
Improving Emergency Alarm Products for Elderly: Using Values to Obtain the User Goals

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Abstract

Although emergency alarm systems provide functionality that can prove to be most useful for elderly, many of them do not use the alarm in practice. Pedell et al. tried to incorporate user emotions into the design of an emergency alarm, which improved the usage rate of the alarm. Unfortunately, obtaining the emotional goals is a time consuming and expensive process, which creates the need for a new method. By creating a value-goal model linking the values of the users per Schwartz Value Survey to goal categories of social applications, a product designer can identify the most important goals based on the values of users with great ease. The value-goal model was validated with the emergency alarm case and resulted in the same selection of goals as researchers originally obtained via interviews. The next step is to test the links between values and goals in a more extensive empirical study.

Author Keywords

Emotional Goal Theory; Goal-Oriented Requirement Engineering; Schwartz Value Survey; emergency alarm

ACM Classification Keywords

D.2.1 Software: Software Engineering: Requirements

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Figure 1. Example of screen of the iPad Emergency alarm application, based on Pedell et al. [7]

Introduction

Typically, eHealth systems are electronic systems that support healthcare practice. One increasingly-important category of eHealth systems are systems to inform a caretaker or relative about the status of an elderly person. These systems provide great benefits, but many elderly still refuse to use these systems due to the fact the wishes of the users are not well accommodated [1,2]. Therefore Pedell et al. [7] tried to incorporate the emotions of users into the design process for an emergency alarm. The emotions of users were obtained via interviewing the users, which was however rather a time and cost-inefficient method. While costly, the approach proved to be effective as an increased adoption rate of the product was observed. To reduce the cost of the product design phase, this paper creates a model that uses characteristics of users to predict their goals and steer the product designer in the right direction.

The emergency alarm

The Goal-Oriented Requirement Engineering (GORE) method [11] formed the basis for obtaining the wishes of the emergency alarm users. This method uses goals of the users to define the requirements for a product. These goals can be functional or qualitative and respectively drive the functional and non-functional requirements. Miller et al. [6] argued that when using the GORE method, designers themselves fulfill the requirements as they see it - instead of fulfilling the desires of the users - which lead to the failure of the design of the original product.

Miller et al. [6] argued the GORE method should be improved and they suggested to do so by including emotional goals based on the Emotional Goal Theory

(EGT), next to the existing functional and quality goals in order to incorporate all user goals. This should help product designers in obtaining a better understanding of the user goals.

The GORE method was combined with the EGT for the design of the emergency alarm by Pedell et al. [7]. They created a goal map, to illustrate the goals the different users hold for this product, including the functional, qualitative and emotional goals. After sketching the initial goal map, they interviewed the elderly and created a new - improved - goal map. The improved goal map showed that the initial goal was missing many emotional goals, e.g. feeling attached, feeling in touch, in control and loved. They hypothesize that this explains the lack of usage of the initial product.

Including these emotional goals in the design of the emergency alarm, resulted in an iPad application that showed pictures of their relatives and friends (Figure 1) as well as required interaction with the application. Elderly could indicate that were okay and did not need any help, which is the main function of an emergency alarm system. A user study demonstrated a preference for the new version over the original version, as it was tailored to wishes of the elderly in a better way and answered their needs [7]. Pedell et al. concluded that by including emotional goals, the product design was improved.

Problem statement

However, the process of obtaining these goals - via interviews with potential users - is rather cost and time inefficient. To overcome this issue, we present a model that allows product designers to predict the goals of

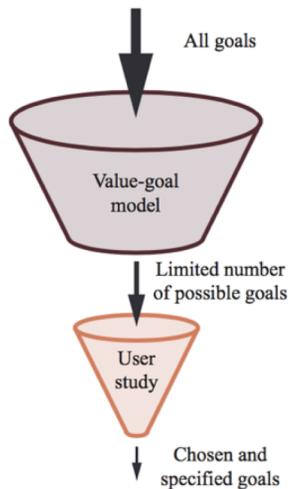


Figure 2. The use of the model of the link between values and goals as a filter before a user study

users. To predict the goals, the drive of goals must be known. The hypothesis of this study is that people have different goals, as people are different and unique.

Many different systems exist to characterize people. In this study a group of users will be characterized and only the system that characterizes people based on their values focuses on classifying groups, whereas other systems tend to focus on classifying individuals. Therefore, for this study a value system will be utilized to create a link between the values and goals of the users. The link between the values and goals can be used to filter the user goals, as shown in Figure 2. When a product designer identifies the goals and requirements by a user study, the number of possible goals are countless. The link between values and goals could give the product designer a direction of preferred goals by the users of the specific product. The number of possible goals can be filtered by this link, giving the product designer a smaller amount of goals to use as input for the user study. This value-goal model will be created as a proof of concept and will thus demonstrate the feasibility of the idea to link values to goals.

Method

Value system

Different systems are available to define a person's value, but for this study there has been chosen to use Schwartz Value Survey (SVS), since it is applicable for all cultures[9]. Moreover, it is frequently used and therefore much data using the SVS is online available. The SVS argues there are 10 important values for a person and a participant gives a rating to every value. This study will link the values defined by Schwartz to the goals.

Goal categorization

The value-goal model for the proof of concept will be scoped for social applications specifically. Goal categories will be set up to make the value-goal usable for more than just one product as to make it reusable within this scope. As the value-goal model will link values to goals, a list of goals is needed, which the values can be linked to. Surely, these goals should be social application specific. Kietzmann, [5] created a honeycomb explaining the functions of social media, to explain the various forms it can take and to show how to engage with social media. Next to the functions of Kietzmann et al. [5], the goal amusement is also added, since it is an important factor in motivating users for usage of social media to achieve a sense of leisure and amusement [3,8,10]. This resulted in the following list of goals which will be included in the value-goal model:

1. Show and keep your own identity (Identity)
2. Have a conversation (Conversation)
3. Share information (Sharing)
4. Amuse yourself (Amusement)
5. Show your reputation (Reputation)
6. Feel part of a group (Groups)

Value-goal model

Now that the value system and the right goal categories have been defined, the links between these values and goal categories are created. Different literature was found to link values to goal categories. However, not all links that would exist based on common sense, have been found or researched in literature. For example, one can argue that if you prioritize the value *achievement*, you will also try to show your reputation to the people around you. This link is not found in literature, but should be included in

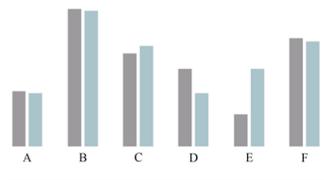


Figure 3. Hofstede's Cultural Dimensions for Australia (grey) and United Kingdom (blue) [10], in which:

- A: Power distance
- B: Individualism
- C: Masculinity
- D: Uncertainty Avoidance
- E: Long Term Orientation
- F: Indulgence

the model. Therefore, a couple of links in the model are not investigated yet. By correctly motivating these thought, these will also be included in the value-goal model.

The European Social Survey (ESS) [4] asks participants from twenty European country about their SVS values and next to this collect data about other topics, such as social demographics, gender, age and income. This data can be used to select the right user group to obtain the right values. This can in turn be used as input for the value-goal model. If the user group does not originate from a country that is included in the ESS, the cultural dimensions of Hofstede can be used to choose the country from the ESS that is most similar to the country of the user group - by comparing cultures against each other. Since the emergency alarm case originates from Australia, which is not a part of the ESS, this method was applied in this study as well. The cultural dimensions of Hofstede showed Australia was most similar to the United Kingdom and therefore the value ranking of the United Kingdom will be used for the validation.

The value-goal model is modeled as a multi-criteria analysis model. ESS values are ranked from negative numbers (most important) to positive numbers (least important). The score for a goal category is calculated by summing the ratings of the values that are linked to that goal category. The lower the score, the more important the goal category (shown in Table 1 in the second column).

Results

Next we will use the emergency as an example to show the use of the value-goal model and to evaluate the

potential of the model, which was designed as a proof of concept. If the value-goal model shows the same priority of goal categories as the goals that came up during the, the possible existence of the link between values and goals is shown and the potential of the value-goal model will be shown as well.

Based on the characteristics of the Australian user group of the emergency alarm case, the input for the value-goal model is the average of the value ranking of people in the UK only living in a (suburb of a) big city and with an age of 66 years and older. This average ranking is used to calculate the goal ranking in the value-goal model and the goal categories are ranked from most to least important goals with the ranking of the goal categories in brackets, shown in Table 1.

To compare the emergency alarm case with the value-goal model, the - large number of - goals from the goal map from the emergency alarm case will be linked to the goal categories of the value-goal. The more goals were linked to a goal category, the more important the goal category would be. This resulted in a list of most important goal category to least important goal category with the number of linked goals of the emergency alarm case in brackets, shown in Table 1.

	Value-goal model	Goal map - Emergency alarm case
1	Group (-1,8)	Group (6)
2	Identity (-1,4)	Identity (4)
3	Sharing (0,4)	Sharing/Conversation (3)
4	Conversation (0,5)	Sharing/Conversation (3)
5	Reputation (1,2)	Amusement (2)
6	Amusement (1,6)	Reputation (1)

Table 1. Comparison of the results of the Value-goal model and the Emergency alarm case

Value-goal model		Goal map	
Goal category		Goal category	
-17,5	G	6	G
-14,3	I		
		4	I
3,9	S	3	S C
5,4	C		
		2	A
11,6	R		
16,5	A	1	R

Table 2. Quantitative comparison of the rating for the goal categories obtained via the value-goal map and the goal map from the emergency alarm case (G=group, I=identity, S=sharing, C=conversation, R=relationship, A=amusement)

We see that the value-goal model does quite well for obtaining the top ranked goal categories, therefore indicating that the value-goal model could aid product designers in gaining insight in their user's needs, while eliminating the need for time and cost inefficient interviews. However, this comparison fails to show just how similar the goal prioritization is. We can overcome this problem by normalizing the results

Table 2 shows the rates between *group* and *identity* is smaller in the value-goal model than in the goal map. *Sharing* and *conversation* are rated at about the same level. *Amusement* and *reputation* are switched and are rated with a large difference.

The rates of the goal categories based on the goal map were relatively small. Moreover, they have been inferred from the number of goals that seemed to belong to a goal category. Both reasons leave relatively large margin of error. Moreover, the rates of the goal categories calculated in the value-goal model, are based on the links between the values and goals, which are not completely based on literature. Therefore, although we cannot conclusively say the value-goal model is valid, the results demonstrate the potential of the model.

Discussion

Hardly any literature found that linked the specific values of Schwartz to these specific goals. In order to overcome this gap, other literature and common sense is used. Asking experts about their opinion and an empirical research will be of great help to find the real relation between values and the goals. This will also make it possible to provide an estimation on the

strength of links individually, which would improve the model accuracy.

Another limitation of the use of this value-goal model, is the fact that the model has been tailored for social applications. On the one hand, it is too general to get specific goals, like the goals in the goal map of the emergency alarm case. On the other hand, it is too specific, because the model can only be used for specific products. A solution for this might be to create a survey containing enough topics, to extend the value-goal model and broaden it for additional products, so product designers can look outside their scope and see other important goals they can incorporate in their product design. A possibility for future research is to create a model for other products than social applications. Since the link between values and goals seems to exist, this could be useful for other product sectors as well. An option can also be to create a broader model, useful for more types of product. The empirical research could give as much information as the researcher wants and the link between the ten values of Schwartz and a large number of goals can be determined and therefore more goals can be used in the value-goal model and thus the scope of the model can be bigger and for more product types. A challenge will still be to keep the goals specific enough to be useful for the product designer.

The study is limited by the fact that only one case study was done as no other studies were available for social application products that included goals. More studies should be conducted to confirm the validity of the value-goal model.

Conclusion and future research

The value goal model proved to be of great help for product designers in identifying the goals of the users for the emergency alarm for the elderly. There seems to exist a link between the values of Schwartz and the user goals, but more research is necessary to better understand this link. With this link, the needs of the users of homecare and other health care products can be identified and thus a better product can be created.

It will be interesting to investigate the links between the cultural dimensions of Hofstede and the values of Schwartz. To make the value-goal model applicable to all countries, there must be a way to obtain the values of a culture in a systematic way, without having to trust on the availability of user data. This may possibly be obtained by quantitative research researching the values of people that have on different cultural dimensions.

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