Approximating user values to preserve privacy – a proposal

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Abstract. Users have different sets of personal values, such as benevolence, self-direction, and tradition. Among other factors, these personal values influence users' emotions, preferences, motivations, and ways of performing tasks - and hence, information needs. We sketch a method where, during software development, multiple value-dependent interface variants with different functions are created. When used the first time, personal values of the individual user are identified, and the software presents itself in the variant that best matches these values. In this paper we focus on identifying values when using software the first time. Currently used methods to identify values are work intensive and/or solicit personal user information. A method intended for routine use when a user starts using the interface, should require little effort and not intrude privacy. Instead of probing for user values directly, we propose to approximate users' personal values based on the users' preferences for work tasks and to neglect other factors influencing preferences. Questionnaires allow efficient data collection, and users have few issues sharing opinions about work. Inasmuch as this indirect querying of user values approximates underlying values, appropriate interfaces can be identified when using the software.

Keywords: personal values, elicitation, approximation, privacy, software tailoring, individualized interface

1 Introduction

Interfaces which are developed with values in mind are better suited for the user's needs, e.g. [1-4]. In general, values describe properties of the context and properties of the user. Among contextual values are ethical values, business values, quality properties of the system to be built, values of the system developers, as well as values of teams of users. Amid a user's values are his or her goals, motivation, emotions, preferences, and personal values or beliefs.

Personal values or beliefs are the concepts which guide individuals during their life and stay constant over time[5] e.g. the concepts of *benevolence*, *self-direction*, and *power*[6]. They are explained in further detail in Section 2.

Users' information needs are impacted by their specific personal values, so tailored interfaces might better support individual ways of working. Personal values influence users' goals, decisions, motivation, and preferences. Specific values therefore influence the tasks individual users see as essential to reach goals, and which information the individual user considers essential to perform these task. Tailored interfaces could show only relevant data and avoid cluttered displays which try to satisfy all information needs.

Consider the following examples of functions dependent on personal values: Imagine a physician whose personal values are predominantly *benevolent* compared to another physician who is rather guided by *power*. Both physicians would need to perform a similar set of basic tasks – however, the information they need, the way it is provided and the functions they can perform would differ according to their specific personal value. The *benevolent* physician may aim to detect a patient's problem before it becomes a threat and may want to plan the least harmful therapy personally. Possibly preferred functions for benevolence include information about the burden of treatment options on the patient and his/her quality of life, and leaving comments to coworkers to ensure continuity of treatment and prevent possible harm. The physician for whom *power* is essential might in the same situation instead want to delegate the task of treatment to co-workers and/or order procedures the patient needs to follow. Possibly preferred functions for power include adding tasks to others to-do lists and seeing their workloads.

However, it is not easy to measure personal values. Approved questionnaires are work intensive and use items that users feel concerned to answer in a work context because they are related to their private lives (Section 2). Software tailoring based on approximated personal values comes with the benefits of individualized information without the privacy concerns of directly measured values. Therefore, we propose a method to approximate personal values without users' privacy concerns.

Requirements for a method to approximate values are that it should have a low workload and a low impact on users' privacy. After determining user interface (UI) variants during development, every user would perform the method once when starting to use the software. Therefore, it should be efficient with many users by requiring low workload on UI practitioners who tailor interfaces to individual users' needs. Furthermore, a method should take into account the user's privacy related concerns. If methods don't respect privacy needs, users might plainly refuse to participate. The approximation of personal values should rely on information people are willing to talk about instead of very personal ("secret") information.

We propose to approximate values through attitudes towards work for situations where it is not feasible to directly measure personal values. Furthermore, we suggest that multiple value dependent interface variants are developed and each user, when using the software, sees the variant appropriate for his or her specific personal values.

Our research focuses on constructing a method to approximate the individual personal values of many users. In the following, we first describe what we mean by the user's personal values, and review currently used approaches to elicit user values. In the Section 3 we explain our proposal of a method to approximate user's personal values - exemplified with a case study. In the last section, we discuss possible implications and limitations of the method.

2 Background

Personal values describe an individual's basic concepts and beliefs which guide the individual through life. We center our research on the validated personal values theory of Shalom Schwartz [6]. Schwartz' value theory provides us with verified questionnaires for value measurement and specific descriptions of each value concept [5]. We expect that using this theory will make our research reproducible.

Schwartz is one of the leading researchers in psychological analysis of personal values and found that the values of individuals stay constant over time and are present in individuals of different races, nationalities, and social or cultural background.

Schwartz' personal values theory was verified through broad empirical research in many countries and individuals with a wide range of different demographics. His value system is commonly used and differentiates between ten personal values.

Table 1 lists the ten personal values which were determined by Schwartz and short descriptions for each. The Schwartz value system is based on two dimensions: 1) focus on the self or not (self-enhancement vs. self-transcendence) and 2) seeking stability or change (openness to change vs. conservation). The category self-enhancement (focus on self) includes the values *achievement*, *power* and *hedonism*, contrasted by the category self-transcendence (not-self) with the values *universalism* and *benevolence*. The category conservation (stability) has the values *security*, *tradition*, and *conformity*, contrasted by the category (openness to change) with *stimulation*, *self-direction*, and *hedonism* (which belongs to two categories).

Table 2 shows an overview of methods which are currently used or proposed to elicit user values and properties. We included requirements elicitation methods that identify properties of users outside of the very strict definitions of the Schwartz value method because we are interested in properties related to IT.

Table 1. Personal values determined by Schwartz [5, 6] and short descriptions for each.

Value	Description
Achievement	Personal success through demonstrating competence according to social standards
Benevolence	Preservation and enhancement of the welfare of people with whom one is in frequent personal contact.
Conformity	Restriction of actions, inclinations and impulses likely to accept or harm

	others and violate social norms or standards.
Hedonism	Pleasure and sensuous gratification to oneself.
Power	Social status and prestige, control and dominance over people and resources.
Security	Safety, harmony and stability of society, of relationship, and of self.
Self-direction	Independent thought and action-choosing, creating, exploring.
Stimulation	Excitement, novelty and challenge in life.
Tradition	Respect, commitment and acceptance of the customs and ideas that traditional culture or religion provide the self.
Universalism	Understanding, appreciation, tolerance and protection for the welfare of all people and for nature.

Table 2. Examples of currently used methods to approximate user values and needs, their estimated impact on privacy, and estimated workload on UI practitioners who tailor the interface to individual user, in case values for many users have to be determined.

Method	**Impact on users' privacy**	**UI practitioners workload with many users**	**Proposed or used e.g. by**
Ethnographic observation	Medium	High	[1, 4, 7, 8]
User review of scenarios and storyboards	Low	High	[1]
User evaluation of prototypes	Low	High	[1]
Discussing users' needs in the design team	Low	High	[4]
Personal informatics	Medium	High	[2]
Interviews	Medium	High	[1, 9]
Questionnaires	High	Low	[5, 10]

Dealing with privacy concerns is important to make eliciting of personal values feasible. Our rating about the impact of methods on privacy in Table 2 is based on how much personal information the user needs to reveal and how. During ethnographic observation, participants are followed by an observer who notes e.g. actions and goals. Some participants might feel they are assessed, which could result in a feeling of uneasiness concerning privacy. During user review of scenarios and storyboards, as well as when reviewing prototypes, participants' comments and feedback can be used to reveal to what extent the system reflects their values or motivation. If used correctly, these review methods should have a low impact on participants' privacy: users only share opinions. If the design team needs to discuss many users' needs this results in a high workload. When using personal informatics systems [2], participants collect personally relevant information, for the purpose of self-reflection and gaining self-knowledge about their personal values without directly talking to the developers. Interviews are time intensive and dependent on the questions require users to directly reveal private information. Users found filling

questionnaire about personal values was difficult [10] – but researchers workload is low due to automated evaluation.

Our assumptions about workload on the UI practitioner in Table 2 distinguish between direct and indirect methods. Methods where direct, time intensive one-to-one contact between UI developer and user is required were assumed to have a high workload when used with many users. Questionnaires, which can be completed without UI practitioner-user contact and which can be evaluated automatically, were assumed to have a low workload.

In conclusion, a method which requires a low workload and has a low impact on user's privacy when approximating personal values of many users is currently missing. In the following, we describe our approach to approximate personal values through a low impact – low effort questionnaire presentation.

3 Method proposal

Our method to approximate users' personal values targets concepts which are influenced by the user's personal values and can be easily obtained from the user. In the following, we describe the method to approximate values based on preferences for work tasks and exemplify it with a case study.

3.1. Description of our proposed method

Values influence behavior indirectly through attitudes. While individuals are seldom aware of their values, they are aware of their attitudes and use them as rationales for decisions [11, 12]. As such, attitudes are one of the values-related concepts which can influence users' preferences and expectations about software. An attitude can be expressed as a single statement of the type "I like X" (a positive attitude) or "I don't like Y" (a negative attitude). Attitudes are formed, among other factors, based on values. For example, if the value *tradition* is very strong in a particular individual, there is a high probability that this individual has a positive attitude towards things considered traditional.

Users are rather more willing to share their attitude towards work tasks than their personal values. Although the preference for sharing personal information varies from user to user, the willingness or reluctance to reveal personal information depends on the type of information to be shared. During preliminary interviews we found users to be very reluctant to reveal personal information such as personal values. However, they were openly talking about what they liked and what they didn't like about their work and their attitude towards individual tasks.

Approximating personal values through attitudes towards work tasks might be feasible without strong privacy concerns but not as accurate as directly measuring values. Figure 1 exemplifies this relationship in a simplified conceptual model. It shows how we plan to approximate personal values based on preferences towards work tasks. Although attitudes towards work tasks are influenced by other factors,

such as the nature of tasks or devices a task is performed with, we believe that attitudes allow value approximation.

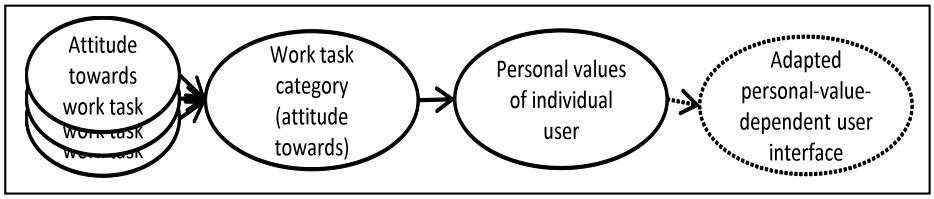

Figure 1 If during development several personal value specific interface variants were developed, then we could display the appropriate variant to each user – dependent on his/her personal values. Our method proposes to approximate users' personal values based on individual attitudes towards (work) tasks for situations where privacy concerns prevent direct value measurement.

Questionnaires suggest themselves as a method for data collection. They can be employed without personal contact between the users or software engineers and can be automatically evaluated, and are less intrusive or intimidating to users compared to revealing personal information in a one-to-one conversation.

We propose to use lists of work tasks, to ask users about their attitudes towards these tasks and to infer their personal values based on value-dependent properties of these tasks. Such task lists can be based on canonical work descriptions. For further streamlining, these tasks can be grouped in work task categories, and questionnaires can be shortened by only asking for tasks that each represent a task category. The correlation between personal values and task preferences would be determined prior to the study based on a reference model with task categories and associated values (e.g. Table 3) which we are currently developing. In the following we explain how we used our method in a case study.

3.2 Pilot study: Approximating personal values of nurses and physicians

A pilot study was conducted with a total of seven participants working at two university hospitals in Germany - three physicians and four nurses. The pilot study covered multiple aspects of our research in several parts. In this paper we report the two parts related to value approximation.

Our research question was: does our proposed method allow to select tasks or task categories appropriate for routine use? By routine use we mean that they approximate user values with enough precision to inform provision of user individualized interfaces?

The first part for personal value approximation was a list of users' work tasks which were typical for their respective professions. Our task selection included different kinds of tasks such as delegation tasks, decision support tasks, and patient centered tasks (see Table 3 for examples), and was based on medical literature and preliminary observations. Physicians received a questionnaire of 43 physician tasks,

and nurses got 45 nursing tasks. For each task, participants indicated their attitude on a Likert scale ranging from 1 (strongly dislike task) to 9 (favorite task).

Table 3. Attitudes towards work task categories and associated values as examples. The table shows task categories which correlated with individual users' personal values. For each task category example tasks are given, followed by the correlated values with positive or negative correlation. For example, we found that communication tasks were liked by 2 users with the value self-direction, and 1 user with the value stimulation and 1 with hedonism.

Task category	Example tasks	Personal value (attitude towards task category)
Communication with co-workers	Ask for second opinion, ask for advice	*self-direction* (likes, 2), *stimulation* (likes), *hedonism* (likes)
Documentation	Document patient data, write a discharge letter	*self-direction* (dislikes, 2), *benevolence* (dislikes, 2)
Manual tasks	Patient examination, drug administration	*hedonism*(likes), *benevolence* (likes)

The second part of the questionnaire consisted of the Schwartz Value Survey[6], a standardized instrument for identifying personal values. The survey asked participants to assess the importance of 56 items in their life and values. Items include human properties such as successful, polite, daring, and healthy. Participants rated each item on Likert scales ranging from "This item is opposed to my personal values" … "very important to my personal values".

Response rates were 100% (physicians) and from the initially invited six nurses, only four replied (67%). We identified task categories in which individual users liked or disliked most tasks. Table 3 shows examples of the findings in our pilot study. Our participants predominantly exhibited the values *self-direction*, *benevolence*, *hedonism*, and *stimulation*. We found that a positive attitude towards communication tasks correlated with *self-direction*, *stimulation*, and *hedonism*. Documentation tasks showed a negative correlation towards *self-direction* and *benevolence*, and liking manual tasks correlated with *hedonism* and *benevolence*.

4 Discussion and Conclusion

We propose to use the attitudes towards work tasks to approximate personal values. We have applied and evaluated our method in a small scale case study, and found a correlation between attitudes towards some task categories and personal values.

Our proposed method is a compromise between workload, accuracy, and the protection of privacy: during pilot interviews, users only took 10 minutes to complete questions about attitudes towards tasks, did not have to reveal very private information, but accuracy might be limited. Therefore, our method might be more feasible in everyday situations than directly measuring values.

Limitations of the case study include the sample size being too small in order to identify significant correlations between values and tasks categories. It also was too

small to allow conclusions whether the four values found in our subjects are prevailing in healthcare professionals or just a selection artifact. The validity of the questionnaires was not verified; therefore, our preliminary results might lack reliability.

Our ongoing work focuses on the correlation between values, attitudes towards tasks and software requirements [13]. We aim to create a reference model for the development of personalized value specific software requirements which shows value-task group relationships and value specific software requirements. Developers should be able to use the reference model to identify which type of information would be particularly useful for users with specific personal values. Finally, we plan to investigate the relationship between personal values and specific interface features.

Future work will aim to evaluate our proposed method and its accuracy to approximate personal values based on attitudes on a large sample of users. Furthermore, studies could explore the relationship between personal values and other soft issues. If successful, our method will make the detection of personal values easier and contribute a step towards value specific personalized interfaces.

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