Use of Personal Values in Requirements Engineering – A Research Preview

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Abstract. [Context and motivation] During requirements engineering the stakeholder view is typically captured by scenario- and goal models focusing on tasks and goals to be achieved with the software. We believe that it is worthwhile to study more general personal values and attitudes of stakeholders and to relate them to software requirements. [Question/problem] The main questions of such an approach are: what values can be expected from stakeholders, how can they be elicited and what can be learned from them for requirements. [Principal ideas/results] The purpose of our research is to provide a value elicitation technique to be combined with existing requirements elicitation techniques in order to infer additional ideas for and constraints on software requirements. [Contribution] In this paper we give a preview on our approach to developing such an elicitation technique. We start with an introduction to the theory of personal values. Then we describe our envisioned approach how values can be used in the requirements engineering process.

Keywords: requirements elicitation, values

1   Introduction

It is widely known from practice that the requirements engineering (RE) process is heavily influenced by soft issues such as politics or personal values of stakeholders, but there is very little guidance on how to deal with these issues [1] [2]. Goals models such as i* [3] include goals, softgoals and actor dependencies, but give only little guidance on how to elicit these intentional elements, and don't call for a deeper analysis of these elements. Therefore they often capture only quite apparent economic or operational goals. Scenario-oriented approaches typically incorporate guidelines from human-computer interaction to focus on user tasks or use cases and to include early prototyping [4], but they do not capture information about user motivation.

We believe it is important to reveal the fundamental issues behind goals and task performance and to incorporate them into current RE approaches. Therefore, we propose to study personal values and their relationship to software requirements. We chose personal values because they are an important motivation factor, which remains stable independent of context [5]. We expect that the effect of personal values on

requirements will be especially pronounced in the health care domain where effective patient treatment is the focus of the work of physicians and nurses.

We have recently launched an interdisciplinary research project with experts from software engineering and medical informatics whose goal is to examine how personal values influence software requirements in health care. Our long-term goal is to construct a practical approach for requirements elicitation that incorporates our insights into personal values. This paper presents the direction of our research. It is structured as follows: in section 2, we describe the psychological theory we base our ideas on. We explain briefly what values and attitudes are, how they affect human behavior, and what methods are commonly used for their elicitation. In section 3, we provide an overview of the approach we intend to develop in our project. Section 4 outlines other related work. We conclude with an outlook.

2   Personal Values

Motivation has always been an important research topic in psychology: what makes an individual behave in a certain way? The widely accepted human value theory introduces the concept of *personal values* as a major behaviour determinant for the individual. Most contemporary publications on value theory build on the work of social psychologist Shalom Schwartz [6], who validated his theory using extensive empirical studies. Note that there are behaviour influences other than personal values, such as economic values or emotions. In our research we focus on personal values, subsequently called "values".

Schwartz defines values as "desirable, trans-situational goals, varying in importance, that serve as guiding principles in people's lives."[7]. The connotation of "goal" in this definition is slightly different than the one typically used in RE literature: personal values like social recognition and free choice are seldom modelled among stakeholders' goals. While goal-oriented RE concentrates on stakeholder goals limited to a single purpose, values function on a much higher level. They are deeply ingrained in culture and the individuals acquire them during the socialization process. Individuals generally behave in a way which helps them achieve these values. Exceptions from this rule arise in situations where other behavioural determinants are predominant, such as biological needs or ideological prescriptions. In early studies, Schwartz discovered ten common values exhibited to a different extent by all participants. Table 1 lists these values and short explanations for each. Since then, extensive research has shown that these ten values occur independently of race, nationality, social and cultural background. This is an important conclusion of value theory: different populations don't strive for fundamentally different values, but there is a set of values common to all of us.

Despite sharing the same values, different individuals act differently in similar situations. The reason is that they place different importance on each value. In a situation where there is a conflict between values (e.g. donating money to a charity aids benevolence and universalism, but spending the same money on one's hobby helps achieve hedonism), an individual would choose the option consistent with the values he or she deems more important. So while everyone believes in the desirability of the same values, each individual has a personal ranking of the values.

Table 1. The ten values found by Schwartz (based on [7])

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.

Values are important in RE because of the way they shape the individual's interactions with software. They are a criterion for the evaluation: the desirability of a behaviour option increases monotonically with the degree in which performing it helps the individual achieve the (high-ranked) values. The evaluation process may be deliberate or subconscious. But regardless of the awareness of the actual process, the individual is usually aware of its outcome. He or she can articulate it as a statement of the kind "I like X" or "I don't like Y". Such judgments of behaviour options (and also judgments of any other entities) are known in psychology as *attitudes*.

An attitude is defined as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" [8]. Unlike the universally applicable values, an attitude always is about some target entity. It always implies an evaluation, which may use one or more dimensions (like/dislike, good/bad), but invariably results in an aggregated assessment, positive or negative.

Attitudes are formed through a judgment process. Since values are important criteria for our judgment, attitudes are at least partly based on values. Thus, when information on values isn't available, information on attitudes can be used as an indicator for the ranking of values [9]. This has important implications for empirical research. As attitudes are much more salient than values, their self-reporting proves easier than self-reporting on values. Thus, researchers interested in values can apply instruments based on attitudes, which are more reliable, and then use the results to draw conclusions about the subjects' values (see e.g. [10]). But the correlation can also be used in the opposite direction: once the connection between value rankings and attitudes toward specific targets is supported by empirical evidence, knowledge of an individual's value ranking can be used (given some conditions described in [11]) to predict his or her attitude toward these targets.

3   Relating Personal Values And Requirements

Research on organizational psychology has shown that the way a person works strongly depends on his or her general motivation factors [12]. Therefore, important motivation factors such as values are likely to have impact on the user satisfaction with a specific software product. Our goal is a value elicitation approach which can be used parallel to existing requirements elicitation methods to discover useful information which usually isn't explicitly stated. As depicted in Figure 1, our approach will provide a method to elicit values, a method to infer attitudes towards tasks from values, and a method to elicit requirements details from these attitudes.
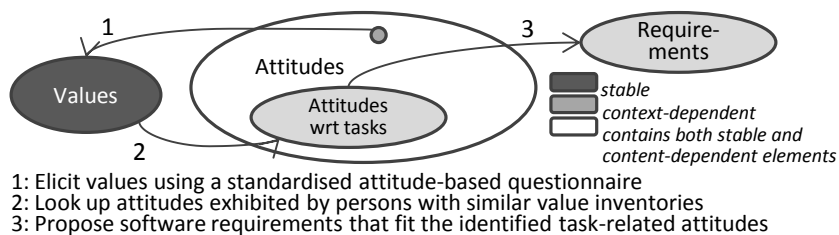

1: Elicit values using a standardised attitude-based questionnaire
2: Look up attitudes exhibited by persons with similar value inventories
3: Propose software requirements that fit the identified task-related attitudes

Figure 1 Our proposed value-based elicitation approach

The first step of our approach is the elicitation of values. Existing instruments for value elicitation might appear too intrusive in requirements engineering practice, because in this situation users might be reluctant to answer direct questions about their personality. As stated in section 2, some attitudes strongly correlate with values. We plan to develop as part of the first method a new attitude-based questionnaire which gives us information about a user's values. We want to explore how acceptance of the original Schwartz questionnaire compares to our instrument.

When the values are known, the requirements analyst can use our second method to predict the user's attitudes towards different tasks. The seemingly superfluous round-trip from attitudes to values and from that to other attitudes is caused by the fact that directly questioning a user about his or her attitudes towards the hundreds of software supported tasks involves too much effort. Moreover, the attitudes towards tasks are situation dependent and likely to change as soon as the context changes. On the other hand, values are an integral part of the user's personality and unlikely to change [13]. They allow us to predict how the user's attitudes will change after a context change.

We plan to identify for our second method correlations between values and attitudes towards tasks at least for the medical domain. But even when a catalogue of empirically founded statements about value-attitude correlations isn't available, a requirements analyst with basic knowledge of value theory can use the information on the values to reason about expected attitudes. For example, if the value elicitation shows that the user is primarily motivated by the value stimulation, which is mediated through novelty, then it is reasonable to assume that whenever faced with a task like "record patient temperature", the user would prefer to input the data using a trendy electronic device instead of scribbling on paper.

In the third step, the analyst uses the information about attitudes and our third method to enrich the existing requirements. Our approach does not include the identification

of tasks and goals; they have to be elicited using classical methods. But knowing the users' attitude towards the tasks allows deeper insight into the requirements. It can be especially useful for uncovering new requirements which weren't verbalised by the user: if a physician has a negative attitude towards tasks involving typing, possibly associated with a value of achievement or power, we can expect him or her to take notes on patient symptoms on paper and delegate the data input to a nurse. This means that he or she needs a system which gives nurses writing access to patient records. Of course, such an inferred requirement cannot be simply included in the specification without discussing it with the relevant stakeholders. But the merit of the value-based approach in this example is that it has revealed the existence of an issue which could be easily overlooked in a traditional process oriented task description.

4 Related Work

By wording, value-based software engineering seems related to our research [14]. However, so far it typically focuses on economic value, not on personal value. Only recently have personal values been addressed in RE [2]. This publication also discusses motivation, but it uses a much broader definition of the term "value", namely any concept which influences human behaviour is a value. Furthermore, it considers other soft issues such as emotions or motivations. Our understanding of "value" is roughly equivalent to their notion of a "motivation". So while our research has a similar focus, that publication remains on a much more general level.

Psychology provides plenty of literature on personal values. We name some of the main sources in this publication. Psychology also offers many studies on the link between work patterns and personal behavioural determinants like values, beliefs etc. Some of these studies focus on health care professionals, such as [12], [15]. They provide valuable insights in the motivation of clinicians, but don't link them to their software use or software requirements. Another type of studies concentrates on professionals' attitudes towards computers in general [16], but we aren't aware of any results which try to establish a link between attitudes and software requirements.

5 Conclusion and Outlook

We have presented the theory of personal values and our approach on how to support the RE process. We aim to achieve two results. First, we want to develop a theoretical description of an approach for eliciting new requirements based on values, as described in Section 3. Second, we want to provide knowledge needed for applying our approach in practice, such as a catalogue with some common relations between values and requirements.

We are currently preparing first empirical studies. In parallel we expand our literature study to include information systems literature on technology acceptance such as [17]. We will use results from our first interview stage to establish hypotheses about relations between specific values and requirements. In subsequent stages, we will try to verify our hypotheses by collecting data from new study participants.

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