Structural User Preferences of Interfaces and Time Orientation

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Abstract. Today the user orientation within the development process of user interfaces in production environment is concentrated on tasks. This is realized by focusing on user groups. To enhance the usability of user interfaces, the development process is expanded by the personalization of user interfaces. Thus user preferences and their attributes e.g. individual differences concerning the structure of interfaces have to be examined for being able to develop appropriate interfaces for specific users. Different test methods to gain these preferences and attributes are described within this paper. The found structural preferences can be connected to the concept of time orientation: it classifies people in two different categories: polychrons and monochrons. The test results confirm that these characteristic are rather individual differences than intercultural variables.

Keywords: Cross-cultural, Usability Engineering, Time orientation, User interface development.

1 Introduction

The personalisation of user interfaces has entered many fields - particularly the consumer product industry. The advantages of personalisation concepts become clear when using such systems: offered information is adjusted to the needs or previous use habits of users. In contrast to the consumer product industry, the personalisation of user interfaces and the orientation on users' needs are still rare in the production environment. Developers have a certain understanding of user needs and interests related to user interfaces. This understanding – no matter, how far or whether at all it is applicable – is realised in the development of user interfaces. The actual needs of users remain unconsidered [17]. One approach overcoming this lack are user groups. Studies in the field of user-group-specific prototypes showed that distinctive advantages result from these user interfaces; higher efficiency and a faster learnability could be obtained by specific structuring and design of prototypes for diverse user groups for example [15]. Personalisation which goes beyond role aspects in the vocational surrounding field and includes the design of user-specific interfaces was

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examined in a study for colour design [10]. Extroverted and introverted users performed different tasks with user interfaces, especially designed for their needs in comparison to a neutral interface. The use of specially implemented user interface could not be proved significantly favourable. However users showed clear reactions to different designs: Those – mainly extroverted people – who preferred the extroverted interface considered the introverted one as boring and vice versa.

For developing user interfaces, the structure of task and functions is the basis for the further user interfaces design process and consequently for the usability of the user interface itself. Therefore it is important to know the structural preferences of those users working with the interface. The structural preferences of users can be connected to different time orientation concepts of users, as Zhang and Goonetilleke [16] found that user having different concepts of time orientation, referred to as monochrons and polychrons, solving tasks, e.g. by working with user interfaces, differently. Monochrons can just do one thing at a time, whereas polychrons do many things at once. Thus Zhang and Goonetilleke [16] concluded the concept of time orientation could be an individual difference within a culture, rather than an intercultural difference.

In this paper user characteristic and structuring preferences within the production environment will be tested. On basis of the test results it will be attempted to corroborate that the concept of time orientation are individual variables rather than intercultural variables.

2 User Interface Development

Most user interfaces in the production environment are the results of a systematic development process, consisting of the phases analysis, structuring, design and realisation. An evaluation accompanies all these phases (see Fig. 1).

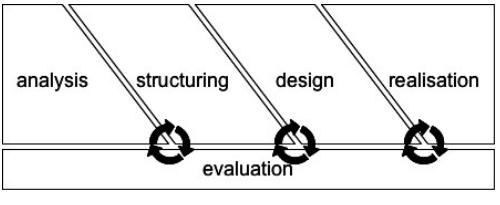

Fig. 1. Useware Engineering Process [2]

Within the analysis user tasks and their needs, as a result of these tasks, are worked out. The analysis phase is divided into the phases preparation, questioning and evaluation. During the preparation users who are to be questioned are selected. Furthermore questioning methods and materials are specified and completed. Then users are asked in order to reveal their tasks and needs, which have not been considered so far and as well as how the system is used. Finally the collected data of all users is aggregated and combined to a task model. Within the structuring phase the task model of the analysis is extended by functionalities of the system for which the

user interface is developed. From these data a platform-independent use model [12] is created, which results in elementary use objects that describe inseparable and elementary user tasks. Through the selection of a hardware platform the usage structure for the future user interface derives from the former use model. In the design phase navigation and interaction concepts are specified on the basis of the usage structure. Furthermore the fundamental layout of the user interface is developed. The evaluation phase takes place accompanying all previously mentioned phases. On this respective results and/or partial results of the phases are evaluated in each case with the users. The aim is the integration of the evaluation outcomes into the specific phase of the user interface development process.

Apart form the evaluation phase direct user integration takes place in the analysis [14]. A user friendly system cannot be archived by the mere involvement of the user at the end of the development process. Quality and user orientation cannot derive from a usability test at the end of the process, but a continuous check must take place comparable to quality management concepts [13].

3 Personalisation of User Interfaces

Today, the personalisation of user interfaces within the production environment is mostly limited to user groups. User groups can be distinguished by different tasks what means that users of one group share the same tasks. Particularly in this environment, personalised user interfaces that consider specific individual characteristics and possible needs are not common. Even the adjustment to user groups is usually limited to the definition of the rights of access for certain areas of user interfaces or to the choice of different functions on a direct access within the user interface.

This kind of personalisation is technically accomplishable for today's operations, because only limited access to information and interactions is available for users. Due to ever changing technology, the development of individual user interfaces for every usage situation would not be efficient. However, a further personalisation of user interface design in production environment shall be permitted in order to cope with the variety of information and interaction. Accounting for requirements of a future, in which the complexibility and amount of information will steadily rise, user interfaces have to be personalised in order to present interaction and information possibilities user-adequately. Personalisation concepts differ by their technical implementation. The concepts can be divided into variable and fixed systems. Variable systems adapt to user’s inputs. They can be divided into adaptive systems on the one hand and adaptable systems on the other hand [11]. The former are systems which adapt dynamically to user inputs. The latter are systems adapted by the user [8] by specifying his preferences before actually using the interface. Fixed systems do not respond to different user inputs. Different aspects of personalisation are considered during their development. At the end of the development process, different personalised interfaces result for different users.

In the production environment users have to habituate to one user interface and feel comfortable with it in order to be able to react fast and intuitively when using the

interface. Therefore personalised user interfaces cannot change their structure and design with every login. Fixed personalised user interfaces with regard to the user attributes are the most promising concept. To consider and specify these attributes in personalized user interfaces, user test have to be performed in order to reveal required factors.

4 The Time Orientation Concept

The concept of time orientation by Hall [4; 5; 6] divides people in two extremes: monochrons and polychrons. Monochrons do one thing at a time and polychrons do many things at once. Originally Hall developed the time orientation concept to describe different cultures and their behavior concerning time. He also adds other attributes to this concept [7]: For example monochrons are low-context, need information and committed to the job. Polychrons are high-context, already have information and are committed to people and human relationships (see Table 1).

Table 1. Characteristic of monochronic and polychronic people [7]

Monochronistic	Polychronistic
Do one thing at a time	Do many things at once
Concentrated on the job	Are highly distractible and subject to interruptions
View time commitments as critical	View time commitments as objectives
Are low-context and need information	Are high-context and already have information
Are committed to the job	Are committed to people and human relationships
Adhere strictly to the job	Change plans often and easily
Emphasize promptness	Base promptness on the importance of and significance of the relationships
Are accustomed to short-term relationships	Have a strong tendency to build lifetime relationships

Through this concept it is possible to order user who differ by geographic parts to one of the two extremes: For example northern Europeans are said to be monochronic and Latin America polychronic. But it is important to note that these cultures have not to be exclusively one concept of time orientation: The Japanese, for example, are polychrons in dealing with other people and monochrons by working for official business [9]. Other research in this field showed that polychrons are able to perform multiple tasks better than monochrons [3]. Zhang and Goonetilleke [16] performed tests once to find out the ability of monochrons and polychrons to control of two parallel processes and second to evaluate further attributes concerning monchrons and polychrons. The first test showed a better performance of the polychrons, as was expected because of the former research in this field.

5 Test Methods

5.1 Psychological Scales

Apart from demographic data, the usage of and the knowledge about technical equipment and devices was prompted. Furthermore, a questionnaire was included in order to examine the belief of control of users within the handling of technical devices [2]. Additionally parts of an intelligence test were integrated to appraise the technical ability and linguistic skills. Finally questions aiming at different traits of character such as an extroverted or introverted personality were used, as it was verified in a study by Karsvall [10] that those aspects have a significant influence on the design of user interfaces. These variables were collected within pre-tests. Therefore they perform as independent variables for the further test to collect the structuring preferences.

5.2 System Tests

To reveal preferences regarding the structure of user interfaces, the user had to perform different tasks with different kind of information systems belonging to a specific machine. While the content of the systems remained the same, the structure differed. Four different systems were tested: two hierarchical systems in one case embellished within a side map, in another case within a tree map; a network structure embellished with hyper links and as a reference system the original system which contained a tree map and hyper links. All systems were equipped with a search function.

5.3 Interviews

Afterwards users were interviewed about their impressions of the systems during the test. Thereby users were asked about their previous knowledge of the content as well as of the machine type belonging to the information system. Furthermore they were asked to estimate their own performance regarding errors and time to solve the tasks. Finally users were to state the preferred system without consideration of their performance and why. They were asked to rate all tested systems in a hierarchical order, beginning with the most preferred one and ending with the system they disliked most.

6 Results

In this study 38 German users (30 male, 8 female; with an average age of 28 years, varying between 18 and 56 years) from the production automation field were tested in three different groups: students, engineers and technicians.

The statistical evaluation of the system tests and the questionnaires about user attributes showed that there was a significant correlation between the hierarchical order of the preferred systems of users and their technical ability. Users who preferred working with the hierarchical system in tree-map-style, showed a higher technical ability than users which preferred working with the network system. Another significant result regarding tested users was the clear preference of only one of the

five different systems: users judging a hierarchical system as the preferred one disliked the network-structure and vice versa. In general this meant that the hierarchical systems were located at one end and the network structured system at the other end of the ranking scale. But the most surprising results were that preferences for network structured system correlated significantly positive with the performance on the verbal skills – one part within the intelligence test. And it could also be shown that the preference for hierarchical systems correlated positively with the performance of a part of the intelligence test which tested the ability of users to recognize the essential. These two last results confirm the finding of Zhang and Goonetilleke [16] that structural preferences really are individual attributes and not cultural dependent.

7 Conclusion

Tests results have shown that there are different structural preferences within the tested persons. This shows as well as Zhang and Goonetilleke [16] (see Fig. 2) have found that the concept of time orientation and the characteristic of persons as monochron and polychron are individual culture-independent variables.

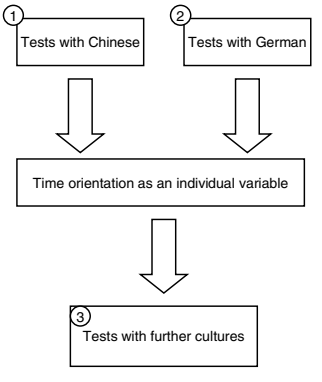

Fig. 2. Previous test to proof the time orientation concept as an individual variable

Next steps will be further tests (see Fig. 2) on the relation between structural preferences, time orientation and individual differences performed within other cultures in order to verify the structural preferences and the concept of time orientation as individual differences within a culture rather than intercultural differences. Therefore first of all tests with other European cultures are intended.

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