events, such as arrival of new email. It may be that also here one may vary the design of the substance of such a notification to create an effect of urgency or pleasantness, for instance.

Affective Computing refers to systems in which the computer is receiving real-time feedback of the emotional state of the user and may use this information to adapt its actions, such as when displaying certain substance of entertainment information, like a movie. With automated design variation, one may vary some emotional components of the substance to create desired emotional effects. A feedback system may then pick up the efficiency of the variations made to make sure an effect has been realized in a particular user.

Collaborative Filtering is a technique to offer personalized substance of information or recommendations based on clustering individual users into groups by buying behavior or some other dimension. Collaborative Filtering as a technique may be altered by automated variation of design to present the substance, for instance a book recommendation as substance may be altered in design to create a desired effect, such as maximum credibility of the recommendation for a particular user.

Persuasive Technology refers to human-computer interaction in which there is an underlying goal to change the attitudes and behavior of the user (Fogg, 2002). For instance, one may motivate users to quit smoking via motivating games. Also socially intelligent agents may be classified as persuasive technology. Often with agents an illusion of being in interaction with another human being is created in the user via using for example animated agents in e-Commerce. It is known that both the substance of the interaction (what is being sold and what the agent says) and the form of interaction (how information is presented, what is the appearance and personality of the agent) influence for instance trust, persuasiveness, emotion and liking of the transaction (Reeves and Nass, 1996). What psychological customization may add here may be more personalization of the way of presenting information in an eCommerce site as well as it may vary the appearance or other features of the agent without changing the substance, i.e. what the agent says.

A Messaging System entails computer mediated social interaction, like, MMS, chat or CSCW-software usage. By varying the design of MMS messages for instance one may be able to create emotional effects in the receivers of the message. Similarly, cognitive processes may be optimized for each individual user with the personalization of different aspects of the form of information embedded in a CSCW-software suite.

A more detailed example of and application for Psychological Customization includes for instance facilitating desired emotions with eCommerce systems to make the systems more persuasive. The goal of persuasion may be to enhance brand awareness of the products sold or to sell more products if the information related to the products on an eCommerce site is presented in a way to facilitate positive emotion, for instance. Affective Computing may be used to create desired emotional states to enhance persuasiveness.

In accordance with particular emotional reactions or moods attention may be increased, memory may be influenced, performance in problem solving may be

enhanced and judgment and decision-making may be influenced (Clore and Gasper, 2000; Reeves and Nass, 1996; Isen, 2000). One may focus on "primitive" emotional responses or emotions requiring more extensive cognitive appraisal and processing. Both of these types of emotions can be linked to various psychological consequences. Consequently, with Emotion Media-type of personalized information products one may focus on i) creating immediate and primitive emotional responses, ii) creating mood and iii) indirectly influencing secondary effects of emotion and mood, such as attention, memory, performance and judgment.

With eCommerce systems one may facilitate positive emotional responses for instance by selecting the modalities of the information to be displayed according to the processing styles and alter visual layouts of the interface according to the personalities of the users. The ease of processing information and the similarity-attraction between visual layouts and personalities may create positive emotional states. As for brand awareness one may indirectly influence memory with the facilitation of positive emotion and increase memory-based performance on the task such as brand recognition and recall. By increasing attention one may increase the likelihood of the user of an eCommerce system to learn product information more efficiently. Positive emotion and mood also has the effect of making the user adapt a less risk-prone approach to making decisions (Isen, 2000). This may be used to present product information in a familiar manner creating a safe atmosphere around to product to make it more desirable when the user is making purchasing decisions in a positive mood.

6. CONCLUSION

Mind-Based Technologies and Psychological Customization as a research area has some overlap with usability studies and design studies. For instance, in usability studies the pleasantness and the aspect of having fun with interfaces have been addressed (Monk and Frochlich, 1999). Affective computing has been developed in the area of computers and emotion (Picard, 1997). Accordingly, in design-related research there has been for some time discussion about emotion and design (Hirsch et al, 2000).

However, according to the authors´ knowledge no other comprehensive framework of varying form of information to systematically create emotional and cognitive effects has been presented. Differences to other approaches to influencing user experience are various. Usability studies traditionally address the question of how to make difficult technology easy to use. Usability is at least partly founded on the idea of optimal human-machine performance, i.e. how well a user can manipulate and control a machine.

While this is certainly important, in consumer applications, like games, online news, e-Commerce and peer-to-peer computer mediated social interaction the emphasis of the use of the computer may well be in the arena of psychological effects rather than on usability as such. Games may be used to experience emotional arousal and excitement, online news may be used to learn of the events of the world

and e-Commerce vendors present their wares in a persuasive manner to users. Consequently, Psychological Customization is founded on the idea of creating a desired psychological effect with the available means of automatic variation of substance and form of information. It may be seen as partly based on or adding to usability studies. Naturally, if an interface is not usable, it may not be possible to systematically create psychological effects.

Design-based approaches to interface design have adopted the perspective of creating desired experiences, such as positive emotion for a user. However, what is lacking is the systematic and explicit, communicable, knowledge of what exactly in the elements of design may produce such effects. Also, the influence of individual differences of the users in the variation of the effects remains unknown. Moreover, it may be difficult to alter hand-made designs rapidly, and almost impossible to do it in real-time. Psychological Customization does not claim to replace design as such, it may rather be a tool for designers to systematically vary some elements of an interface in real-time within a hand-designed template, for example.

From the point of view of contribution to HCI community, Psychological Customization poses a possible change in the perspective to technology. One may view technology as a source for creating added value for a user, such as enabling desired emotional and cognitive effects. However, it is beyond the scope and aim of this chapter to provide detailed and ready-to-use, low-level practical advice on how to design for psychological effects. There are case-studies in which various effects have been studied in the area of mediapsychology, educational psychology and experimental psychology but only a few examples in the HCI area.

This may also be partly due to the fact that HCI research does not very often conceptualise the users as possessing individual differences related to processing information presented via user interface and the consequential differences in user experiences. It is evident, that designing for the “average user experience” is economical and may cover many of the usage-cases, but in some more “mission critical” application areas it may be sensible to closely match the information form and user interface to the type of user. Naturally, if one wishes to design for different types of user experiences for different segments of users, this may require new types of methods for capturing the user experience as well as systems for automatic variation of the form of information and user interface discussed in this chapter to inform design.

As for having clear hypothesis on how different technologies may be used to facilitate for instance positive emotion, it may be said that the most obviously fruitful focus area of manipulation in different application areas may differ. An example of a persuasive e-Commerce system was given. Further, for example, in Messaging Systems it may be sensible to concentrate on MMS-message templates (colours, shapes, animations, other) that can be used to facilitate a desired emotion. In Augmentation Systems, such as augmented online news services, it may be sensible to find out the most efficient ways of supporting in-depth information processing with types of additional information elements and their modalities. In Affective Computing, one interesting area is the personalized generation of background textures, colours, shapes and sounds in games based on navigation in 3D space to facilitate desired emotions.

In sum, to be able to realize Psychological Customization one may have to conduct a number of experimental studies in which certain applications with certain tasks are tested in laboratory and field conditions. Laboratory methods, such as psychophysiology, may be used for indicating emotional effects in addition to qualitative methods.

However, the real challenge comes from conducting research with more ecological validity than laboratory studies. It may be fruitful to see how the most intense and probable psychological effects in laboratory simulations hold together in everyday contexts. This may be studied with qualitative methods or with ambulatory psychophysiological tools. Also, one should develop content management technologies to utilize the design rules acquired from user studies. In the light of the considerable amount of experiments and development work needed to realize Psychological Customization it appears that the effort and collaboration of various research groups will be needed on this emerging area of HCI.

7. REFERENCES

Agre, P. E. (1998). Designing Genres for New Media: Social, Economic, and Political Contexts, In Jones, S.G. (ed.) Cybersociety 2.0: Revisiting Computer-Mediated Communication and Community, Thousand Oaks: Sage Publications

Benkler, Y. (2000) From Consumers to Users: Shifting the Deeper Structures of Regulation. Federal Communications Law Journal 52, 561-63.

Billmann, D. (1998) Representations. In Bechtel, W. and Graham, G. (1998) A companion to cognitive science, 649-659. Blackwell publishers, Malden, MA.

Biocca, F. and Levy, M. (1995) Communication in the age of virtual reality. Lawrence Erlbaum, Hillsdale, NJ.

Brands, S. (2000). Rethinking Public Key Infrastructures and Digital Certificates; Building in Privacy. MIT Press, Cambridge, MA.

Chavis, D.M., Hogge, J.H., McMillan, D.W. (1986). Sense of community through Brunswick's lens: a first look. Journal of Community Psychology, No. 14.

Chesebro, J. W. and Bertelsen, D. A. (1996) Analyzing media. Communication technologies as symbolic and cognitive systems. The Guilford Press, New York and London.Cuperfain, R. and Clarke, T. K. (1985) A new perspective on subliminal perception. Journal of Advertising, 14, 36-41.

Clore, G. C. and Gasper, K. (2000). Feeling is believing. Some affective influences on belief. In Frijda, N.H., Manstead, A. S. R. and Bem, S. (Ed.), Emotions and beliefs: How feelings influence thoughts (pp. 10-44). Paris/Cambridge: Editions de la Maison des Sciences de l´Homme and Cambridge University Press.

Elo, S. K. (1996) PLUM: Contextualizing news for communities through augmentation. Master´s thesis, MIT MediaLab, Cambridge, MA.

Erickson, T. (1995) Designing agents as if people mattered. In Bradshaw, J. M. (eds.) Software agents, 79-96. AAAI Press/The MIT Press, Menlo Park, CA, Cambridge, MA, London, England.

Fogg, B. J. (2002) Persuasive technology. Using computers to change what we think and do. Morgan Kaufmann Publishers, New York.

Hirsch, T., Forlizzi, J., Hyder, E., Goetz, J., Stroback, J., and Kurtz, C. (2000) The ELDeR Project: Social and Emotional Factors in the Design of Eldercare Technologies. Conference on Universal Usability, 2000, pp. 72-80.

Isen, A. M. (2000). Positive affect and decision making. In Lewis, M. and Haviland-Jones, J. M. (Ed.), Handbook of emotions (2nd ed.) (pp. 417-435). New York: Guilford Press. Kallinen, K. (2001) Speakers versus headphones: preference, valence, arousal and experience of presence in audio PDA news. In Michitaka Hirose (Ed.) Human Computer Interaction INTERACT ' 01, Amsterdam: IOS Press, 805-806.

Kallinen, K. and Ravaja, N. (2002) Creating tension from chromaticism: self-reported judgments of and physiological responses to audio news with raising versus falling chromatic background melody [CD-ROM]. In M. Britta & M. Melén (eds.), Proceedings of the 10th anniversary conference of the European Society for the Cognitive Sciences of Music: Musical Creativity. Liège, Berlgium: University of Liège.

Kihlström, J. F., Barnhardt, T. M. and Tataryn, D. J. (1992) Implicit perception. In Bornstein, R. F. and Pittmann, T. S. (eds.) Perception without awareness. Cognitive, clinical and social perspectives, 17-54. Guilford, New York.

Krosnick, J. A. , Betz, A. L., Jussim, J. L. and Lynn, A. R. (1992) Subliminal conditioning of attitudes. Personality and Social Psychology Bulletin, 18, 152-162.

Lang, A. (1990) Involuntary attention and physiological arousal evoked by structural features and mild emotion in TV commercials. Communication Research, 17 (3), 275-299.

Lang, A., Dhillon, P. and Dong, Q. (1995) Arousal, emotion and memory for television messages. Journal of Broadcasting and Electronic Media, 38, 1-15.

Lang, A., Newhagen, J. and Reeves. B. (1996) Negative video as structure: Emotion, attention, capacity and memory. Journal of Broadcasting and Electronic Media, 40, 460-477.

Lombard, M. and Ditton, T. (1997) At the heart of it all: The concept of presence. Journal of Computer Mediated Communication, 3 (2).

Lombard, M., Reich, R., Grabe, M. E., Bracken, C. and Ditton, T. (2000) Presence and television: The role of screen size. Human Communication Research, 26(1), 75-98.

Manovich, L. (2001) The language of new media. The MIT Press, Cambridge, MA, London, England.

Marcel, A. J. (1983) Conscious and unconscious perception: An approach to the relations between phenomenal experience and perceptual awareness. Cognitive psychology, 15, 283-300.

Miller, C. R. (1978) Technology as a form of consciousness: A study of contemporary ethos. Central States Speech Journal, 29, 228-236.

Monk, A.F. and Frohlich, D. (1999) Computers and Fun, Personal Technology, 3, 91.

Olson, D. R. (1974) Introduction. In Olson, D. R. (eds.) Media and symbols: The forms of expression, communication and education, 1-24. University of Chicago Press, Chicago.

Picard, R. (1997) Affective Computing. MIT Press, Cambridge, 1997.

Ravaja, N. (2002) Presence-related influences of a small talking facial image on psychophysiological measures of emotion and attention. Proceedings of the 5th Annual International Workshop Presence 2002. Porto, Portugal: University Fernando Pessoa

Ravaja, N., Kallinen, K., Saari, T. and Keltikangas-Järvinen, L. (2003) Effects of Suboptimally Presented Facial Expressions on Emotion, Attention, and Memory when Viewing Video Messages from a Small Screen. Submitted to Journal of Experimental Psychology: Applied

Reeves, B. and Nass, C. (1996) The media equation. How people treat computers, television and new media like real people and places. Cambridge University Press, CSLI, Stanford.

Riding, R. J. and Rayner, S. (1998) Cognitive styles and learning strategies. Understanding style differences in learning and behavior. David Fulton Publishers, London.

Riecken, D. (2000) Personalized views on personalization. Communications of the ACM, V. 43, 8, 27-28.

Roediger, H. L. (1990) Implicit memory: Retention without remembering. American Psychologist, 45, 1043-1056.

Rogers, E. M. (1986) Communication technology: The new media in society. Free Press, New York.

Saari, T. (1998) Knowledge creation and the production of individual autonomy. How news influences subjective reality. Reports from the department of teacher education in Tampere university. A15/1998. Licenciate thesis.

Saari, T. (2001) Mind-Based Media and Communications Technologies. How the Form of Information Influences Felt Meaning. Acta Universitatis Tamperensis 834. Tampere University Press, Tampere 2001. Doctoral thesis.

Saari, T. (2002) Designing Mind-Based Media and Communications Technologies. Proceedings of Presence 2002 Conference, Porto, Portugal, pp. 79-87.

Saari, T. (2003a) Designing for Psychological Effects. Towards Mind-Based Media and Communications Technologies. In Harris, D., Duffy, V., Smith, M. and Stephanidis, C. (eds.) Human-Centred Computing: Cognitive, Social and Ergonomic Aspects. Volume 3 of the Proceedings of HCI International 2003, pp. 557-561

Saari, T. (2003b) Mind-Based Media and Communications Technologies. A Framework for producing personalized psychological effects. Proceedings of HFES´03 -conference. 13.-17.10.2003 Denver, Colorado.

Saari, T. and Turpeinen, M. (2003) Psychological Customization of Information for Individuals and Social Groups. Proceedings of MCPC´03- conference, Munich, Germany 6.-8.10. 2003

Shardanand, U., Maes, P. (1995). Social Information Filtering: Algorithms for Automating "Word of Mouth". Proceedings of CHI'95 Conference on Human Factors in Computing Systems, ACM Press.

Turpeinen, M. (2000) Customizing news content for individuals and communities. Acta Polytechnica Scandinavica. Mathematics and computing series no. 103. Helsinki University of Technology, Espoo.

Turpeinen, M. and Saari, T. (2004) System Architechture for Psychological Customization of Information. Accepted for publication in proceedings of HICSS-37- conference, 5.-8.1. 2004, Hawaii.

Wenger, E. (1998). Communities of Practice: Learning, Meaning, and Identity. Cambridge University Press, Cambridge, UK.

Weitzman, L., Wittenburg, K. (1994) Automatic presentation of multimedia documents using relational grammars. In proceedings of Second ACM International Conference on Multimedia. 15-20 Oct. San Francisco, 443-451.