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## Editorial Preface

This last 2004 issue comes in a period in which PsychNology Journal has been honored with signals of appreciation from the scientific community, first of all the inclusion into major indexing databases. The themes gravitating around the label of 'the other side of technology' are accruing, issue by issue, like gifts under a Christmas Tree, revealing their richness and providing a place for unplanned encounters among previously unknown streams of research. May it be cross-fertilization or simple 'exposure' to differences, such occasional encounters are more important nowadays given the tendency to create small areas of interests and to stay within their confines. In the present issue, there is a series of individual valuable contributions that we offer to our readers.

The opening one, by Alexander Voiskounsky, describes a study on Russian MUD's users and tests the feasibility of the 'flow' concept to explain their longstanding fidelity to the medium. In order to do this, a questionnaire has been built and administered. Readers will find all about it in the article. The paper by Henrik Wimelius is an exploratory application of Environmental Psychology to the study of web sites. The idea is that the perception of web pages may be equaled to the perception of new environments and measured according to the parameters proved relevant there, namely complexity, spatial configuration and mystery; particularly interesting is the role of functionality and aesthetics. Hokyong Ryu proposes some

guidelines with which designers can evaluate the effectiveness of their system by using a revised interaction cycle model. The discussion is enriched with several examples and illustrations. The conclusive paper by Carlos Andres Ruggeroni (in Spanish) is a reflection on the way in which the idea of 'virtual' in the field of human-computer interaction can be better understood through the concepts of 'artefacts' and 'construction' elaborated by cultural psychology.

Yours,

The Editors-in-Chief

Luciano Gamberini  
Anna Spagnolli  
Giuseppe Riva

# Playing Online Games: Flow Experience

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## ABSTRACT

Playing MUDs (Multi-User Dungeons, or Multi-User Dimensions), text-only online gaming environments, may initiate flow experience. Online survey research was administered within the population of Russian MUDs players, using the specially designed questionnaire with 3 blocks of questions: demography and experience in playing MUDs; flow experience; interactive patterns. Replies of respondents (N = 347) fit a six factor model: F1 (Flow experience); F2 (Achievement); F3 (Activity/Passivity); F4 (Interaction); F5 (Thoughtfulness/Spontaneity); F6 (Cognition). To analyse the data, structural equation modeling was done. All the correlations between the factors are significant ( $p < 0.05$ ). The set of dimensions describing flow experience while playing MUDs was selected. Since players experience flow while MUDding, it was proposed that flow is one of the sources of MUDs' long-time attractiveness for players.

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## 1. Introduction

Online gaming is an essential component of the variety of virtual behaviors: children, adolescents and (mostly young) adults allocate long time periods to playing online. Players often enter club-like online communities and enjoy the mixture of competitive gaming and computer-mediated encounters. A well-known example is a steady online community of MUDders. Basically, MUDs (Multi-User Dungeon, or Multi-User Dimension) are text-only virtual environments, usually in a form of an adventure game; the latter is either original, or is based on fantasy books or movies. Non-adventurous social MUDs and graphic (i.e. not text-only) MUDs are less numerous and less popular, and thus will not be analyzed in the paper.

Important, MUDs are online role-play group games, often with hundreds of simultaneous players. The players' goals include the development to the maximal level of the certain character chosen by the player and representing him or her in all the situations taking place during the game. But this is not the only possible goal; popular

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enough goals are connected with interaction patterns within the players' communities. Strong human ties and friendly relations are common within the communities of MUDders: competitive players use the advantage of intense communications (in the text-only mode) during playing sessions. Since their origin a quarter of century ago, the communities of MUDders have not once been investigated, though no exhaustive study has been done. Anyway, the focus of our research, i.e. flow experience while playing MUDs is far from being intensely studied; besides, the current research deals with the community of Russian players, and this group of MUDders has not been thoroughly investigated earlier.

## **2. Research of human behavior patterns on the MUDs**

In the review of literature sources we limit ourselves to the discussion of major views and data expressed on behavior of MUD players, not video/computer gamers in general. Besides, special discussion is devoted to flow experienced in the process of using information and communication technologies (ICT), especially the Internet. This is due to the fact that flow experience is the main topic of this paper.

The earliest issues investigated in the field include disinhibition, friendly attitudes, and openness of MUDs players, as reviewed by Sempsey (1997). Some of these problems are still of high importance; for example, effects of disinhibition have been recently discussed within the broader context of Web related behavior (Joinson, 2003).

An empirical typology of MUDders worked out by Bartle (1996) is another example of an important contribution to the field. His taxonomy is based on two crossing axes, namely "acting with" (i.e., interacting) vs. "acting on", and "emphasis on players" vs. "emphasis on the environment". Thus, the typology includes four basic types:

- "achievers" (acting on / emphasis on environment),
- "killers" (acting on / emphasis on players),
- "socialisers" (acting with / emphasis on players), and
- "explorers" (acting with / emphasis on environment).

Bartle states that these four types of players are equally important to keep the balance of interests within the MUD environment; any surplus or underrepresentation of this or that type of players might result in a total loss of interest toward the imbalanced environment. Thus, Bartle recommends to keep the subtle balance: otherwise, the former MUD will transform into a chatline full of socialisers; or into an

arcade game, if killers start to dominate the gamers' community; or into an online book enjoyable to explorers; or into a single-player game for achievers.

Investigating development of virtual friendship, Utz (2000) found that 76.6 % of respondents report they have had relations with fellow MUDders. Having collected diverse data (intensity of MUD use, online friendship, sociability, attitudes toward MUDding, use of paralanguage while the exchange of messages, degree of skepticism toward computer-mediated communication, various demographic data), and having done cluster analysis using three attitudinal scales (role-play, game, and skepticism), Utz (2000) was able to differentiate types of players. Her typology, like that of Bartle, consists of four types. These types include:

"Role-players" – those interested in playing roles;

"Gamers" – those interested in having adventures and playing games;

"Virtuals" – those interested either in online meetings with virtual partners and in chatting with them, or else in development of virtual environments;

"virtuals" seem to be indifferent toward role playing;

"Sceptics" – those disinterested in most of the features of MUDs, playing less hard (in the amount of hours per week) and refusing to identify themselves with any group of MUDders.

In an unpublished diploma thesis (Psychology Department, Moscow State University) by Bekhtina (2002), supervised by the first author, four (again four!) basic types of MUDders' motivations have been described. These motivations are:

- motivation of curiosity, astonishment and interest, reported by 66% respondents;
- cognitive motivation, reported by 65% respondents;
- motivation of enjoying a different life style in virtual environments, reported by 64% respondents;
- recreational motivation, reported by 57% respondents.

Obviously, individual players reported partly overlapping types of motivations, and thus no strict typology of MUDders has been worked out. Nevertheless, it is easy to notice that the classification of basic types of motivation partly fits the typologies worked out by both Bartle (1996) and Utz (2000).

Turkle (1997) is known to carry out high-quality qualitative studies; most of her respondents are MUD players. In her research she touches cultural, metaphorical, interpersonal, and personal aspects of MUDding. Particularly, Turkle has thoroughly analyzed the specifics of establishing virtual relations, including friendship and romance, intimacy and deception; she described the means and ways, available to MUDders, to construct their identities, to present online personae and to develop their self-concepts. Special interest she pays to gender issues and gender swapping, i.e. to experiencing gender roles other than in the real life. For example, she describes a respondent whose roles, played simultaneously, were as different as (1) a courageous young man, (2) a timid young man, and (3) an attractive girl. Turkle states that in online environments the boundaries between one's real life and his/her virtual lives have been significantly eroded.

Salvay (2002) compares MUD related environments with a virtual space for psychodrama; both promote, he believes, personal and social growth. The effect is gained by changes in players' positions, roles, characters, ways of behavior and the related changes in feelings, affects and emotions. Again, we can borrow an example from Turkle (1997). She describes a young girl who had been tense with her mother: they misunderstood one another, hardly communicated and often quarreled. While playing MUD, the girl used to create two characters, one of which symbolized her mother, and the second herself. Playing several sessions involved interactions between the two. Finally, the girl developed an easier mode of real-life communication with her mother.

To avoid gender bias, it is reasonable to remind that Turkle also writes about a young man who managed to cope with his real-life father after he had created the MUD character symbolizing his own father. Thus, psychological experience gained while playing MUDs might help in solving personal problems, i.e. compensate possible lack or inadequacies of real-life social contacts. Turkle (1997) comes to a conclusion that virtual environments might be viewed as a sort of a psychotherapeutic tool.

In a theoretical work, Kwan Min Lee (2000) introduces a new context, that of the social learning theory. Particularly, Kwan Min Lee states that self-efficacy, i.e. self-realization of one's capabilities to deal with and to oppose to real-life problems, is a major psychological dimension inherent of MUD-related behavioral analysis. The researcher has worked out a theoretical model, according to which effects of the MUD experience might be measured, taken certain parameters of self-efficacy (Kwan Min Lee, 2000).

### 3. Flow in the ICT Environment

A promising approach has been undertaken by McKenna and Lee (1995). Their research is strongly based on the theory of flow experience, initiated by Csikszentmihalyi (1990; 2000). This theory – later called positive psychology – rests on an analysis of subjective positive experience: processes of pursuing a desired or a cherished result seem sometimes to be more pleasing and self-rewarding than the result itself, when and if it is gained. Csikszentmihalyi describes this experience as someone's "flowing from one moment to the next, in which he is in control of his actions, and in which there is a little distinction between self and environment, between stimulus and response, between past, present, and future" (Csikszentmihalyi, 2000, p. 34).

The researcher and his followers have found that flow might accompany almost every type of human behavior. Major characteristics of flow are: temporary loss of self-consciousness, and of sense of time, high concentration on the task and high level of control over it, objectives become clear and distinct, and actions merge awareness, experience brings full satisfaction and seems worth doing for its own sake (that means, motivated intrinsically), immediate feedback. What is especially important, the flow rests upon the precise matching between the available skills and the task challenges (Csikszentmihalyi, 1990; 2000).

The dimensions listed above make it tempting to find out whether the overwhelming devotion of MUDders to the processes of playing might be partly or fully explained in the terms of positive psychology. Indeed, human beings usually feel satisfaction while MUDding, they often keep control over the tasks, the complexity of the tasks might be dynamically changed and task objectives might be quantified, feedback is close to immediate, the sense of time periods is most often altered, concentration and awareness are reportedly very high, motivation is certainly intrinsic. This problem area is really quite promising for doing research in the flow paradigm.

McKenna and Lee (1995) have shown that MUDding fits the flow model, and that social interaction while playing MUDs is inseparable from the flow experience. Not many further empirical evidences are available in the field. Korean researchers, too, have shown that flow experience and interaction patterns collaborate in forming long-term attachments to certain online games (Choi, Kim, 2004). We may also note that the highest level of involvement into MUDding is reported to take place at the moments when the gaming environment is not too simple but not too complex (Reinberg et al.,

2002). Decisions made in these environments tend to be optimal due to a balance between the players' skills and task challenges; according to Csikszentmihalyi's (1990) statement, such a balance is both effective and welcomed for experiencing flow.

To put MUDding and in general computer gaming aside for a while, we will review studies of flow experienced while carrying out diverse online activities. Hoffman, Novak and their collaborators have developed and validated a structural model of online flow experience (Novak, Hoffman, 1997; Novak et al., 2000; Novak et al., 2001). This universal approach is, however, rather hard to follow in practice due to its global context: the main method of collecting empirical data is putting questions to users of online services, and it is easy to notice that the potential respondents meet problems and get confused determining their skills and task challenges related to multi-purpose computer and Web related activities (Chen et al., 1999). Probably due to this reason, the most part of research projects in the field deal with specialized, and not universal types of online behavior. No new research is, however, done on flow experienced while playing MUDs.

It is worth to mention publications on flow experience inherent of human-computer interaction and computer-mediated communication (Finneran, Zhang, 2002; Ghani, Deshpande, 1994; Novak, Hoffman, 1997; Trevino, Webster, 1992), Web related activities, including – but not restricted with – Web navigation (Chen et al., 2000; Novak et al., 2001; Rettie, 2001; Skadberg, Kimmel, 2004), computer hacking (Beveren, 2001; Voiskounsky, Smyslova, 2003), and learning to use professional resources on the Web, or using these resources (Heidman, Sharafi, 2004; Pace, 2004). Researchers try to link ICT-related flow experience with theoretical paradigms which have been established earlier – for example, the engagement mode model and the activity theory (Heidman, Sharafi, 2004), with sociological findings of the reasons of illicit behavior (Voiskounsky, Smyslova, 2003), and with certain behavioral phenomena, for example, with symptoms of internet addiction (Chou, Ting, 2003; Tzanetakis, Vitouch, 2002). The latter seems to need a really profound justification, since flow is universally understood as an entirely positive joyful experience, while Internet addiction, like any psychological dependence, is a sort of a forced escape from personal problems.

Use of computers and the Web, usually purposeful and effective, is at the same time emotive. In the context of the ICT use, as in all the other contexts, the emotional states accompanying flow experience are usually called fun, playfulness, and enjoyment (Bryce, Higgins, 2000; Pace, 2004). It is well-known though that computers and the Internet might well bear negative affects as well. Interviewing information seekers on

the Web, Pace (2004) has worked out theoretical background for flow experience in Web environments. His respondents report such task challenges as “negotiating a vast, constantly changing, uncharted information space; selecting suitable key words for a search engine query; using the correct syntax for a search engine query; distinguishing relevant links from irrelevant links; scanning a page for relevant information; and understanding the content and non-linear structure of a Web site” (Pace, 2004, p. 345).

These task challenges refer to entirely cognitive applications of online sources and services. Other applications, too, refer to highly specialized ICT-related behaviors. Is the set of factors, or dimensions describing ICT-related flow experience universal, or is it task-specific? It is worth mentioning that the Csikszentmihalyi’s original dimensions of flow, introduced in his pioneer books and later used in hundreds of works, have been not once changed in different ways. Besides, to state flow it is important that most of dimensions, not necessarily every dimension is marked. “Though Csikszentmihalyi lists factors that contribute to flow, he does not intend them to serve as the exclusive factors of flow, but more as the most commonly exhibited ones” (Finneran, Zhang, 2002, p. 1048).

Taking into consideration all this, we are inclined to expect that there possibly are numerous sets of flow dimensions, or let us informally call them “flow dialects”, which are strongly dependent on task specificity, and probably on some other parameters. Flow patterns inherent of ICT related behaviors, too, differ a lot: flow experienced while online shopping might be described using a set of dimensions which only partly match the dimensions describing flow experienced while online gaming, or navigating the Web, etc. Rettie (2001) states that “while respondents recognized most of Csikszentmihalyi’s dimensions, the merging of action and awareness and loss of self-consciousness were not really relevant...” (Rettie, 2001, p. 111). Pace (2004), too, enumerates the dimensions of flow, as reported by respondents: “The joy of discovery, reduced awareness of irrelevant factors, a distorted sense of time, a merging of action and awareness, a sense of control, mental alertness, and telepresence” (Pace, 2004, p. 351).

We should state that Pace’s (2004) respondents, as well as those of Skadberg and Kimmel’s (2004), are far from naïve: they mention telepresence, and this concept is not universally known, though rapidly developing (Riva et al., 2003). Not to go into deeper details, it would be enough to note that in the ICT-related field there are indeed several subsets, or “dialects” of the flow dimensions. It is likely that these subsets differ, taken for example less competent vs. more competent respondents, or differing types of

activities. A thorough discussion of research dimensions and/or constructs used in the field may be found elsewhere (Chen et al., 1999; Finneran, Zhang, 2002; Novak, Hoffman, 1997).

To sum up, the methodology of flow experience is being investigated within the ICT area in an accelerating tempo. This methodology seems to be promising and fruitful indeed. To the best of our knowledge, there are only few studies of flow patterns within communities of MUD players; the most influential of them has been done by McKenna and Lee (1995). This work is among the earliest ones carried on within the flow paradigm; its results supported the view that MUDders experience flow, and that flow is positively related to the players' communicative patterns. Supposedly, these findings might provide a valid explanation of long (lasting over a quarter of century) popularity of MUDs among gamers. In a recent paper it is shown that flow is one of several constructs (along with personal and social communication patterns, and loyalty) explaining behavior of those who long-time play the same online games (Choi, Kim, 2004). No data is nevertheless available whether the findings gained by McKenna and Lee (1995) are true for modern communities of MUDders, and especially for non-English speaking communities.

#### **4. Research Goals, Methodology and Procedure**

According to the issues discussed in the previous Sections, the goals of the current research are the following.

First, we are going to determine factors influencing behavior patterns of MUD players. Supposedly, flow experience is just one of these factors.

Second, we are going to find out whether Russian MUDders experience flow. Though text-only MUDs have not changed too much, and though the current communities of devoted MUD players seem to resemble the earlier communities, it is time to update the data gained by McKenna and Lee (1995) ten years ago. Besides, there is no research data available on the communities of Russians playing MUDs, and playing/chatting in Russian language. Taking into consideration a delay in adopting new entertainment technologies – a certain lag time is needed to accept a new hand-held and/or online gadget, to make translations, to organize and advertise services and facilities, etc. – we might very informally suppose that the current level of development of communities of Russian MUDders is close to the ten-years-ago level of the MUD communities in the USA.

Third, in case the second goal is realized, we are going to select on empirical basis a set of dimensions – a sort of a “flow dialect” – describing a flow pattern typical for a MUD player. Supposedly, a subset of criteria is enough to characterize flow experienced while MUDding.

In order to achieve these goals, we have planned the research. The first point to note is the method of collecting empirical data which has been chosen.

The main way of getting data on flow experience is putting questions to the members of selected samples. Putting open-ended questions means interviewing respondents; most often the procedure includes retrospective reports about flow-like experiences within any type of respondents' behavior. When multiple choice questionnaires are used, there are two main approaches: (1) questioning refers to possible dimensions of flow-like experiences – reported retrospectively – within a certain type of behavior, in our case, within playing MUDs, or (2) the questionnaire is administered many a time at randomly selected moments in attempts to catch the moment when the respondent experiences flow and is able to reflect it (this is the Experience Sampling Method, worked out and intensely used by Csikszentmihalyi and his followers).

With online gaming, it is in principle possible to combine the two methods of administering a questionnaire, for example sending out questions (referring to the experience in playing MUDs) on a random-time basis, but exclusively at the moments when a respondent is connected with the distant game server. Nevertheless, we did not administer this sort of an online research, due to the two main reasons. First, this type of research might be administered within a pre-defined sample of gamers. Carrying out the first study of Russian MUDders, we would prefer to increase the number of possible respondents, not to decrease it to a narrow enough sample. Second, one of our research goals says that we intend to investigate the (supposedly, numerous) factors influencing the behavior of the MUD players; thus, the questionnaire has to include questions on flow and also on issues which stand outside the flow experience. For these reasons, the Experience Sampling Method does not fit our research paradigm.

The next issue to note is the questionnaire. Since no surveying methodology to measure the behavior of MUD players has been available in Russian language, our aim has been to design the needed questionnaire. At the first step we have collected the questions used in earlier works (McKenna, Lee, 1995; Novak et al., 1997). We have also reflected over the measuring techniques that have been worked out and used in some of the papers mentioned in the previous Sections. We have thought for

example over a possible use of introducing questions on telepresence experience. We do not expect it is worth to ask respondents whether they feel immersed in any sort of augmented reality: questions on telepresence are supposedly relevant not for text-only games like MUDs, but for CAVE-type games which are intensely investigated nowadays (Schroeder, 2002). Besides, the concept of telepresence is entirely unknown in Russia both in theory and in practice.

Having collected the questions, we have chosen the non-identical ones, translated them into Russian and adapted, i.e. tested within a restricted sample of gamers to make sure that the questions can be easily and uniformly comprehended. This testing procedure resulted in some modifications of the questions; after that the questionnaire got the following structure. It includes three blocks of questions: a block on demography and experience in playing MUDs (8 questions), a block on flow experience (32 Likert-type questions) and a block on interaction patterns within the game (8 Likert-type questions). The latter block is similar to what has been used in the McKenna and Lee (1995) study.

The next issue to note is the methodology of handling the data. In our study we have used the traditional method of handling survey data, i.e. factor analysis. Thus, our research is entirely quantitative; no qualitative data has been collected and/or analyzed.

The final issue to note is the procedure. We have planned to carry out an online research, similar to what we have done earlier within the hackers' community (Voiskounsky, Smyslova, 2003). The online methodology of doing psychological research is rapidly progressing since the end of the previous century; this methodology has not once proved its validity (Hewson et al., 2003; Kraut et al., 2003; Reips, 2000). Thus, we have done the Web questionnaire to be filled out by the respondents, and placed it at one of the MUD-related Web sites (<http://c7i.mud.ru/voting/public>). To save the results, the administrator of the site organized an electronic table. The survey has been administered in Spring, 2003 and lasted about two months. During this time we have advertised the survey at various Web forums and at numerous game servers hosting MUDs.

## **5. Results and Discussion**

Of 352 respondents five provided incomplete data and were excluded. We have checked that no identical replies are sent from the same e-address; no such cases happened. The replies of 347 respondents were handled using exploratory and

confirmatory factor analysis. In the current paper we are presenting the results of the exploratory factor analysis.

### **5.1. Demographic Analysis**

But first we note some demographic data and data on game experience. The respondents represent neither the population of Russia, nor the population of the Web/Internet users in Russia, which includes plenty of non-gamers. What they do represent, is the community of Russian MUDders; no alternative data characterizing this community is available. To illustrate some directions in which the community of MUDders differs from the population of the Web/Internet users in Russia, we refer to the results of sociological studies published by the most advanced organization in Russia which holds all-Russia fieldwork surveys and fully publishes the results. This independent organization is called the Foundation "Public Opinion" ([www.fom.ru](http://www.fom.ru)), it carries on quarterly representative surveys (21,000 respondents) and uses the methodology compatible with that of the Nielsen//NetRatings – one of the leading companies in the area. The results gained by the Foundation "Public Opinion" are representative for the adult population of Russia; it does not work with respondents under 18.

Besides, we will use selective data on overall demographical statistics of the Russian population, as it is shown on the site [www.fom.ru](http://www.fom.ru) of the Foundation "Public Opinion".

The results of our study say that an average MUD player turns out to be a male of 21, a Muscovite, a college/university student, his experience in playing MUDs is 3 years, and he plays 16 hours per a week. To compare it with the broader populations, we turn to the sociologic data gained by the Foundation "Public Opinion", and referring to the same time period, i.e. Spring, 2003.

Our respondents are presumably males. Only 45% of Russians are males, and 55% females. Only 13% of Russian males are Web users (8% females). Of the Web users in Russia, 58% are males (the data refer to Spring, 2003).

Our average respondent is a Muscovite. As much as 16% of Web users in Russia are Muscovites; 33% Muscovites are using the Web. Generally, the Muscovites have long been the most influential part of the population of Russian Web users; this leading role is slowly coming to the end.

Our average respondent is 21; we can compare it with the age range of 18-24. Only 13% of Russians are within this age range, and 12% of Muscovites. Among the Web

users there are 28% of those who are over 17 but before 25. Not a surprise, at every country the Web audience is much younger than the population itself.

Our average respondent is a college/university student. To compare, we can use the data on the highest degree gained, since there is no reliable data on the proportion of college/university students among the Web users. The high school (and equal to that) degree have 19% of Russian Web users, all the others have higher degrees (for example, 31% have a college/University degree) – almost nobody has a less high degree, since the Foundation “Public Opinion” represents population of 18 and above, and the majority of young people graduate from the high school at the age of 17 or 18. To compare, we may note that statistics says 69% of Russian population have a high school (or equal to that) degree; many of them have higher degrees as well. In case the Foundation “Public Opinion” had got data concerning the use of the Web by high school students, the whole educational structure of the Web users in Russia might have changed, since rather a lot of high school students are hard users.

Finally, our average respondent plays MUDs 16 hours a week. No data for strict comparison are available. We can note that the daily Web audience (i.e., those who access the Web every day) is 28% of all the Web users, and only 3% of the Russian population; the weekly audience (those who access the Web at least once a week) is 55% of all the Web users, and 6% of the population of Russia.

To sum up, the average MUD player is close to a typical Russian Web user in three parameters: he is young, he is a male and he lives at Moscow. He is far from typical in some other important parameters; for example, he is online more often and for longer periods than the majority of the Web users in Russia.

## **5.2. Patterns of the MUD Players' Behavior: Factor Analysis**

### **5.2.1. Factor Model**

To work out and validate a factor model of the data, structural equations modeling has been done (Bentler, 1995). Using two traditional steps of statistical analysis, we have found latent factors at the first step (namely, exploratory factor analysis). At the next step we have confirmed the significance of the factor model using the confirmatory factor analysis which is much more powerful and puts less restrictions on the hypotheses about the empirical data.

Having done exploratory factor analysis, we received six major factors. To describe and discuss these factors we use the results of both exploratory and confirmatory analysis.

Factor 1, or F1, might be called **Flow**. It is positively connected with the experience in playing MUDs and with the average duration of time allocated to playing MUDs per a week, and includes the following parameters: inspiration and enthusiasm toward the play, specific absorption of attention on the game, loss of the sense of time, belief in full reality of the situations taking place in the game, feeling of pressure and mobilization, indifference to everything beyond the play, overuse of time allocated to the play sessions.

F2 might be called **Achievement**. It is positively connected with the time allocated to the game, and with the orientation on achieving success. The parameters included in this factor are: orientation on successful results, reiterative replay of the same situations taking place in the game – frequently using the same role-play character, choice of familiar types of MUDs.

F3 might be called **Activity/Passivity**. It is positively connected with the experience in playing MUDs, and with the average duration of time allocated to playing MUDs per a week. For an active player it includes the following parameters: constant strict control over situations taking place in the game, and orientation towards being the leader when two or more players decide to play collaboratively. The opposite – the passive pole – is characterized by the opposite meanings of the same parameters.

F4 might be called **Interaction**. It includes parameters which are indifferent to success in MUDs: orientation towards communication with other players, high frequency in getting to know other MUDders and establishing close contacts with them, constant control over messages sent by fellow players, desire to be a member of collaborative teams of players, and loss of the sense of time while exchange of messages during the play.

F5 might be called **Thoughtfulness/Spontaneity**. It is positively connected with the experience in playing MUDs, with the average duration of time allocated to playing MUDs per a week, and with an orientation towards the achievement of success. This factor includes the choice of known from the previous experience (or the opposite – completely unknown) ways and routes of playing, reflections over the situations taking place in the game after the game sessions end (or the opposite- indifference to these situations), frequent – or the opposite, i.e. infrequent - attempts to play the same situation taking place in the game several times during different game sessions, constant control over messages sent by fellow players.

F6 might be called **Cognition**. It assumes that players find interest and feel pleasure while playing MUD, and they prefer to investigate the areas and situations of the MUDs environments which were unknown to them earlier.

To prove the model, we present the results of the confirmatory factor analysis. The results are the following:  $\chi^2 = 430.889$  and df (Degree of Freedom) = 338; CFI (Comparative Fit Index) = .959; RMSEA (Root Mean-Square Error of Approximation) = .028. A factor model is adequate when the meaning of  $\chi^2$  divided by df does not exceed 2.0, CFI > .9, and RMSEA < .05. In our case all of these conditions are valid. Thus, the six-factor model described in this Section fits the empirical data quite well.

We can state that the six-factor model describes fully the behavior of the MUDs players. It is necessary to note that the factor F1 (Flow Experience) is the most important (the first) factor. One of the results of the discussion in the above Section "Flow in the ICT Environment" is that flow has been recognized as a significant factor attracting visitors of numerous Web services. Taking into account the result gained in our research, i.e. that flow turns out to be an important factor in human behavior patterns within MUD environments, it is very prompting to make an attempt to conclude that flow experience should be essential to explain in a reasonable way the gamers' long-term fascination with the MUDs.

The full description of the results of research on the processes of playing MUDs includes five more factors, which have to be discussed. The factor model includes F2 (Achievement) – needless to say, the desire to acquire achievements while playing is crucial in almost any type of games people play. Bartle (1996) noted that "achievers" are very important for the prosperity of communities of MUDders. In the MUD environments an achievement means that the chosen character presenting the player is high-scored and gains a very high – up to the highest possible – level of a character's development. In a sense, MUDs are "infinite": no player is able either to "win", or to "lose" once and forever. Instead, after having achieved the highest level of a certain character, a player may choose a different character and keep playing. In fact, many players choose several characters – diverse or the same type – and use all of them simultaneously. Thus, their wish to acquire achievements might be called everlasting.

The factor model includes F4 (Interaction) – that means, communication is really important for MUDders. Moreover, many players enjoy the play because it helps them enhance their social contacts and gives access to computer-mediated patterns of interactions with close or distant fellow players. Ease of communication with other

players is one of the main attractions of the MUDs, and the current research fully supports this regularly reported view. Supposedly, interaction is a major goal for the players who would tend to refer to themselves as non-achievers; Bartle (1996) called them “socialisers”. The groups of socialisers are very special to be discussed within the MUD’s context, since not too many computer/video/online games provide interactive services; players’ fascination with MUDs takes origin – partly, of course – in the easy means to carry on communication with other players.

The factor model includes also F6 (Cognition). Based on this result we can state that MUDders believe the game environments are interesting, intricate and non-transparent, worth being investigated. As we can see, these environments initiate players’ curiosity. To investigate the environments while playing MUDs, the players use specialized computer-mediated means: whenever they have to make decisions in the situations which take place during the game and to give directions to their characters, MUDders may choose completely unknown or less known options and directions of movement. This interest includes also the choice of diverse characters to present the player within the gaming environment; since different characters have diverse patterns of behavior and specific lines of development, these patterns are too worth to be studied. Pursuing cognitive interests may possibly result in a failure, and this is not the most likely way to acquire achievements: indeed, following well-known directions might often be beneficial, compared to processes of seeking new ways. Not a surprise, most often groups of “explorers” and “achievers” do not match (Bartle, 1996). It is necessary to state though that cognitive actions and reasonable cognitive strategies are essential for gaining success in almost any type of activity.

The rest of the factors – F3 (Activity/Passivity) and F5 (Thoughtfulness/Spontaneity) – represent opposing personality traits, polar cognitive trends and supposedly, entirely different life-styles. One might also admit that these factors represent certain cognitive styles, for example, reflection or impulsiveness. It is more than reasonable that these two factors describe the behavior patterns of MUDders: active or passive, impulsive/spontaneous or thoughtful/reflective actions might easily enough be perceived in almost every gaming environment – not only in online role-play or computer/video gaming behaviors, but also in traditional board games and/or sports, including for example boxing, chess, basketball, preference, tennis, etc.

The two factors, F3 and F5 refer to styles of gaming in the MUD environments, unlike the other four factors, namely, F1 (Flow), F2 (Achievement), F4 (Interaction), and F6 (Cognition) which might refer to the MUDders’ goals, their conscious intentions or

unconscious drives, but evidently not to tactics and styles. Within the MUDs environment, we might call the two bipolar factors, F3 and F5, the style-factors, and the rest of the factors, namely F1, F2, F4, and F6 the goal-factors. Each of the style-factors might selectively correlate with each of the goal-factors, and the analysis of these correlations might enrich our knowledge of the ways the MUDders play their favorite online games.

**5.2.2. Analysis of Between-Factors Correlations**

We may expect that correlations between the factors are important for the further analysis. Within the process of confirmatory factor analysis we calculated the Pearson correlations between the six factors, and the Cronbach alpha. At the Table 1 the meanings of Cronbach alpha are placed on the diagonal and marked bold; the intercorrelations between the factors are placed in the lower triangle. All the correlations are positive and significant ( $p < 0.05$ ).

	F1	F2	F3	F4	F5	F6
F1	<b>0.75</b>					
F2	.502	<b>0.65</b>				
F3	.282	.386	<b>0.59</b>			
F4	.357	.209	.346	<b>0.65</b>		
F5	.486	.387	.240	.166	<b>0.61</b>	
F6	.642	.423	.360	.435	.428	<b>0.59</b>

**Table 1.** Correlations between the factors, and the Cronbach alpha.

Considering the data presented in the diagonal of the Table 1, we can conclude that the Cronbach alpha meanings are significant at the level .05. The highest meaning has the Factor 1 "Flow experience" (.75); the Cronbach alphas for the rest of the factors are rather close, and the least meanings have the Factor 3 and the Factor 6 (both .59).

The interpretation of the data presented in the lower triangle at the Table 1 is the following. First we discuss the correlations between the factors, mainly between the F1 and the rest of the factors. This is due to the fact that the F1 (Flow Experience) is the most interesting in the context of this paper factor. After that we will briefly discuss the correlations between the goal-factors and the style-factors.

The correlation between the F1 (Flow) and the F2 (Achievement) is .502. We can note that flow experienced while playing MUDs is positively correlated with achievements. Thus, flow accompanies behavior oriented towards maximal development of the characters chosen by the gamers – often MUDders use the same

character during the successive playing sessions. The choice of familiar types of MUDs and of the well-known situations taking place within the game correlates, too, with flow experience. Thus, the general statement saying that flow experience depends on the matching of the task challenges and the available skills, seems to get a new empirical confirmation.

Correlation between the F1 and F3 (.282) testifies that players experience flow when they are sufficiently active (i.e., do not pursue passive strategies), but not too active, since the correlation is not too high. Long enough time periods allocated to MUDding weekly, player's strict control over the situations taking place within the game environments, orientation towards being the leader of temporary collaborative teams of MUDders – all this seem to match flow experience.

Correlation between the F1 and F4 (.357) assumes that patterns of interaction and flow are inalienable while MUDding. Computer-mediated dialogic communications are specific for MUD environments; players even admit they often lose the sense of time while communicating. This type of interaction seems to be effective in initiating flow experience. Correlation between the two factors is significant and positive, but at the same time not too high. We can conclude that MUDders, experiencing flow, are not heavy communicators, and vice versa, players who are fond of interaction with fellow players might experience flow, but are not destined to it. This finding supports the results gained by researchers earlier and discussed in the Section "Flow in the ICT Environment", i.e. the results evidencing that flow experience might emerge while computer-mediated communication sessions.

Correlation between the F1 and F5 (.486) means that flow might accompany mainly thoughtful behavior of gamers. Thus, flow is likely to occur when MUDders repeatedly play with the same characters and in the same situations, and allocate long enough time periods weekly to playing. We may conclude that players preferring familiar routes and ways and doing it on a regular basis might experience flow: this seems to be the main reason of their thoughtful and repeated actions in familiar situations while playing MUDs.

Correlation between the F1 and F6 (.642) is the highest in the first column in the Table 1. That means, flow experience is likely to occur when MUDders feel themselves interested and inquiring, when their cognitive motivation is initiated. This finding corresponds the data discussed in the Section "Flow in the ICT Environment", saying that flow is likely to be experienced while users seek information on the Web. Interesting, the F6 correlates highly enough with all the rest five factors; this is the only

factor which is somehow low (for example, less than .350) correlated with the other factors. We may conclude that every factor easily coordinates with F6; at the same time, cognition may accompany every type of behavior of MUDders.

The other correlations between the factors are either much less than the correlations of F6 (Cognition) with the rest of the factors (four correlations), or slightly greater than the minimal correlation for the F6 (two correlations: between F2 and F3, and between F2 and F5). We will not discuss these correlations, since the most interesting for us is the factor F1, and we have already discussed the correlations of F1 with all the other factors.

We are going now to discuss the correlations between the goal-factors and the style-factors. The discussion will be brief, since these correlations are not very special. Each of the two style-factors has one low correlation with the goal-factors: F5 and F4 (.166); F3 and F1 (.282). All the other correlations are higher (over .340). In other words, the correlation of the style-factor F5 (Thoughtfulness/Spontaneity) with the goal-factor F4 (Interaction) is low; the same with the correlation between the style-factor F3 (Activity/Passivity) and the goal-factor F1 (Flow). It is reasonable to note that the two style-factors are not tensely correlated: the correlation between F3 and F5 is only .240. Between the four goal-factors we might see only one low correlation: it is the correlation between the F2 (Achievement) and F4 (Interaction), the meaning is .209. It is worth to note once more that all the correlations are significant ( $\alpha=.05$ ).

### 5.3 Dimensions of Flow Experience

As we have discussed in the Section "Flow in the ICT Environment", the dimensions describing flow patterns of typical Web shoppers, gamers, information seekers, chatters, and/or those interested in entertainments might slightly differ. Though there is no canonical set of dimensions, one cannot expect that the sets of dimensions characterizing diverse types of behavior differ too much; in the latter case there would not be good reasons to name the differing sets of dimensions the same name.

Anyway, we expect that the behavior of MUDders experiencing flow might be described using a certain subset of dimensions. These dimensions supposedly correspond to the points of the research questionnaire which refer to the F1 (Flow Experience).

At the positive pole of the F1 there are the following points: *loss of the sense of time; attention is directed solely on the game; inspiration is felt; nothing distracts from the game; playing sessions last longer than planned; real-life and within-game situations*

*are mixed and the latter situations acquire the status of reality; strain and tension are constantly experienced; when interactions with other players take place, time flies very slow. At the negative pole of the F1 there is only one point: MUD is a play, and nothing more than a play.* These are the points describing flow experience of the MUDders.

We can conclude that the dimensions which are likely to specify MUD-related flow experience include the set of universal points characteristic for flow in almost any sort of activity, and specific points characteristic for MUDding. The former dimensions include the points which refer to psychological conditions (tension, inspiration, concentration of attention, etc.) and to allocation of time (sessions are longer than planned, sense of time is lost). The latter dimensions refer to what is specific for games in general (playing behavior means more than simply a game, what occurs in the game become a reality) and for the MUDs as a special type of games (time is slow while computer-mediated interactions take place).

To sum up, we can conclude that the set of flow-related dimensions characterizing behavior of MUDs players consists of the three main subsets. The first is the subset of universal dimensions describing flow in any type of activity. Supposedly, this subset is in a way variable: certain dimensions might be omitted or added, depending on specific types of human activities. The second subset is specific for games, or – to be careful and not to over-generalize – for computer/video/online games. Supposedly, actual dimensions constituting this subset might be even more subject to possible substitutions, than the dimensions constituting the first subset. Substitutions would not, however, result in no dimensions in the subset at all: supposedly, dimensions referring to gaming need to be represented in the total set of dimensions. The third subset includes dimensions specifying flow experienced while playing MUDs, thus differing from flow-related behavior while playing other computer/video/online games. The third subset is the most task-specific, the most variable and depending on the actual type of a game.

## **6. Conclusions**

The three main goals of this research are the following. First, it was planned to investigate the factors describing fully enough the behavior of MUD players. Second, it was planned to find out whether the players experience flow. And third, it was planned to learn the set of dimensions describing flow experienced while MUDding, possibly differing from sets of dimensions characterizing behaviors other than playing MUDs.

These three goals have been realized. We have found out and described the six-factor model of MUDders' behavior; the model fits the empirical data. Two types of factors have been selected: goal-factors and style-factors. We have described correlations between the factors; correlations are positive and significant.

The results clearly show that MUDders experience flow; flow is the first, the most important factor. This result confirms the previously published data, namely that of McKenna and Lee (1995).

The set of dimensions describing flow experienced while MUDding is found to consist of the three subsets: an universal subset (dimensions describing flow experience irrespectively of any particular type of activity), a gaming subset (describing flow experienced while playing computer/video/online games), and a MUDs-related subset of dimensions specifying flow experienced while MUDding, not playing the most of the other computer/video/online games.

MUDs have a long enough history and steady enough communities of players. We believe, this type of online games represents a promising model to be investigated using diverse psychological platforms, including of course the field of positive psychology. The research has been carried out within the Russian community of MUDders; we believe this community does not differ altogether from players speaking other languages than Russian, and thus the results described in the paper should be regarded not as ethno-specific, but as universal. This point, nevertheless, might be the subject of further investigations.

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

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## ABSTRACT

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

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Keywords: *environmental psychology, WWW, CHI, perception, interaction*

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## 1. Introduction

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

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

## **2. Theoretical framework**

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

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

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

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

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

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

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

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

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

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

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

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

### **3. The study**

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

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

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

### **3.1. Participants**

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

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

### **3.2. Web sites used in the study**

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

*K10k.net*

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



**Fig. 1:** Screenshot from k10k.net.

*TheRemedProject.com*

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



**Fig. 2:** Screenshot from theremedproject.com.

*Spelbutiken.se*

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



**Fig. 3:** Screenshot from spelbutiken.se

*Vnunet.com*

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



**Fig. 4:** Screenshot from vnunet.com

### **3.3. Procedure**

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

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

### **4. Results – central attributes**

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

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

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

#### **4.1. Legibility, simplicity and boring**

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

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

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

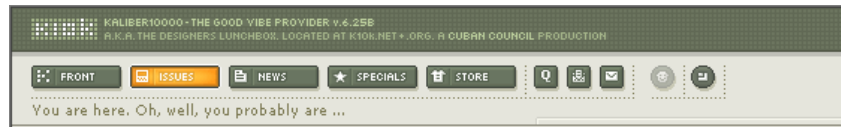


Fig. 5: Screenshot from k10k.net.

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

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

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

## 4.2. Nice looking

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

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

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

#### **4.3. Good structure**

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

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

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



Fig. 6: Screenshot from vnunet.com.

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

#### 4.4 Exciting

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

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

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

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



Fig. 7: Screenshot from theremedieproject.com.

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

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

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

#### 4.5. Messy

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



Fig. 8: Screen shot from k10k.net.

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

#### 4.6. Confusing and lack of structure

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

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

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

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

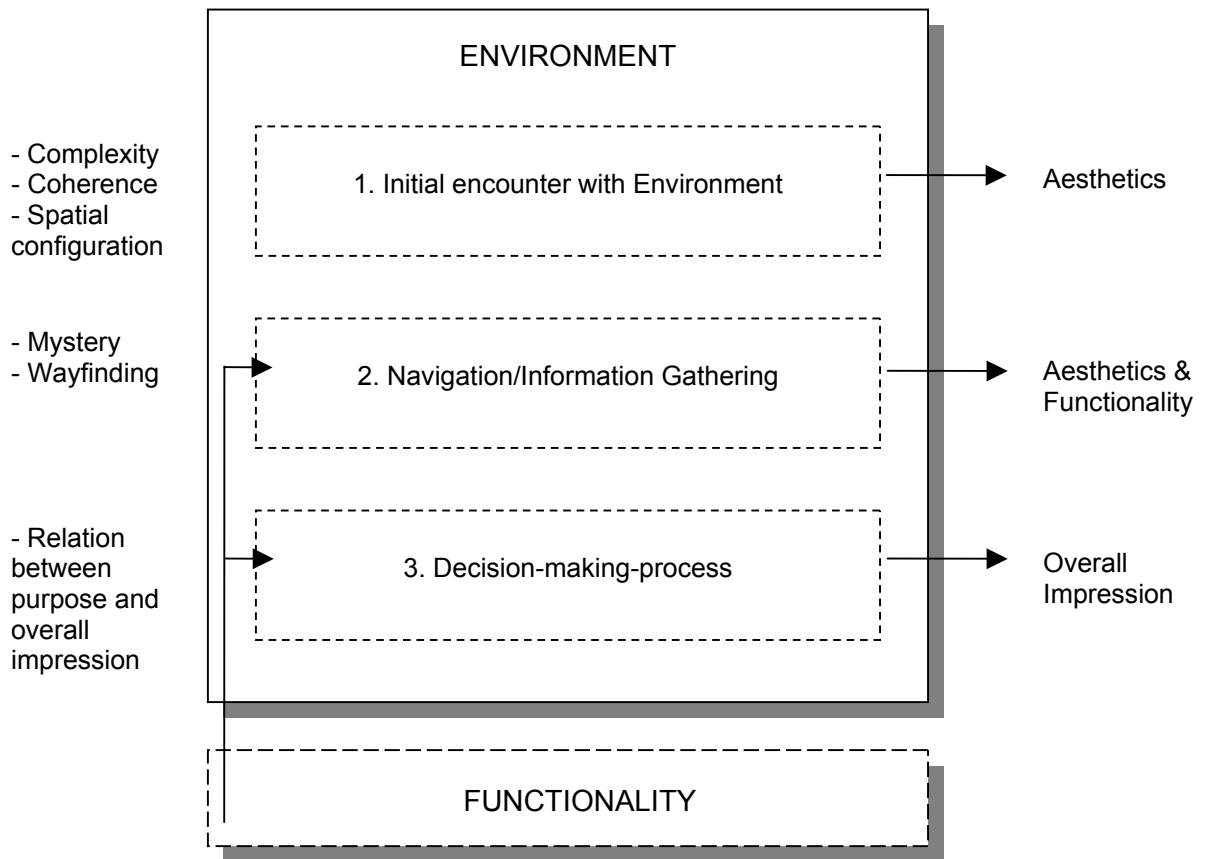
The concept confusing was also in some contexts perceived as lack of structure in the web page. For some respondents this expressed itself in a lack of recognition of familiar patterns and structures in the web page.

#### **4.6. Central attributes – summary**

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

#### **5. Discussion - a model of interaction with web pages**

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



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

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

### **5.1. Stage 1 – Initial encounter with environment**

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

### **5.2. Stage 2 – Navigation/Information Gathering**

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

### 5.3. Stage 3 - Decision-making-process

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

## 6. Conclusions and future research

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

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

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

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

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

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

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

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

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# Analysing interaction problems with cyclic interaction theory: Low-level interaction walkthrough

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## ABSTRACT

This paper aims to develop a brief interface evaluation method on cyclic interaction theory, allowing low-level interaction analysis, i.e., action-effect problems, effect-goal problems, and goal-action problems. It illustrates low-level interaction problems from everyday examples and, in turn, based on cyclic interaction theory a designer review method, the low-level interaction walkthrough, is introduced. The method is a modified version of cognitive walkthrough and the analysis focuses on the issue of direct concern to the practitioner who intends to identify low-level interaction problems in their design specification.

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Keywords: *Cyclic interaction theory, low-level interaction walkthrough, mode, goal reorganisation, goal-action matching.*

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## 1. Introduction

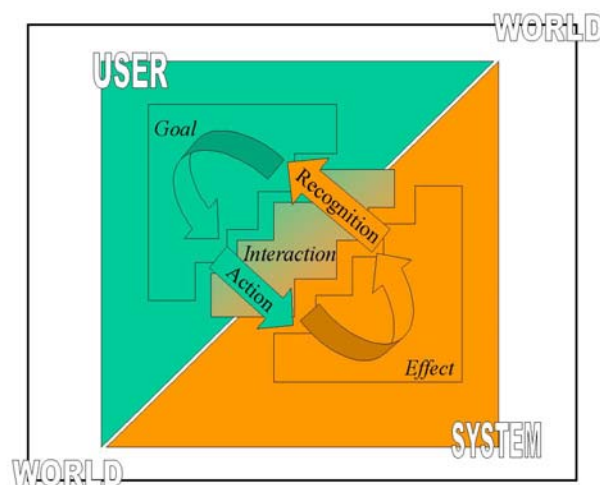
When users interact with a user interface they do so in a piecemeal and iterative way. In a series of iterations, the user performs various actions towards achieving desired outcomes. This is a very effective way of interacting with systems particularly graphical user interfaces, which are the most important application of Human-Computer Interaction (HCI). In HCI this idea of cyclic interaction was introduced by Card et al. (1983) as their recognise-act cycle. Norman's (1986) seven stages model also envisages a cycle of interaction, says "the action someone takes leads to changes to the environment. These are evaluated with respect to, and in a manner conditioned by, the user's current goals. This evaluation leads to the reformulation of goals and further action, leading to a new state of the environment, and so on". However, neither Card et al., nor Norman makes explicit how effects of actions on the environment could

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generate the subsequent iterations of interaction or how the context of interaction would make differences in the user's interaction.

Recent researches on the HCI theories, e.g., *situated action* (Suchman, 1987), *distributed cognition* (Hutchins, 1996), and *activity theory* (Nardi, 1997), have advanced the account of cyclic interaction in a broader context, emphasising how actions are informed, in taking actions, and how users configure the next step in the different contexts. Building on these advances, Monk (1998) and Wright et al., (2000) have re-established the account of cyclic interaction, making explicit low-level interactions between the user and the system at each point to provide a clearer understanding of cyclic interaction. While they might impose great efforts on modelling interactions, they provide what a process results in, as well as what triggers that interaction in a particular context. It is thus possible for the designer to build interactive versions of the design so as to assess the assumptions made or being made regarding the interaction between the user and the system. This paper shows cyclic interaction theory may be applied well to walk through a proposed interaction design, as cognitive walkthrough (Polson, Lewis, Rieman, & Wharton, 1992) and activity walkthrough (Bertelsen, 2004) do.



**Fig. 1:** Cyclic interaction theory. It illustrates a recognition-based interaction working on graphical user interfaces (GUIs). That is, action results from the user having some goal and recognition of the environment. The action leads to some effects on the environment. The new state of the environment (or world) is evaluated, leading to new goals and new recognition that in turn lead to new actions, and so on.

The key characteristics of cyclic interaction theory can be reasonably simplified as that of Figure 1, which depicts three paths in an interactive cycle: goal-action path, action-effect path, and effect-goal path. That is, the user begins an interactive cycle with the formulation of goals arising from the task or visible parts of the display in an interaction

context. The only way the user can manipulate the system is through an action, i.e., goal-action path. An action with the input device triggers system effects (action-effect path). The execution phase of the cycle is complete and the evaluation phase begins. The system is in a new state within the environment (or world), which must now be communicated to the user. The effect-goal path deals with changes in what are perceived and then continues to new goals in the interaction context.

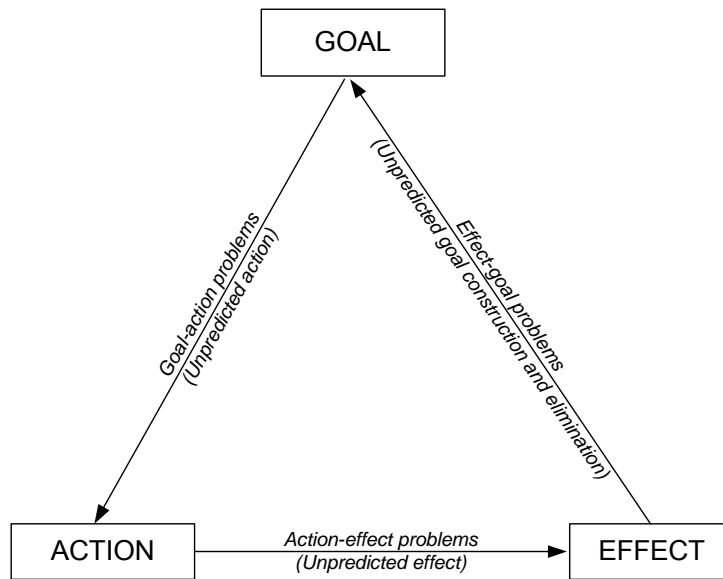
Yet, this cyclic understanding of interactions between the user and the environment has been less applied to an analysis of user interfaces. This is because the models, e.g., State-Transition Scenarios (STS: Monk, 1999), based on cyclic interaction theory are more likely to provide a descriptive understanding rather than a formative perspective to analyse how the users tasks would be achieved in the course of interactions with the environment.

We do see that the walkthrough approach, e.g., Cognitive walkthrough (Polson et al., 1992), Activity walkthrough (Bertelsen, 2004), can make cyclic interaction theory operationalise for HCI practitioners, which is readily applicable for practical analysis of a design specification without real users in the evaluation stage.

In the following sections, we identify three classes of low-level interaction problems with cyclic interaction theory and develop a brief walkthrough analysis to detect them. Note that in this paper, we do not assume a specific interaction specification, but we will suggest how interaction specification of the designers' own use can be analysed in terms of cyclic interaction theory.

The three paths of interactions which are illustrated in Figure 1 in turn result in the three sets of interaction problem: *action-effect problems*, *effect-goal problems*, and *goal-action problems*. They have already been identified by the second author of this paper (Monk, 2000). We see that it may be an oversimplified assumption of all interaction problems, so this taxonomy would be very contestable with other classifications. Although it is open to dispute, we will show how this classification can provide many useful applications of the low-level usability check at the design stage.

Firstly, we will consider action-effect problems as unpredicted effects caused by user's action. That is, if the users are trying to take actions, expecting some effects in their head, however if the effects are not predictable, it results in action-effect problems. In turn, if system effects or environmental cues cannot generate any goals to be followed, the interaction would fail to proceed to the next action. The issues considered here are how the next goals are generated or eliminated by the system effects. This results in unpredicted goal-construction and elimination.



**Fig. 2:** Categorisation of interaction problems in terms of cyclic interaction theory.

Finally, the crux of the user interface design is how to assign physical actions on the system to achieve a particular goal or task. Therefore, if we imagine a user-friendly interface, most of the actions available to achieve any goal are very straightforward to find. Otherwise, the user is not able to match the correct action with the current goal state. This would be a goal-action problem, if the designer has not considered how the match between the goal and the action would be derived by the user. Figure 2 shows the three classes of interaction problems in terms of predictability.

In the following sections, the three sets of interaction problems will be illustrated with everyday practical examples and provide a brief walkthrough method to identify the interaction problems.

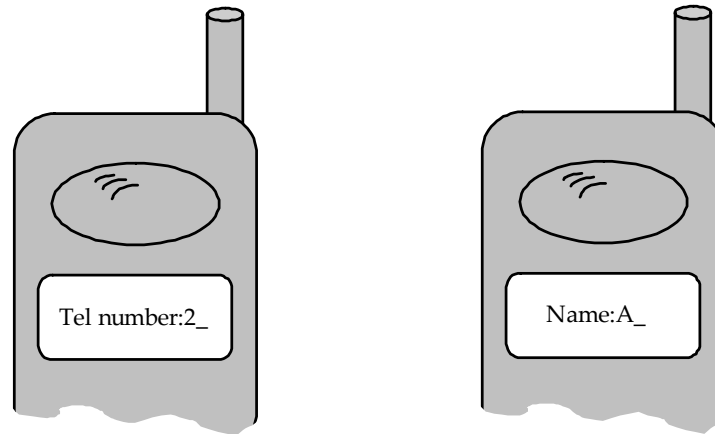


Fig. 3: Number-entry mode vs. letter-entry mode in a mobile phone. The user notices the current entry mode from the different prompts, i.e., 'Tel number' and 'Name' – Extended from Monk (2000).

## 2. Action-effect problems

Of all, an important issue to be analysed with respect to the action-effect path is the mode in which the same action leads to different system effects. Formally, this can be stated as the principle of action-effect consistency (Dix, 1991). That is, the consistent action-effect association reduces the effort needed to carry out a task and so makes learning by exploration much more effective.

Unnecessary modes in the interface should be avoided but sometimes they are inevitable. For instance, small devices like mobile phones employ the same action to perform various tasks. Thus, the action of pressing a particular button will lead to different effects depending on what mode the system is in. This moded interaction is less of a problem if a user is aware of what mode they are in (Monk, 1986). This is a noticeable mode. In normal calling mode pressing the button “ 2 abc ” has the effect of putting the number ‘2’ on the display; on the other hand, when the user edits their address book, pressing the button adds the letter ‘A’ first. They are less likely to feel confused about the different effects, because the mobile phone provides a clear mode signal using the prompt in the display (e.g., See Figure 3, ‘Tel number:’ for number-entry, and ‘Name:’ for letter-entry).

This character entry-mode example as shown in Figure 3 in a mobile phone demonstrates an instance where modes are signalled through the environment. Otherwise, mode errors are liable to occur. Mode errors, which give rise to action-effect problems, tend to occur where (i) *the mode change has been forgotten*; (ii) *there has been a failure to recognise the environment including information to indicate the mode*;

or (iii) a *misleading mode signal is perceived by the user*. The first possibility is a *hidden mode problem*, because the identification of the current mode depends on the recall of an earlier event rather than the recognition of external cues. The second possibility can be thought of as a *partially hidden mode problem* because of the relatively low salience of the mode signal given. One can attribute the third possibility to a wrong user model, which misleads users into believing that they are doing the correct action, i.e., *misleading mode signal*. Each of the mode problems is explored in the following sections.

## 2.1. Hidden modes

Most GUI guidelines (e.g., Apple computer, 1992) have emphasised a clear mode design, suggesting that all relevant information about modes should be noticeably presented in the environment. If the environment cannot signal the current mode, this causes the first type of mode error, i.e., *hidden mode*.

A typical hidden mode problem can be found in a UNIX `vi` editor. Mode errors in the Unix text editor `vi` – like many text editors, `vi` has a command mode, in which characters that are typed as input are interpreted as commands, and input mode, in which characters that are typed are inserted into the document being edited. Because there is (by default) no indication of which mode the editor is currently in, users often type in text thinking they are in input mode, but `vi` interprets their characters as commands because it is actually in command mode. This hidden mode issue can also be found in the L-0111 aircraft disaster (Vicente, 2004). The main cause of the disaster is that the autoflight system became disengaged as soon as a pilot inadvertently grabbed the control yoke, however, nobody noticed the aircraft was being manually controlled because there were no clear mode signals of whether it was in the manual or the automatic control mode.

For an everyday hidden mode example around us, see Figure 4. In the current New Zealand TV environment, in general, a television set has two different tuners: Terrestrial TV tuner (built-in tuner for each TV set) and Satellite TV tuner. When one wants to tune into a satellite TV channel from a terrestrial TV channel, one needs to change the mode from terrestrial to satellite, taking an appropriate action on the remote control. Yet, it is almost impossible for the user to know whether they are in satellite TV or terrestrial TV mode without any support from the environment as s/he is watching a TV programme. In the absence of a clear mode signal, the user has to recall what

mode the TV set was last changed to. This is a hidden mode problem, because the user does not have any external cue to reason about the current mode or the mode reachable by the action.



**Fig. 4:** A satellite TV environment. It has at least two different tuners: one is a terrestrial TV signal tuner and the other is a satellite TV signal tuner. If the tuner selection is not easily recognised by the user, it may result in a hidden mode problem.

Whenever the mode change is likely to happen in any interaction situation, a designer should see if some recognisable signals of the current mode could be provided. In fact, some digital set-top boxes, for instance, signal the current mode explicitly by means of text or coloured icons in the display.

## **2.2. Partially hidden modes or poorly signalled mode**

The second kind of mode ambiguity is where mode signals are not saliently designed. This is different from the first type of mode ambiguity, because mode cues do exist in the environment; however there is a difficulty in recognising them as mode signals.

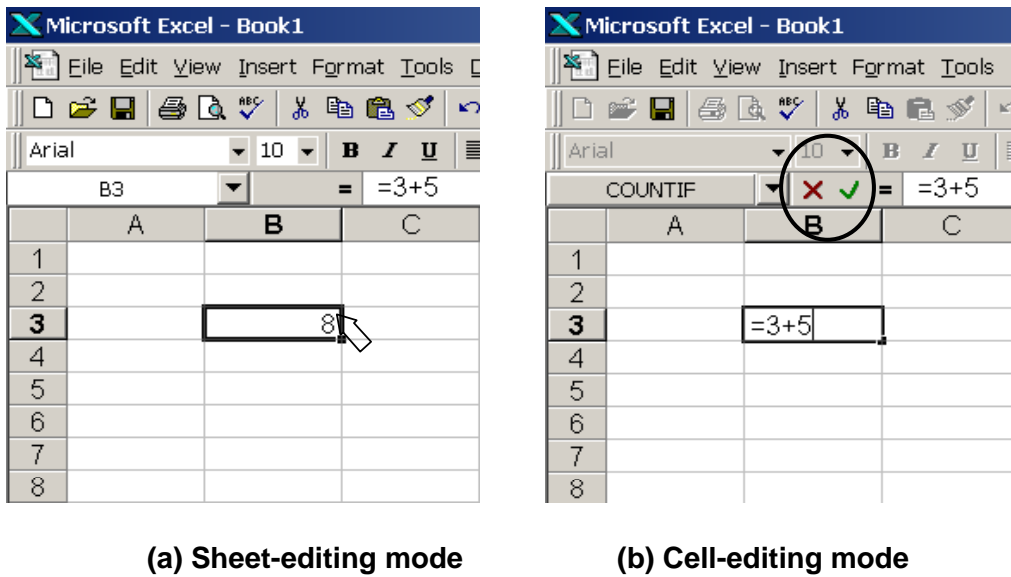


Fig. 5: Two editing-modes in Microsoft Excel™ 97.

A poorly signalled mode is found in the Microsoft Excel™ 97 spreadsheet application (Dix, 2001). Excel™ 97 has two editing-modes: one is a cell-editing mode that enables the user to edit the contents of a single cell by, for example, adding a formula. The other is a sheet-editing mode that allows the user to edit or move sheets around. A mode ambiguity in Excel™ 97 occurs when the system changes the sheet-editing mode automatically into the cell-editing mode when users type anything whilst they are in the sheet-editing mode. Also, hitting the 'Enter' key returns the cell-editing mode promptly into the sheet-editing mode (Dix, 2001).

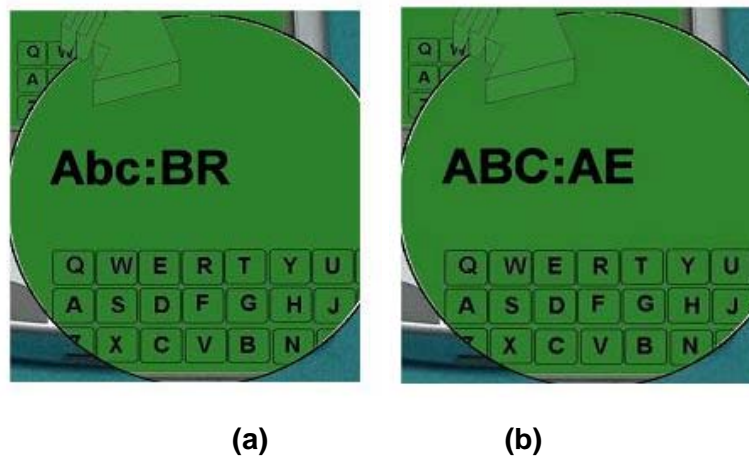
Consider the following situation from Dix: "if a user has selected a cell and can see the formula '=3+5' (see Figure 5(a)), the user may simply type '+2' thinking wrongly that they are in the cell-editing mode. However, this results in deleting the original cell contents rather than getting '=3+5+2' as probably expected. This mode error will be detected easily when the user is looking at the screen, and then they will try to undo the edit. However, if the user is looking back and forth to a paper list of numbers, it will be quite difficult to notice this error." See Figure 5(b). The application signals the current mode using only small icons, a cross (×) and a tick (√) in the formula box. The difficulty in recognising the current mode from the relatively low salience of signal (i.e., poorly signalled mode) may give rise to the partially hidden mode problem.

Whenever recognition of mode appears to occur, designers should ask themselves whether the mode signals provided are strong enough for mode changes to be

recognised. The partially hidden mode problem can be reduced by strongly signalled cues that enable users to reason about different outcomes of the same action. For instance, Dix (2001) suggests that a visual effect such as adding a very slight coloured tint over the spreadsheet would be effective to distinguish the two different modes in Excel 97.

### 2.3. Misleading mode signal

The third kind of action-effect problem may arise when the environment hinders the correct interpretation of the current mode. This commonly happens when mode signals are in conflict, in turn; it is ambiguous what the system status is in, at the time of interaction. It can account for the failure of highly moded interfaces, i.e., interfaces with many modes. In the aircraft flight circumstance, many accidents have been reported, which are caused by conflicting mode signals. For instance, consider the A320 Strasbourg disaster. Due to the confusing display of the mode reads 33 in the one mode and 3.3 in another, the aircraft descended at 3,300 ft per minute instead of 3.3 degree glide slope. That is, pilots selected the wrong mode of descent in a highly moded situation.



**Fig. 6:** Various case mode signals (a) the first letter 'B' as a case mode signal, (b) both the prompt 'ABC' and the first letter 'A' imply the second letter 'E' will be upper-case.

Ryu and Monk (2002; 2004b) also carried out several mode experiments with respect to case-mode signals in hand-held devices. These experiments demonstrated that the users with the given information 'Abc:A' had more difficulty in learning the upper-case correct mode than those with 'ABC:A'. It was argued that the poorer performance of 'Abc:A' to that of 'ABC:A' resulted from the fact that the prompt 'Abc' could imply that

the letters would be lower-case from the second letter on. See Figure 6(a). This shows that the designer employs the last letter 'B' as a case-mode signal for the case of the second letter. Yet, another plausible case-mode signal from the prompt, i.e., Abc, may turn to the user to reason about the case of the second letter as lower-case, instead. Therefore, whenever recognition of mode is likely to occur, a designer should ask himself or herself whether there are possibly competing mode signals.

First phase: preparation

- Step 1. Examine your interaction specification where the same action has different effects.
- Step 2. For each interaction specification where the same action has different effects, list system effects that may inform the user what the current mode is.

Second phase: walkthrough

To check mode problems, the questions are composed of three parts that will be answered in parallel, i.e., iteratively. The subquestions are interdependent because it is not possible to separate perception of modes. The three questions are partly redundant which helps the practitioners identifying more mode problems from the user's perspective.

- Q1. Hidden mode: Does the user recognise (rather than recall) the current mode from system effects?
- Q2. Partially hidden mode (Poorly signalled mode): Are system effects sufficiently salient for the user to discriminate the mode change from the previous interaction?
- Q3. Mode signals in conflict (Misleading mode signal): Is it possible that mode signals imply different modes?

Third phase: walkthrough verification

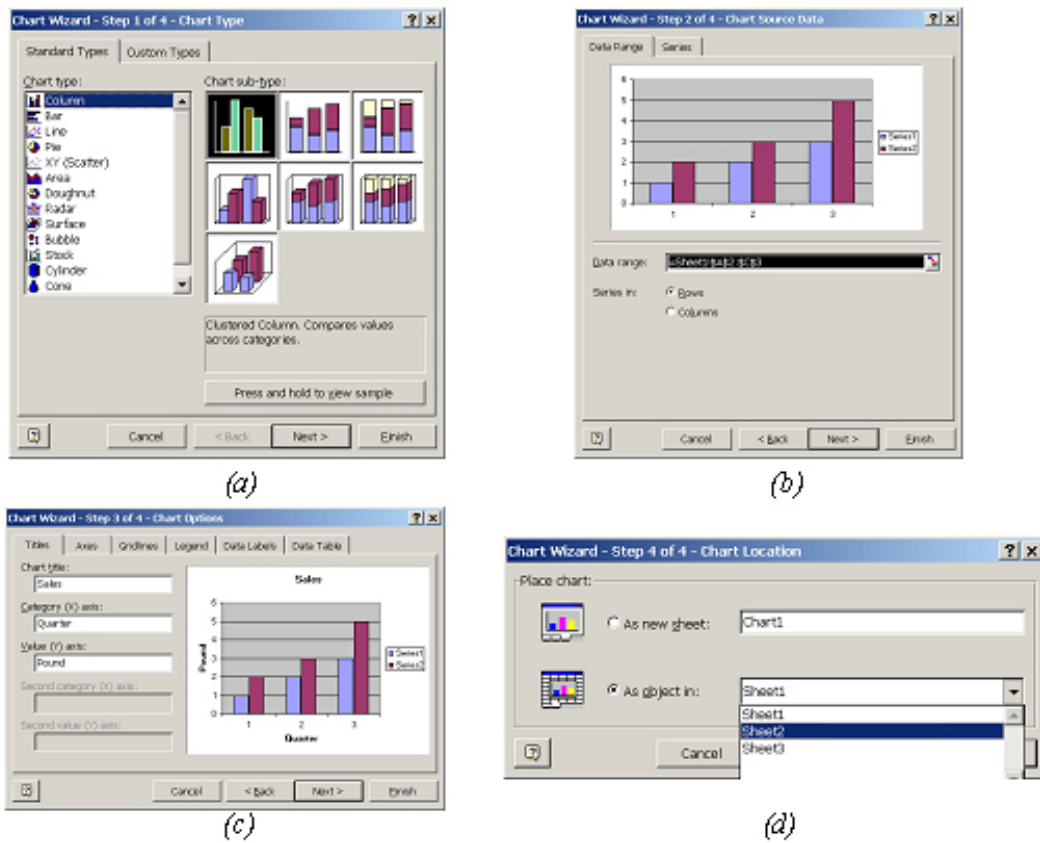
Finally, the mode problems identified from the walkthrough questions should be reviewed critically whether they are following mode design heuristics. Special attention is directed to how well the mode signal of the current interaction matches to the following heuristics:

- Do not rely on user's recall of mode changes.
- Provide mode signals with visibly or audibly salient signals in system effects, so that the user notices the mode change between interactions.
- Keep mode signals to indicate the same mode between interactions.
- Remove competing mode signals in system effects where there is more than one mode signal.
- Provide consistent mode signals across all tasks.

**Fig. 7:** The low-level interaction walkthrough of action-effect problems.

In summary, most systems have modes of one kind or another. This is a problem if the user is not aware of the contingency, i.e., if the mode is *Hidden* (no signal to the user); *Poorly signalled* (mode signal insufficiently salient to guide the user's behaviour); or *Inappropriate* (mode signal misleads the user). This classification accounts for why the user's perception of the current mode needs to be considered whenever there are modes.

However, these case-by-case analyses do not offer ready-made techniques and procedures. Furthermore, it must be concretised according to the specific nature of the technology-in-use under scrutiny. For this purpose, we do provide a walk-through procedure (or checklists), as depicted in Figure 7, in order to identify action-effect problems. Having written a complete interaction specification of some parts of a system the designer is asked to examine all relevant action-effect pairs where the same action has different effects. Having answered the questions in Figure 7, the designer will be satisfied that the assumptions made in the design are without mode problems. In this way, the designer can provide a credible argument for their proposed design based on the interaction behaviour of the user depicted in their design specification.



**Fig. 8:** Chart wizard from Microsoft Excel 97. (a) Step 1/4 – Select Chart type, (b) Step 2/4 –Select data to be referred, (c) Step 3/4 – Select chart options, and (d) Step 4/4 – Select chart location.

### 3. Effect-goal problems

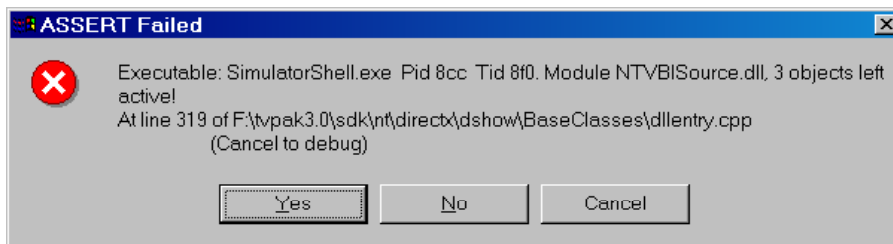
In most HCI tasks, the way a user communicates with a system heavily depends on system effects. This is a very effective way of working and GUIs are arguably the single most influential application of HCI research. Of this, cyclic interaction theory explains that when visible and audible system effects are inadequate, the user will not be able to construct or eliminate appropriate goals. The only way to interact with such systems is to recall the correct task procedure. In turn, this kind of interaction results in more efforts to learn.

The effect-goal path in cyclic interaction theory can be effectively thought of as the goal reorganisation process. For instance, the chart wizard in Excel™ 97 helps users decompose a goal into a number of subgoals (Wright et al., 2000). In this way, they realise what has been achieved at each step and how many steps are left to accomplish the overall goal. In Figure 8, the controlled process of goal reorganisation in the chart wizard application is starting from a goal 'Create Chart'. It is very straightforward to imagine that the goal gives rise to the action 'Click Icon(Chart)' in Excel™. The environment in Figure 8(a) generates another goal 'Specify chart type'. The next interaction allows the user to eliminate the goal 'Specify chart type' and in turn initiate the subsequent goals 'Specify Chart subtype' in Figure 8(a), 'Specify data range on sheet' as in Figure 8(b), 'Specify X- and Y- axis' as in Figure 8(c), and 'Specify location' as in Figure 8(d).

Affordances (Djajadiningrat, Overbeeke, & Wensveen, 2002; Gibson, 1979; Norman, 1999) of each display help the construction and elimination of appropriate goals (Ryu & Monk, 2004a, 2004b). The main benefit of the wizard application results from the affordances of these objects on establishing and then removing subgoals appropriately. The wizard application example demonstrated the instance where the subsequent goals are naturally generated and the completed goals are explicitly terminated through the appropriate changes to the environment. Otherwise, effect-goal problems are liable to occur. An inadequate goal-reorganisation process thus can be classified into four categories as follows: (i) *missing cues for goal construction*– effects do not suggest appropriate goals; (ii) *misleading cues for goal construction*– effects suggest irrelevant goals; (iii) *missing cues for goal elimination*– effects do not delete completed goals; or (iv) *misleading cues for goal elimination*– effects delete incomplete goals. The first two possibilities may be followed by incorrect actions; the last two are likely to result in repeating attempts to achieve the goal.

### 3.1. Missing cues for goal construction

The user reasons about the subsequent goal from system effects, except when obviously given to the user. Thus all relevant cues for reasoning about the subsequent goal should be presented appropriately. The lack of appropriate cues may result in goal construction problems arising from *missing cues* or *misleading cues*. An extreme example of the former case is where cues or information are not presented in the system. The latter implies that inadequate cues are in the system, leading to irrelevant goals and, in turn, incorrect actions.



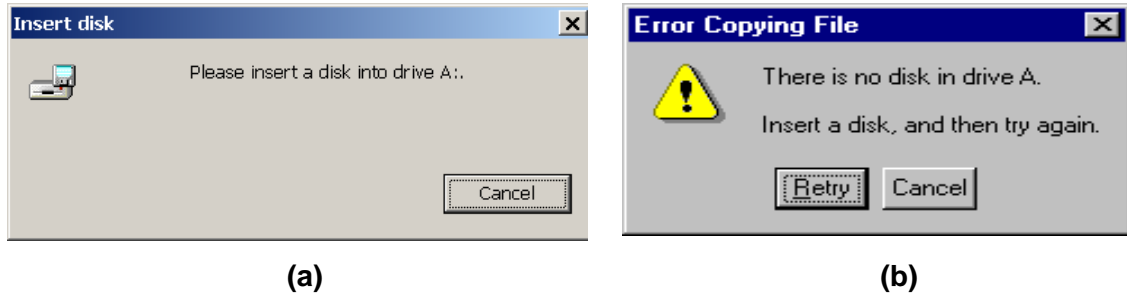
**Fig. 9:** An alert message in starting an application.

The first kind of goal construction problem refers to the instance where it is difficult for the user to reason about subsequent goals from system effects. In turn, it is less likely to take the subsequent correct action. An example of this kind of goal-construction problem can be found where a system generates an alert box when a user initiates an application as in Figure 9. A critical criticism of this dialogue box is that it is very difficult for the user to click the 'Yes' button to start the application, even though the 'Yes' button has been signalled as the default button. Indeed, this problem originated from the fact that an action indicating goal – i.e., Select 'Yes' – cannot be straightforwardly constructed from this system effect. They may be more likely to choose 'Cancel' as being safer. In fact, this will invoke the debugger causing the novice user further confusion. Whenever it is assumed that subsequent goals will be generated by system feedback, a designer should see if the goal could be added by the strong affordance of the system effect.

### 3.2. Misleading cues for goal construction

The second kind of goal construction problem is where system effects strongly imply irrelevant goals, thus leading to incorrect actions. This is common when the affordance

of a display (or object) is so strong that users instinctively establish inadequate subgoals that are related to the affordance of the display.



**Fig. 10:** Copying a file onto a floppy disk in (a) Windows 2000™, (b) Windows NT™

For instance, consider the task of copying a file onto a floppy disk. In Windows™ 2000, when users have not inserted a floppy disk into the drive, a dialogue box as that of Figure 10(a) appears. In contrast, Windows NT™ employs an alert box like Figure 10(b).

It can be thought that the designer of Windows™ 2000 assumes that users will construct the subsequent goal, i.e., Insert disk, from the message ‘Please insert a disk into a drive A’; however the designer overlooks a possibility that the strong affordance of the sole clickable object – i.e., the Cancel button – may suggest an irrelevant goal, i.e., Cancel first, that does not pertain to the overall goal. In contrast, Windows NT environment allows the user to plan appropriate subgoals from appropriate affordances of the display at the cost of an extra click (see Figure 10(b)). The affordance of the ‘Retry’ button and the message inform the correct sequence of actions such as ‘Insert a disk, and then Click Retry’. In fact, we found that many users selected the ‘Cancel’ button instinctively in Figure 10(a), when asked to perform the task.

As stated above, this phenomenon is partly because the affordance of the ‘Cancel’ button is too obvious at the point of interaction. Polson et al. (1992) have also claimed that this problem arises from a dialogue box that cannot produce an ‘and-then’ goal such as would be required in the example shown in Figure 10(b). Here, the user has to ‘Insert a disk’ and then ‘Retry it’.

First phase: preparation

- Step 1. Examine system effects in the system specification that are designed to construct the subsequent goals.
- Step 2. List the system effects and the subsequent goals.

Second phase: walkthrough

To check goal-construction problems, the questions are composed of two parts that will be answered in parallel, i.e., iteratively. The subquestions are interdependent because the two types of goal-construction problems are frequently co-existing. The two questions are partly redundant which helps the practitioners identifying more goal-construction problems from the user's perspective.

- Q1. Missing cues for goal construction: Do system effects strongly suggest the constructed goal?
- Q2. Misleading cues for goal construction: Do the other system effects suggest that the user conceive of goals that do not pertain to the overall goal?

Third phase: walkthrough verification

Finally, the goal-construction problems identified from the walkthrough questions should be reviewed critically whether they are following goal-construction design heuristics. Special attention is directed to how well the system effects matches to the following heuristics:

- Suggest next goals using comprehensive system effects (or strong affordance to imply subsequent goals).
- Inform the sequence of actions for the user to plan subsequent goals.
- Remove situations or system effects that can strongly suggest irrelevant goals.

**Fig. 11:** The low-level interaction walkthrough of goal-construction problems.

In summary, goal construction problems occur when the subsequent goal is ambiguous or irrelevant, i.e., if system effects do not suggest appropriate goals (missing cues); or, effects suggest irrelevant goals (misleading cues). These two problems tend to be followed by incorrect actions, thus they can be equally considered as effect-action problem. In any system specification, the two kinds of goal construction problems can be detected by examining all the effects which can construct subsequent goals and then determining whether all the goals pertain to the overall goal. Figure 11 describes a walkthrough approach to be applied for identifying goal-construction problems.

### **3.2. Missing cues for goal elimination**

In addition to constructing subgoals, system effects in interactive systems remove any doubt about what the system is doing and how it is responding to the user's action. For example, where there is a long system delay a user needs to know whether the system is actually responding to their last action and how the command is progressing. That is,

system effects have to show whether the user's goals have been successfully completed or not. The lack of appropriate feedback results in goal elimination problems arising from *missing cues* or *misleading cues*. The former implies that feedback of goals completed is not presented in the system, therefore the user has to remember what they have completed. The latter suggests that feedback leads to the elimination of incomplete goals inadvertently.

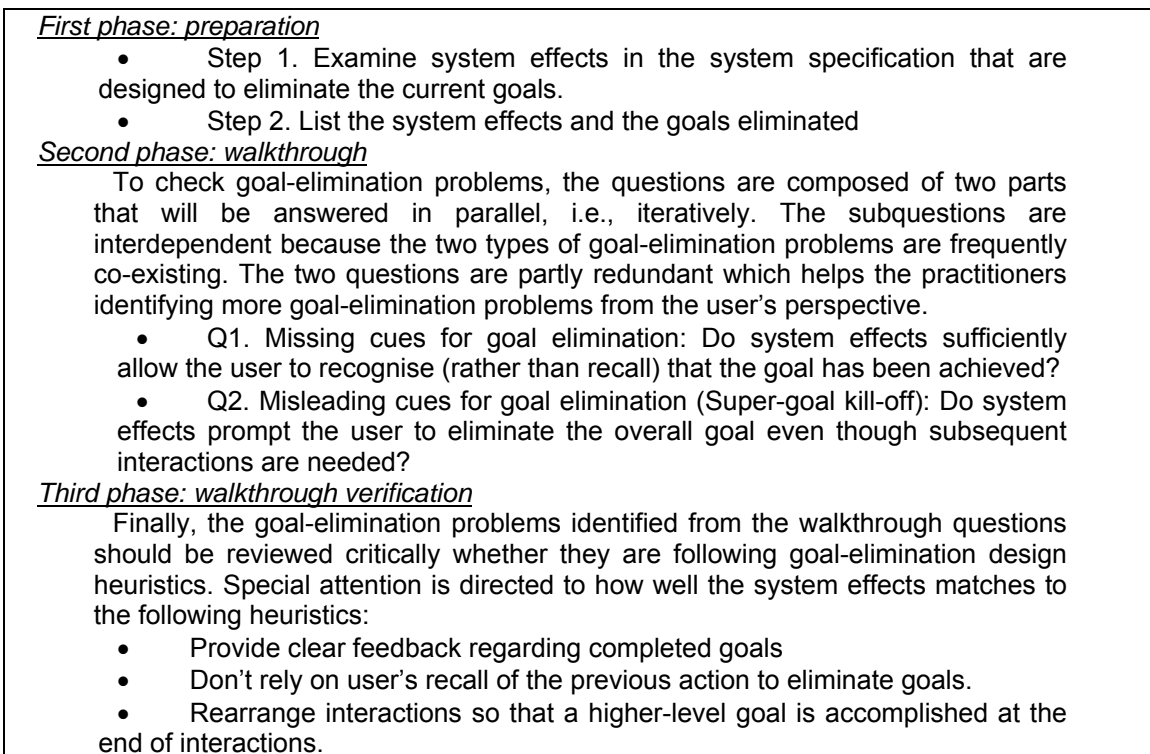
The first kind of goal elimination problem refers to the instance in which completed goals are not eliminated from the current goal set due to the lack of clear system effects. This implicit feedback is also found in the DOS environment, when a user types 'del my.doc' to delete the word file, and the system responds with a new command-line prompt, if successful. The new prompt is feedback, however, one cannot identify whether the file was deleted. Here, the feedback is provided only with respect to the lower-level goal of typing a syntactically correct command. Consequently, in order for the user to eliminate the higher-level goal, i.e., delete a file, they have to refer back to the previous action taken – 'del my.doc'; or follow up with a DIR command to check the right file was deleted. In addition, the two experiments carried out by one of the authors (Ryu, 2003) demonstrated the importance of the notion of goal elimination process through feedback.

Whenever it is assumed that a goal will be eliminated in the interaction specification, a designer should see if the goal could be deleted by the system effect. The implicit feedback may not provide sufficient information that the goal has been achieved, in which case users will be compelled to take action to check whether the goals were completed.

### **3.3. Misleading cues for goal elimination**

In an old automatic teller machine (ATM), many people used to leave their cash card in an ATM after withdrawing cash (Byrne, 1995). This error comes from the inappropriate task procedure, i.e., 'withdrawing money, and then taking out the card'. Indeed, as the users have cash in hand they believe that the overall goal (i.e., withdrawing money) has already been achieved and inadvertently leave their card in an ATM. This example illustrates the second kind of goal elimination problem. That is, a strong cue (i.e., cash in hand) before the overall goal is completed would eliminate the subsequent goal (i.e., take out the cash card).

A sensible way to remove this ‘super-goal kill-off’ phenomenon by misleading cues (Byrne, 1995; Wharton, Bradford, Jeffries, & Franzke, 1992) on an ATM is to modify the interaction procedure from ‘Withdraw money → Take out card’ to ‘Take out card → Withdraw money’ that is adopted in the present ATMs. As a consequence, the user cannot retrieve the money from an ATM until they take out the card.



**Fig. 12:** The low-level interaction walkthrough to identify goal-elimination problems.

In summary, goal-elimination problems can be classified into two categories: (i) implicit goal-elimination arising from missing cues; (ii) irrelevant goal-elimination from misleading cues. The two kinds of goal elimination problems can be detected by examining subgoals which are eliminated in each interaction specification and then determining whether all the elimination arise from system effects.

Figure 12 shows a walkthrough for tracking down goal elimination problems. Having followed these steps, the designer will find that the assumptions made for the interaction would not be reasonable because of the implicit goal-elimination process.

In conclusion, this section has discussed how one can identify four kinds of effect-goal problem. In fact, effect-goal problems make the user’s task performance even worse. In the first category, i.e., the appropriate goal is not suggested, it is difficult to complete the task because the effect does not reduce the knowledge demands on the

user (Norman, 1988), so that the user may need to recall events in the past. In the second category, when inappropriate goals are suggested, the problems will divert the user from the overall goal and may lead to an action that is not relevant to the overall goal. In the third category, where the completed goal is not eliminated, there is a dramatic effect on the task performance in that it will compel users to redo the task. In the fourth category, where an incomplete goal is deleted, this is related to the super-goal kill-off phenomenon (Wharton et al., 1992). This may lead the user to prematurely believe that the ultimate goal has been achieved.

#### 4. Goal-action problems

Early studies of interface design (e.g., Payne & Green, 1986; Young, 1983) have claimed that the adequate connection between goal and action is one of the most important design issues. In particular, Payne and Green (1986) have emphasised that similar goals should be accomplished by similar action sequences, establishing a predictable relationship between the goal and the action, i.e., goal-action matching.



**Fig. 13:** Ejecting compact disk in the old Macintosh environment (Mac OS B1-8.6).

An example of the goal-action matching problem can be found in an old version of the Macintosh desktop environment (e.g., Mac OS B1-8.6). Consider Figure 13. To eject a compact disk users had to drag the disk icon to the trash can. Novice users on the Mac environment, particularly familiar users of Windows™, may be wary of dragging their compact disk icon to the trash can icon to eject it, because this is the same way one

deletes a file. Even though the two goals are obviously different, the two actions are almost the same.

Indeed, the primary criticism of this Mac environment is the affordances of objects (Djajaningrat et al., 2002; Gibson, 1979; Norman, 1999). That is, affordances of the trash can icon and the other icons (compact disk and file) do not tell any difference between the two goals, i.e., ejecting or deleting.



**Fig. 14.** (a) Delete a file or folder in the new Macintosh environment (Mac OS X). In contrast, (b) the trash can icon is automatically changed into the eject icon as a floppy or a compact disk is dragging to the icon.

To some extent, this problem is eliminated in the new Macintosh environment (e.g., Mac OS X) by providing objects with different affordances. See Figure 14. In contrast to the previous Mac environment, the trash can is automatically changed into the eject icon as a floppy disk is dragged. This modification allows the user to construct two different kinds of goal-action matching in terms of the recognition of the objects: Eject→(Floppy→Eject icon), and Delete→(File→Trash can icon). At the same time the system remains consistent with previous Mac OS.

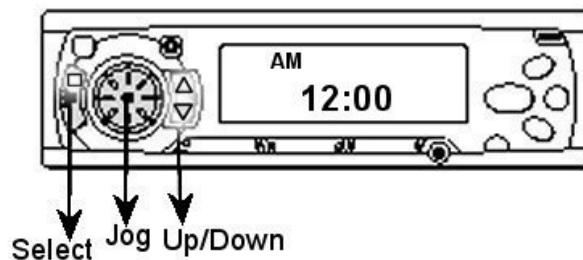
As the example above shows, goal-action problems are commonly observed on the occasions where unpredictable actions are designed to accomplish the current goal. The analysis considers the following unpredictable actions: (i) *the weak affordance of the correct action*; and (ii) *the strong affordance of the incorrect action*.

The first case results in the user being able to take any other action due to the weak affordance of the correct action (or the object designed for the correct action). The second case results in an incorrect action. Either possibility involves unnecessarily complex actions. That is, the first case may compel the user to look for documentation, the latter will require that the user has to redo the task.

#### 4.1. Weak affordance of the correct action

The first type of goal-action matching problem refers to an instance where the affordance of the correct action is not clear. As a consequence, a user may make considerable efforts to find the correct action. The problem of the old Macintosh environment stated above can be explained by the 'Trash can' icon having a weak affordance as a cue for the correct action for ejecting a floppy disk.

Consider another working example where one wants to set the clock on a portable MP3 player (e.g., AIWA™ CDC-MP3). Figure 15 depicts the control panel of the MP3 player. By holding down the jog dial for two seconds, the clock (AM 12:00) appears in the display. In order to set the hour the user has to press button '▲', then rotate the jog dial to change the hour. In contrast, the user has to press button '▼' to set the minute, then rotate the jog dial. The goal-action matching seems to be very arbitrarily assigned. This way of interaction is very confusing as the '▲/▼' buttons normally afford increment or decrement.



**Fig. 15:** AIWA™ CDC-MP3. In the clock-setting mode, the '▲/▼' buttons are used to initially indicate hour or minute, not for increasing or decreasing the figures on the display.

If the recall of the correct object for the relevant action fails to happen, the user either guesses and tries incorrect actions or looks for assistance from other resources such as the documentation (Mack & Montaniz, 1994). A sensible way to reduce this weak goal-action matching is to employ a consistent way of performing a particular task. For instance, in order to set the clock the user rotates the jog dial until the required time is displayed and then activates it by holding down the jog dial for a predefined time. This procedure may avoid a further recall of each object, thus supporting goal-action consistency as suggested by Payne et al. (1986).

## 4.2. Strong affordance of the incorrect action

The second case of goal-action matching problem refers to occasions where the affordance of the incorrect action is too strong, so that the incorrect action may frequently be selected. In order to avoid incorrect actions through strong affordance, for example, the common GUI environment deactivates certain menu options, thereby restricting the user from choosing incorrect actions.

Consider a working example where one wants to tune the radio waveband on a commercial audio player, AIWA™ RX 408. The player has a control labelled 'MODE' that one would think would tune the wave band. Yet, the control labelled 'MODE' only changes the mode from 'Tape Mode' to 'Radio Mode', and vice versa. Instead, a different control 'RADIO ON' changes the waveband between AM and FM. The difficulty in tuning the waveband arises from the inadequate label (i.e., RADIO ON), facilitating the selection of the incorrect control 'MODE'. The designer seems to consider that the affordance of control 'RADIO ON' would indicate more directly the radio function rather than control 'MODE' does. Yet, it is not so easy for the user to select the correct control 'RADIO ON', partly because the correct 'RADIO ON' button has a weak affordance to be selected, and partly because the incorrect 'MODE' button has a strong affordance.

A sensible way to reduce the difficulty is to use a different identifier for the 'MODE' button such as 'TAPE ON/OFF', thereby restricting the user to choosing the 'Mode' button to tune in the waveband.

### First phase: preparation

- Step 1. Examine actions in the system specification that are designated for the current goal set.
- Step 2. Examine system effects in the system specification that indicate the actions.
- Step 3. List the actions, the system effects and the current goal set

### Second phase: walkthrough

To check goal-action problems, the questions are composed of two parts that will be answered in parallel, i.e., iteratively. The subquestions are interdependent because the two types of goal-action problems are frequently co-existing. The two questions are partly redundant which helps the practitioners identifying more goal-action problems from the user's perspective.

- Q1. Weak affordance of the correct action: Can the user associate the action with the affordance of the corresponding object?
- Q2. Strong affordance of the incorrect action: Do system effects prompt the user to take an incorrect action from the strong affordance of the corresponding object?

### Third phase: walkthrough verification

Finally, the goal-action problems identified from the walkthrough questions should be reviewed critically whether they are following goal-action matching

<p>design heuristics. Special attention is directed to how well the actions on the system matches to the following heuristics:</p> <ul style="list-style-type: none"><li>• Avoid arbitrary and ambiguous goal-action matching.</li><li>• Don't assign any irrelevant goal to objects with other affordances.</li><li>• Provide strong affordance of the correct action</li></ul>
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**Fig. 16:** The low-level interaction walkthrough of goal-action problems

In summary, it may be difficult for the user to find the correct action in a particular situation. This can be explained by goal-action problems. This is a problem if the user cannot correctly match the goal-action, i.e., if the correct action has an inappropriate affordance (no or weak indication of the effect of the action); or the incorrect action has strong affordance (the strong indication misleads the user).

To pinpoint the two kinds of goal-action problems in a proposed design, the designer must be able to provide a credible answer for their proposed design with the procedure as depicted in Figure 16. The procedure suggests that the two kinds of goal-action problems can be detected by examining the action in each interaction specification, and then determining whether the action can be triggered by the strong affordance of the display for the action.

This section has discussed how one can identify two kinds of goal-action problems with the notion of affordance. Goal-action mismatching accompanies complex actions. The problem of complex action is that users tend to forget the correct action. Therefore, complex actions should be avoided when the user may have insufficient knowledge to choose the correct action. For example, wizard applications (see Figure 8) will lessen the possibility of goal-action problems, because most work by the strong affordances of the display for the correct actions.

## 5. Conclusions and Discussion

This paper has developed an analytic framework of human-computer interaction, by setting out a way of thinking about cyclic interaction theory. The walkthrough approaches represented in Figure 7, 11, 12, and 16 were also developed to identify the classes of interaction problems according to cyclic interaction theory.

Cyclic interaction theory (Monk, 1998, 1999) has made it possible to envision interactions between the user and the environment in a relatively simple way. Three classes of interaction problems have been proposed and described. First, action-effect problems can be equally thought as mode problems in which the same action leads to

different system effects, categorising them into hidden mode problems, partially hidden mode problems, and misleading mode signals. Unexpected effects caused by inappropriate mode settings have been discussed. Second, effect-goal problems have been set out as goal-reorganisation problems, weighing up missing or misleading cues. Unpredicted goal construction and elimination caused by poor system specification has been described. It may be difficult or almost impossible to analyse these problems in that user goals are reorganised in the course of interactions and are not likely to be observable. Though it may be true to some extent, a specific assumption of a goal reorganisation process may produce detailed accounts that do match observed behaviour. Finally, two goal-action problems have been explained in terms of the concept of affordance. It has provided a possibility of understanding how the user would match their current goals with actions (or objects) in the system. Of course, one design error may result in interaction problems in several of these classes because the influence of each problem propagates rapidly through the interaction cycle. For instance, effect-goal problems may be detected where a user is expected to have difficulties in selecting the subsequent correct action, and that this could be equivalently considered as a goal-action problem.

Whilst this classification of interaction problems is no mutually exclusive nor exhaustive in explaining all interaction problems posed in the HCI research, they provide a brief base by which to contribute not only to an understanding of user's possible attitudes and responses to the system (or user interface), but also to the substantive HCI research seeking to understand specific interaction problems.

The low-level interaction analysis presented here has two different potential uses. One use is in the process of design. The other is in generating a modelling approach with the potential of extending HCI theory.

### **5.1. Cyclic interaction theory as a modelling tool**

In this paper, there is no specific interaction specification presumed. This is partly because it is beyond the scope of this paper, and partly because different designers have their own preference for a specific type of interaction specification. For instance, they may describe interactions using state transitions or formal notations (e.g., Dix, 1987; Harel, 1988; Monk, 1999). More recently, some designers are very keen on using UML (Unified Modelling Language), which is a general-purpose notational

language for specifying and visualizing complex software, especially large, object-oriented projects.

Indeed, the main purpose of this paper is to apply cyclic interaction theory for identifying low-level interaction problems for an interactive version of their design, not to propose a modelling tool. It may result in a weak aspect of this paper in that there is no thorough mechanism specified with detailed explanation of each interaction specification. This paper sets out a research idea, for future study of models of cyclic interaction for improved this low-level interaction analysis. Further, at least the low-level interaction should be described on both the system and the user side at the same time and at the same level. That is, in order to interact with the system a user model must also generate low-level actions such as keystrokes and button presses. If this kind of model is developed, the analyses presented here can be further formalised (Ryu & Monk, 2004a).

## **5.2. Cyclic interaction theory as a design tool**

From a theoretical point of view, the paper exploits only cyclic interaction theory, too easily clearing the findings of recent and important HCI theories that underline the situated and pragmatic nature of the human-computer interaction. Actually, we do not intend to trivialise other works. Instead we aim to provide a practical framework to evaluate low-level interactions with the practitioner, which we see what the cyclic interaction theory can provide.

In this context, the low-level account of user behaviour has a value in analysis of the potential interaction problems introduced at the design stage. For example, the mode detection walkthrough, given in Figure 7, makes it possible to reason about the cycles of interaction required to reduce mode problems in a highly moded interface. This analysis has a very similar purpose to the Cognitive Walkthrough (CW) analysis (Wharton et al., 1992) in that it also analyses interaction at the level of recognition and action cycles. In both cases the analysis focuses on the issue of direct concern to the designer, that is, identifying points in the human-computer interaction where the system may lead to inappropriate action, recognition or goals (Monk, 1999). However, sometimes following the steps in the CW is not simple. In such situations, the CW does not help the designer get insights into what is understandable and how things make sense from the users' point of view (Bertelsen, 2004). Thus, the simple question about visibility may be difficult to answer without detailed knowledge about how users

interpret what they see. By contrast, this low-level account of interaction problems can make explicit what problem a process results in, as well as what triggers that problem. It is thus possible for the designer to build interactive versions of the design so as to assess the assumptions made or being made regarding the interaction between the user and the system.

Hence, a main advantage of this paper is to provide the designer with the ability to evaluate their design when reasoning about new tasks and new systems. Any potential design could be checked against the assumptions that make explicit: the effects on the system of the different actions needed; what the user must perceive in the display; and the goals that have to be generated. To this end, the designer must be able to provide a credible answer to their proposed design as to why they assume the interaction behaviour of the user and the system as depicted in their system specification. If the answer to any one of these questions is negative, then this may indicate a potential low-level usability problem.

## **6. Future work**

This paper provided a promising alternative to analyse low-level interactions in human-computer interaction tasks, simulating the user's behaviour. However, the user's behaviour cannot be independent of 'technology-in-use'. We see that technologies should be seen 'in use', inside activity settings meaningful to the user, in a broader context. Making hypotheses about the technology's use or simulating it, which is purported in this paper, without clarifying the conditions of such a simulation, brings to results of uncertain validity.

In this context, this paper may oversimplify the problems of the human-computer interaction without empirical data that support the conclusions and the walkthrough approach. For this purpose, we are currently working on establishing empirical understandings of this work more thoroughly.

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# A Psychological Cultural approach to VR experiences

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## ABSTRACT

In this paper it is argued that virtual reality represents a locus where general psychological processes can be investigated thanks to the fact that it epitomizes a characteristic that is proper to every human endeavor, namely the construction of reality. This presupposition is taken from Cultural Psychology and its insistence on cultural artifacts as key elements in human development. A brief presentation of major concepts used in the field, like different categories of presence are presented in order to enhance the idea proposed.

En este artículo se propone a la realidad Virtual como un escenario posible para investigar los procesos psíquicos generales que intervienen en la construcción de la realidad, definida esta última como una cualidad psíquica general humana. Para dicha articulación se recurre a la Psicología Cultural y específicamente al concepto de "artefacto cultural". Diferentes conceptualizaciones del término presencia son presentados aquí en la intención de sostener la idea propuesta

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Keywords: *virtual reality, cultural artifact, presence, psychological processes.*

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## 1. Introducción

La idea de este artículo es proponer a la realidad virtual como un escenario para la investigación en Psicología. Escenario que puede ser considerado como herramienta que contribuya a la producción científica. Esta propuesta no es nueva: desde la perspectiva cultural, que enmarca esta presentación, la construcción del conocimiento es posible a través de los "artefactos culturales", (Cole, 1996).

Las experiencias con los artefactos tecnológicos, que emergen en la cultura digital, son las que propongo para ser estudiadas por la Psicología. A su vez, propongo a las Nuevas Tecnologías de la Información como a escenarios donde la experiencia humana se despliega posibilitando el estudio de procesos psíquicos.

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Las Nuevas tecnologías han producido reordenamientos significativos a nivel mundial, económico, social y psicológico, suponiendo cambios en las modalidades de pensamiento, aportando a los sujetos nuevas posibilidades para la interacción. El objeto de estudio aquí es la experiencia humana que se elicitaba cuando se interactuaba con estos artefactos, la importancia de este desplazamiento tiene que ver con

descentrarse de “Las nuevas tecnologías” o “La Realidad Virtual” como actores protagónicos de los procesos, siendo que en su diseño, elaboración y utilización, para la mediación, reside su potencial. Es un descentramiento de lo tecnológico a lo subjetivo, que los lectores deberán realizar a medida que avanza este trabajo. Es por esto que considero al concepto de “artefacto cultural” de Cole como un andamio conceptual pertinente que da cuenta de las características relevantes que las Nuevas Tecnologías de la Información, en especial las relacionadas con la Realidad Virtual parecen nuclear.

Los equipos interdisciplinarios avocados a la construcción de estos artefactos desarrollan conceptos que refieren a procesos psíquicos con el fin de mejorar la performance de la tecnología en cuestión. Esta finalidad acota la amplitud de uso de los conceptos desarrollados. Considero que estos desarrollos pueden contribuir a la Psicología en general.

En una primera parte me referiré al concepto de “artefacto cultural” y sus principales características, luego a la Realidad Virtual como artefacto tecnológico, a los conceptos operacionales que explican su fenomenología y a los procesos psíquicos. Finalmente plantearé las condiciones que hacen posible considerar a estas experiencias dignas de observación científica y su relevancia para la investigación en Psicología.

## **2. Artefacto Cultural**

Michael Cole (1990), considerado uno de los máximos exponentes de la Psicología Cultural desarrolló el concepto de artefacto cultural para sustentar sus ideas sobre la importancia de la dimensión cultural en el desarrollo de los procesos psicológicos. Cole sostiene que las características propias de los procesos psicológicos humanos son su mediación cultural, su desarrollo histórico y su utilidad práctica. Estas características se nuclean en el concepto de “artefacto cultural”. Los artefactos están destinados para la comunicación e interacción entre seres humanos y el mundo físico. Los artefactos culturales como unidad descriptiva indican por un lado la materialidad del artefacto como así también su aspecto simbólico. De esta forma el entorno cultural humano, estaría compuesto por artefactos culturales de doble condición “material” y “artificial” (Cole 1990, p. 285).

Los artefactos culturales intervienen en la constitución de los procesos psicológicos, al estar desarrollados históricamente y tener una finalidad práctica que implican a los sujetos entre sí. Estas cualidades de los artefactos culturales los habilitan para el

estudio y abordaje de los procesos psíquicos humanos, ya que estos son productos de los mismos y mediaciones para su formación. Si interpelamos a la realidad virtual como artefacto cultural encontramos en su armazón a las cualidades que define Cole como constituyentes de los artefactos culturales, otorgando relevancia a la mediación como modalidad de subjetivación del hombre y por ende como andamio para abordar los procesos psíquicos. Es pertinente si bien redundante, recordar aquí las específicas cualidades de esta tecnología, las cuales rodean una intencionalidad manifiestamente anudada a los procesos psíquicos que intervienen en la constitución de la realidad.

### 3. Realidad Virtual.

Gaddis (1998) define realidad virtual como *“a computer-generated simulation of the real or imagined environment or world”* (una simulación de un ambiente imaginario o del mundo real generado por computadora)<sup>1</sup>.

Existen distintos tipos de realidad virtual (Cronin, 2000) las categoriza por el grado de inmersión - concepto que se trabajará mas adelante - que el sistema provee:

- No inmersiva ( desktop VRE) Las imágenes se observan por una pantalla o monitor, aunque sean imágenes en tres dimensiones, es la mas común y menos costosa de la RV.
- Semi inmersiva ( projected VRE) las imágenes y los efectos son proyectados en una pantalla, la inmersión es alta pero la interacción se ve afectada.
- Totalmente Inmersiva (fully immersive VR): esta es la más cara y famosa de las RV, requiere de interfases especiales como guantes electrónicos, pantallas estereoscópicas, trajes virtuales, rampas, sistemas de audio de alta fidelidad, cascos, etc.

Los conceptos aquí enunciados, bastante generales, intentan un significado suficiente que permita comprender la articulación que pretendo hacer.

*Otro factor relevante son los altos niveles de interacción en tiempo real, producto de la conectividad de interfaces específicas a los sistemas preceptuales humanos, los cuales deben funcionar sincrónicamente, estas interacciones pueden ser monitoreadas, registradas fácilmente, lo que posibilita su utilización para la investigación.*

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<sup>1</sup> Todas las traducciones de las citas en inglés son del autor.

### 3.1. Realidad Virtual: aspectos psicológicos

En el uso de la realidad virtual, se intenta hacer emerger el sentido de la *inmersión* con el motivo de elicitar el de *presencia*, conceptos claves en este campo, la intencionalidad es lograr que el sujeto se sienta envuelto y contenido dentro del espacio sintético, sin embargo vale aclarar aquí que presencia remite a un proceso mucho más abarcativo que la inmersión o que el involucramiento.

Inmersión es definido como “*an intense feeling of self-location within the computer-generated reality with which the user interacts*” (Cronin, 2000) (un intenso sentir de auto localización dentro de la realidad generada por la computadora con la que el usuario interactúa). Tiene que ver con la apreciación subjetiva de “estar dentro y envuelto” por el ambiente virtual. Es el encuentro entre la tecnología por un lado con sus cualidades y por el otro con la subjetiva sensación de involucramiento que se elicita desde el uso del sistema. Lo primero se conceptualiza como fidelidad, al decir de (Knapp,1998) “*the extent to which the VE and interactions with it are indistinguishable from the participant’s observations and interactions with the real environment*”. (El grado que hace que las interacciones con el ambiente virtual sean indistinguibles por el usuario con las interacciones con el ambiente real). La otra faceta de la inmersión tiene que ver con el sujeto, con la condición subjetiva, al decir de (Knapp,1998) “*environmental fidelity*” (fidelidad ambiental), se manifiesta en el “*judgement of similarity*” (juicio de similitud) que ejecuta el usuario. Estas cualidades son trabajadas con atención cuando el objetivo del ambiente virtual es lograr la transferencia de conocimientos espaciales de una realidad a otra (simuladores de vuelo, de guerra, teleoperaciones quirúrgicas, manejo de unidades robotizadas en espacios hostiles a la biología humana).

Existen otros procesos cognitivos que elicitan la inmersión, estos tienen que ver con procesos de atención selectiva y concentración Cronin (2000) que permiten al usuario disociarse de distractores externos (Witmer & Singer ,1998).

Es por lo tanto un espacio creado por el hombre y destinado a acoplarse a su forma de mediatizar la realidad, es una herramienta generadora de estados concientes envolventes e inclusivos. Desde la concepción de tecnología como extensionalidad de la humanidad nos encontraríamos frente a la continuidad de la mente, la metaforización del sistema nervioso.

Para promover el sentido de la inmersión se conectan interfases a los órganos perceptuales humanos y por ende su corporalidad y contactos con la realidad se ven comprometidos. La perceptualidad es el primer nivel de complejidad que se debe cubrir para alcanzar niveles de inmersión óptimos. Esto no quiere decir que la perceptualidad este en una suerte de “afuera” cultural, y aquí surge una línea de investigación valida tanto para la psicología como para la realidad virtual: ¿podríamos hablar de una inmersión cultural? El concepto de inmersión da cuenta de los aspectos perceptuales que se ponen en juego en el contacto con la realidad y se intentan recrear en la interacción con la RV.

Estar inmerso en una realidad es solamente el primer paso y una cualidad notoria en el uso del sistema. La interactividad es otra cualidad de la RV, que nos remite a otro estado psíquico, pero que además contribuye fuertemente con la inmersión. La complejidad de la relación entre el usuario y el sistema y entre el usuario y otros usuarios, puso en consideración otro concepto que se transformo en el eje operacional de la realidad virtual: es el sentido de la *presencia*, un concepto que tiene una relación mucho mas estrecha con aspectos subjetivos.

Es interesante destacar la evolución del concepto de presencia como herramienta operativa del campo de la realidad virtual, así encontramos distintos niveles, inclusivos y no excluyentes del término.

Estar presente es definido por (Lombard & Ditton, 1997) como “*the perceptual illusion of nonmediation*” (la ilusión perceptual de no mediación). Desde esta conceptualización, referida al primer nivel de complejidad, el concepto de presencia ha sido reelaborado, como dije antes, ampliando su campo: presencia aparece ligado a ilusión, inmersión, transportación, como así también se acuñaron conceptos compuestos como; co presencia, presencia social y presencia cultural.

Presencia no es un concepto que da cuenta solo de la experiencia subjetiva con la realidad virtual sino que es parte componente del estado conciente. Heeter (1992 pp. 262-71) define presencia como al proceso de ‘*discerning and validating the existence of self in the natural world which humans have engaged in since birth*’ (Discernimiento y validación de la existencia del sí mismo en el mundo natural a la cual los humanos nos anudamos desde el nacimiento). Por lo tanto el sentido de la Presencia es un concepto propio de la Psicología que hace de andamio, en los estudios sobre la realidad virtual. El concepto de presencia fue creciendo junto con las Comunidades Virtuales posibles de ser, por las interfases abiertas, configurando a la RV como un

espacio cultural. Es importante señalar aquí que las interacciones cerradas de los usuarios con el sistema ya configuran un espacio cultural.

Esta bien claro en la Psicología, que este sentido de presencia se elicitaba fundamentalmente en los seres humanos a partir de la intersubjetividad. Con el objetivo de sistematizar lo expuesto hasta ahora, expongo aquí algunos de los conceptos de presencia:

En un trabajo recopilador de (Van der Straaten,2000) encontramos algunos de los más relevantes:

**3.1.1. Presencia como transportación (presence as transportation)**

(Sheridan,1992), (Zeltzer, 1992). Consideran que la presencia tiene que ver con sentirse estar en un espacio u otro desarrollando una secuencia temporal entre uno y otro.

**3.1.2. Presencia personal, presencia ambiental y co presencia (personal presence, environmental presence and copresence).**

Son conceptos acuñados por (Heeter, 1992), el primero se define por sentir la presencia propia, el segundo por percibir la presencia de un ambiente (a través de la interacción) y el tercero se relaciona con percibir la presencia de otros sujetos dentro del ambiente virtual. Si bien se categoriza en estos conceptos no se explicita que es presencia.

**3.1.3. Presencia como una construcción social (Social Presence).**

Mantovani y Riva (1999) plantean una perspectiva cultural donde la construcción de la realidad se genera mediante la negociación y la mediatización : “...*reality is co constructed in the relationship between actors and their environment through the mediation of the artifacts...*” (la realidad es una co- construcción de la relación entre los actores y sus entornos a través de la mediación de los artefactos)

**3.1.4. Presencia Social (Social Presence).**

Biocca, Burgoon, Chad y Stoner (2001) realizaron un trabajo exhaustivo sobre el concepto de presencia social, donde se plantea que presencia es “*estar allí*” mientras que presencia social sería “*estar juntos*”. Biocca define presencia social (social presence) como “*The minimum level of social presence occurs when users feel that a*

*form, behavior, or sensory experience indicates the presence of another intelligence. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another”* (Biocca, 1997). (El nivel mínimo de presencia social ocurre cuando el usuario siente una forma, conducta o experiencia sensorial que indica la presencia de otra inteligencia, intenciones, e impresiones sensoriales del otro)

**3.1.5 Presencia Cultural (Cultural Presence).** Champion, Arch y Phil (2004), definen a la presencia cultural como al sentimiento de estar presente en un ambiente culturalmente similar o distintivo del sistema de creencias del sujeto (“*The feeling of being in the presence of a similar or distinctly different cultural belief system*”). Vemos como el concepto de presencia recorre desde lo perceptual, hasta lo cultural, no habiendo contradicción, sino inclusividad.

#### **4. La Realidad Virtual como un espacio para la intersubjetividad.**

La realidad virtual extiende sus usos desde actividades de entrenamiento, recreación y comunicación hasta arte, psicoterapia y medicina, entre tantos otros. Los dispositivos tecnológicos que permiten las experiencias en la realidad virtual devienen artefactos culturales.

Otras problemáticas de la Psicología ya han sido abordadas y desarrolladas recurriendo a la tecnología computacional como modelo. La Psicología Cognitiva<sup>2</sup> es un ejemplo de esto. El potencial de la RV para la investigación psicológica se relaciona con que incluye en su modo de accionar, la perceptualidad humana por un lado, y por otro posibilita interacciones cerradas y abiertas, transformándose en escenario para la mediación entre sujetos.

Acción, Intención, Interactividad, Comunicación, Mediatización, son aspectos que se ponen en juego en estas experiencias, sumándole como ninguna experiencia sintética puede proveer, de una vivencia de la mediatización, interrogando el sentido de exterioridad, de realismo, desde la experiencia de la primera persona.

El valor educativo desde una perspectiva filosófica y psicológica, de una experimentación de estas características pondría en jaque a muchos organizadores conceptuales del sentido común.

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<sup>2</sup> Me refiero a la Psicología Cognitiva que recurre a la metáfora del ordenador para explicar procesos mentales.

Con estas herramientas se podrían abordar estudios sobre la intersubjetividad, en especial algunas áreas dejadas de lado por la Psicología – por falta de métodos adecuados – como lo es la Conciencia.

Los estudios sobre la conciencia han recobrado interés en la última década, luego de periodos de desatención científica sistemática. El cambio de situación se debe a los avances en neurociencias, psicología, filosofía y por la aparición de las nuevas tecnologías que interrogan los conceptos de realidad, de virtualidad y experiencia.

La noción de conciencia que aquí se esboza, se acerca más a la noción de “proceso emergente” que a una estructura. La cualidad de emergente otorga a los procesos una flexibilidad operativa que pone de manifiesto la relación con el entorno. Sin embargo no podemos pensar que los procesos conscientes emergen de ninguna parte, su localización es el sustrato biológico, al respecto (Searle, 1998) ha dado suficiente cuenta de esta premisa *“Consciousness is entirely caused by neurobiological processes and is realized in brain structures. The essential trait of consciousness that we need to explain is unified qualitative subjectivity. Consciousness thus differs from other biological phenomena in that it has a subjective or first-person ontology, but this subjective ontology does not prevent us from having an epistemically objective science of consciousness”* ( La conciencia es totalmente originada en procesos neurobiológicos y se realiza en las estructuras cerebrales, la esencia peculiar de la conciencia que necesitamos explicar es la cualidad subjetiva global. La conciencia difiere de otros fenómenos biológicos en que posee una subjetividad u ontología personal).

La conciencia puede ser metaforizada como al procesamiento humano que virtualiza la realidad, la mediatiza, construyendo modelos de realidad. Las investigaciones sobre experiencias en los ambientes virtuales tal vez no lleguen mas que a rodear la problemática de la subjetividad, lo que se quiere llegar a saber es como se produce esta virtualización, tal vez solo sea un punto de partida para este objetivo. Sin embargo la Psicología debe considerar incorporar en sus temáticas estas interacciones y dirimir cuales son sus efectos en la constitución de la subjetividad, a tales nuevas problemáticas se deberán construir herramientas metodológicas flexibles que puedan dar cuenta de estos procesos. Esta flexibilidad, que enunciaba mas arriba, nos posiciona frente a una realidad multidimensional y multidireccional, expande la realidad, la pluraliza, haciendonos reflexionar sobre la validez futura del propio concepto de realidad virtual y pone en manifiesta evidencia la relación entre procesos psíquicos complejos y lo que actualmente denominamos realidad.

Resumiendo, la idea que trato de expresar en este artículo es:

- que el ser humano genera la primera instancia de virtualización.
- que la tecnología virtual es la materialización de este aspecto de la humanidad.
- que esta temática debería considerarse en la agenda investigativa de la Psicología.

Generalmente, el concepto de realidad virtual está anudado a los artefactos tecnológicos que la componen. En un primer momento estuvo fuertemente vinculada a la idea de simulación donde la eficacia se lograba en tanto esa simulación se constituía como un símil perfecto de la realidad, ya no una representación sino una hiperrealidad, una entelequia nueva. Desde la noción de simulación se intentó crear una realidad virtual intercambiable plenamente con la realidad virtualizada por los procesos conscientes, esto se puede correlacionar de alguna manera, con la idea que se tuvo en la psicología sobre cómo percibimos los seres humanos, donde lo representacional estaba al servicio de la reproducción de la realidad, de la lectura de una realidad exterior. En el marco culturalista, la percepción por un lado y la tecnología virtual por el otro se liberan de la noción de “copia”, para ir más allá. Los mundos que se crean con la realidad virtual son el reflejo, la proyección de mundos mentales, transformados en artefactos culturales, que oficián de escenarios para el intercambio y la comunicación entre sujetos.

La realidad virtual se nos presenta como la más humana de todas las construcciones, es un intento de instrumentalizar a la conciencia. Ideaciones que son generadas desde artefactos tecnológicos, dotados de intencionalidad. La RV le propone a la virtualidad humana un espejo donde recrearse, es redundancia, caleidoscopia.

Atrae a investigadores de todas las áreas, pone en evidencia la relación que se establece entre ilusión y conocimiento, entre pensamiento y creatividad.

La RV valida al fenómeno *phi*, y lo hace montada en el poderoso aparato tecnológico y científico de la cultura, y más aun de la experiencia .

Más solo será un “agujero negro” de la cultura cuando los sujetos que se encuentren inmersos en ella, instalen la comunidad, el devenir intersubjetivo, y más aún, cuando no solo sea un espacio construido (pre hecho) para la intersubjetividad, sino que la intersubjetividad protagonice su construcción, en ese momento podrá adquirir una dimensión política distinta, democrática.

Por el momento se restringe a la producción del equipo interdisciplinario que la crea, donde el sujeto habita un espacio construido es decir que este espacio aparece determinado, como también lo es el espacio social. La posibilidad de manipular

ambientes virtuales, no es una desventaja, permite moldear intencionalidades diversas y generar artefactos educativos, de entretenimiento, de comunicación y de investigación, siempre y cuando su accionar se enmarque en una ética científica y democrática.

Hay que destacar que la RV crea un afuera imaginario, actúa la ilusión realista, y lo hace eficazmente, ofreciéndole al proceso de mediación un escenario para realizarse.

Desarrollar dispositivos virtuales e investigar en esta área es de lo más cotoso y se ubica en la franja de investigadores con acceso a los presupuestos más abultados, generalmente de doble financiamiento por un lado las Universidades, sus investigadores y el prestigio institucional y por el otro las empresas que diseñan y producen las interfases y los sistemas, que aportan las millonarias sumas que demandan las concreciones de estos proyectos. Nacida en el seno de la dinastía tecnológica, pone la luz sobre temas filosóficos y psicológicos. El concepto de presencia es un ejemplo tal, aparece como una necesidad conceptual y operativa, al servicio de las investigaciones y de los avances de la interfase. A la vez que el concepto de presencia intenta dar cuenta de como el hombre capta la realidad.

En los inicios se la asocio con los artefactos tecnológicos que generan estas cualidades en el sujeto por medio de conexiones inmersivas a los órganos perceptuales humanos, al sistema nervioso. Superando, pero no descartando esta operatoria se avanzó hacia las condiciones subjetivas sociales y culturales componentes del cotidiano del hombre. De esta manera la RV se supera a sí misma es más que perceptualidad: es escenario de la cultura, es idea, es espacio, que no admite un adentro ni un afuera, que no presenta bordes ni divisiones. Nos muestra que mente y cultura son las caras de una misma moneda.

Las investigaciones en RV interrogan a la Psicología sobre sus grandes temas, como por ejemplo, los procesos concientes (Biocca, 1996), plantea a la presencia como a "la ingeniería de la conciencia" "In attempting to engineer presence, the VR community is realizing that it must better understand consciousness, because the engineering of presence is the engineering of consciousness (En el intento de instrumentalizar presencia, la comunidad científica de la realidad virtual se da cuenta que será mejor entender a la conciencia porque la instrumentalización de la presencia es la ingeniería de la conciencia).

Desde William James hasta los tiempos actuales la Psicología desatendió una de sus Problemáticas Cruciales, el apartamiento de la Conciencia no se debió a que este recorte problemático no revista el rango y status principal dentro de la Agenda

Psicológica, sino más bien por las imposibilidades metodológicas que la Ciencia tiene para abordarla, la historia de la Psicología, se construye en torno a esta falencia metodológica.

Para finalizar este trabajo, convoco a un contundente comentario de (Luria, 1997), quien describe a la Psicología como a la "Física" de la RV "Psychology is the physics of VR in the sense that the virtual environment is manufactured towards creating a cognitive state" (La Psicología es la "física" de la realidad Virtual en el sentido que el ambiente virtual es producido para crear un estado cognitivo).

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