

User-Oriented Requirements Engineering

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Abstract—A method for eliciting user requirements in affect-laden applications is described. The method extends personal RE where requirements are for individual users and their needs. Theories from psychology of emotion and motivation are introduced and applied in a top-down pathway motivated by system goals to influence users, and a bottom-up scenario-based path to analyse affective situations which might be produced by user-oriented RE. Use of agent technology in storyboards and scenario analysis of affective situations is described and illustrated with a case study in health informatics.

Index Terms—personal requirements, emotion, motivation, scenarios, interactive agents, persuasive technology, health informatics.

I. INTRODUCTION

As more applications become oriented towards entertainment and personal systems, requirements will become increasingly focused on users as individuals rather than on goals for groups of stakeholders. Personal requirements have been addressed in the context of assistive technology [1] and where individuals' behaviour needs to be monitored, so that attainment of personal goals can be assessed. User requirements have also been considering in applications where user values may influence the acceptability of systems [2]. Emotions may be implicated in a growing class of applications where goals are personal [1], [3], since they relate to individual people. For example, achieving personal goals may evoke pleasure, while failing to achieve a personal goal may cause pain and frustration. Considering emotion as part of the requirements picture for personal goals enables designers to anticipate human emotional responses and mitigate their downsides, for example by providing sympathetic advice when goals are not achieved or relaxing goals to avoid disappointment.

Many advisory or explanatory systems have a high-level goal to influence human behaviour; for example, marketing in e-commerce aims to persuade people to buy products, while e-health systems may attempt to influence users towards improving their lifestyles. These applications, frequently described as persuasive technology or captology [4], incorporate design features which play on people's emotions. Somewhat surprisingly, people tend to react to even minimal human presence on computers by treating the computer representation (i.e. virtual agent, character or even a photograph of a person) as if it were a real person. The CASA (Computer As Social Actor) effect [5] is extremely influential,

hence choice of media, characters, and dialogue content can all be manipulated to evoke emotional responses. User interface technology has now progressed to enable development with character-based agents as a standard technology [6]. Requirements analysis therefore needs to address how people may react to character-based interfaces, to plan for productive influences of human emotion and to anticipate adverse responses. However, analysis of users' affective reaction to requirements and exploration of designs has received little attention in the RE apart from some consideration in games design [7, 8].

This paper proposes a model and process for analysing the role of emotion in interactive, user-centred applications, with requirements directed towards agent-based interfaces and social software. It does not address the more general problem of handling emotion during the requirements process since this perspective concerns inter-personal skills and communication rather than RE per se. In the next section, previous literature in RE and related disciplines is reviewed. In section III, models and theories of motivation and emotion are briefly reviewed, with their relevance to RE. A process of analysing emotional responses by stakeholders and specifying requirements for affective applications is described in section IV, followed by an illustration of the process in case studies of persuasive e-health applications. The paper concludes with a discussion of the prospects for personally oriented RE and affective applications.

II. RELATED RESEARCH

The role of emotion in games application was analysed by Callele [7], [8], who described a process of scripting with storyboards and scenarios for planning user interaction. Design effects to evoke emotions such as surprise and fear were annotated on to drawings of the game world; however, no particular model of emotion was proposed. Emotions formed a component of a requirements analysis process which addressed stakeholder values in RE [9]; but in this case emotions were treated from the viewpoint of stakeholder-analyst interaction, with some guidelines for requirements management if emotional responses were detected, e.g. user frustration might indicate disagreement with goals or requirements not representing their views.

Value-based design [10] elicits user feelings and attitudes to potential systems by presenting cue cards associated with possible emotional responses and user values. Scenarios and

storyboarding techniques are used to elicit stakeholder responses, but value-based design does not focus directly on user emotions; instead, it aims to elicit users' attitudes and feelings about products and prototypes as an aid towards refining requirements with human-centred values. Values and affective responses have been investigated by [11] in worth maps, which attempt to document stakeholders' views about products or prototypes.

The role of emotion in user-centred design of products was reviewed by Norman [12], who argued that good design should inspire positive emotional responses from users, such as joy, surprise and pleasure; however, Norman was less forthcoming on how to realise affect-inducing design, beyond reference to the concept of affordances, intuitively understandable user interface features. Techniques for exploring affect in requirements include use of personas, pen portraits of typical users, including their feelings and possibly emotion in their personalities [13]. Personas were developed further into extreme characters [14] as a means of eliciting stakeholders' feelings to provocative statements about designs, although neither of these techniques considers the role of emotion explicitly. Requirements for emotion are tacitly included in design of embodied conversational agents (ECA) [15]-[17] as scripts for controlling facial expression, posture and gaze of virtual agents. However, the ECA literature contains no techniques for eliciting or specifying desired emotional responses.

III. THEORIES OF EMOTION & MOTIVATION

The starting point for the analysis is a focus on personal goals, i.e. goals related to an individual's needs. Two areas of psychology are relevant to personal needs: first, motivation theory, which explains deep-seated goals or drives which determine our behaviour; and secondly, emotions, which characterise our automatic reactions to events and situations. The intention is to augment personal goal analysis with knowledge from psychology about goals which are tacit (motivation) and reactions that may arise when goals or motivations are frustrated (emotions). We might anticipate rational reactions when obstacles [18] confront goals; however, not all reactions are rational, hence knowledge of human emotion might be usefully deployed in the RE process. Motivations and emotions will also play a role in amplifying understanding of RE models which include relationships between (human) agents such as trust, responsibility and agent properties including capabilities, skills and preferences [19].

Psychologists distinguish between emotions, which are specific responses, and moods, which reflect more general good or bad feelings. Moods are temporary, whereas emotions are part of our cognitive response and persist as memories of responses to events, objects and people. Emotions may be either positive (pleasure and joy) or negative (fear, disgust) and may have a force, e.g. worry or anxiety is a mild form of fear. There are many theories of emotion. The Ontony, Clore & Collins (OCC) model was selected for its broad coverage [20]

of 22 emotions, classified into reactions to events, agents (other people) and objects which may be either positive or negative.

A simplified view of the OCC taxonomy is shown in Fig. 1. Reaction to events depends on whether the consequences concern oneself (+ve hope, -ve fear) or others, and then the impact of the event (satisfaction, fears confirmed/relief, disappointment). Responses to objects may either be mild (like or dislike) or stronger (love/hate). Emotional response to agents' actions depends on who the action relates to (self, others, group) and then the perceived effect of the action and whether it was positive such as pride as a positive response to one's own action, or reproach as a negative reaction to another person's action. Events related emotions are responses to situations and changes in the environment and related either to oneself or others in terms of consequences and impact. For example joy is a positive assessment of an event (e.g. birthday party) relating to oneself with a general impact, and hope is the positive emotion in a specific response to getting a present-which may than happen (satisfaction) or not (disappointment).

Some emotions such as gratification, remorse, gratitude and anger are complex responses to events and agents/objects.

Even though the OCC model is comprehensive it does not account for social emotions such as empathy (+ve reaction to an agent) and belonging (+ve reaction to group membership)

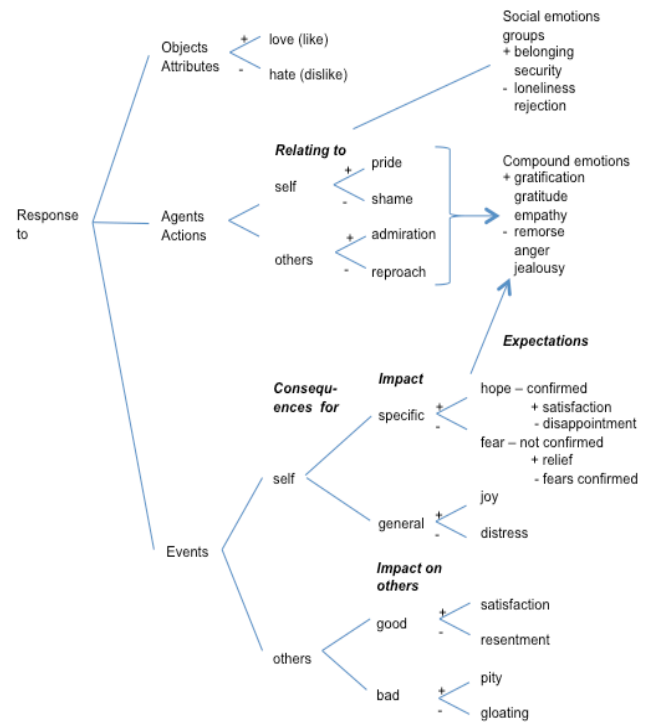


Fig. 1. OCC model decision tree for classifying emotions; augmented with social emotions

[21]. In spite of these limitations the OCC model is suitable for application to requirements analysis since the

event/agent/object taxonomy and decision tree can be applied to analysing emotional reactions. Individual stakeholders may experience emotions in response to events, objects or agents produced by the software system, or which may be a consequence of events and objects in the system environment. Once a range of “emotion inducing” states have been identified, responses to them can be planned as requirements for software agents and their behaviour.

A. Motivation Analysis

Motivations are related to personality, and can be considered as long-lasting, high-level personal goals [1]. Table I summarises the more important motivations for requirements analysis, synthesised from Maslow’s motivation theory [22]. Motivations are not easy to detect so elicitation guidance from the description in column 2 can only provide hints to guide questions, some of which are suggested by the motivation type itself, i.e. questions about interest in learning, or willingness to help others.

Column 3 suggests implications for personal goals and needs for each motivation type; for example, self-efficacy, curiosity and learning point towards the need for opportunities to experiment which may suggest requirements for customisable or programmable systems.

TABLE I. MOTIVATIONS AND THEIR CONSEQUENCES

| Motivation | Description | Implications |
|---------------------|---|--|
| Safety | Self preservation, avoid injury, discomfort | Avoid danger: safety critical applications; avoid natural and artificial threats to self |
| Power | Need to control others, authority, command | Work organisation, responsibility, control hierarchy |
| Possession | Desire for material goods, wealth | Resource control, monetary incentives, ownership, products, wealth |
| Achievement | Need to design, construct, organise | Project & personal goals, completing tasks, lifestyle targets |
| Self-esteem | Need to feel satisfied with oneself | Linked personal goals, personal achievement, also perception of self |
| Peer-esteem | Need to feel valued by others | Inclusion in groups, teams social feedback and rewards, praise |
| Self-efficacy | Confidence in own capabilities | Confidence building, training, encourage responsibility |
| Curiosity, learning | Desire to discover, understand world | Opportunities to experiment, time to explore, self tutoring and learning support |
| Sociability | Desire to be part of a group | Group membership and social relationships, collaboration in work |
| Altruism | Desire to help others | Opportunities and rewards for helping, selfless act |

Safety subsumes basic motivations to satisfy hunger, thirst,

and protect oneself. Power, possession and achievement are all related directly to personal goals, although in different ways. Power is manifest in actions and social relationships, and is associated with responsibility, trust, and authority. Possession is more personal, concerning goals to own resources, wealth or products. Achievement (or failure) is the end state of most goals, although in motivation theory it spans many personal goals as a lifetime ambition. Self- and peer-esteem concern personal perceptions of self and of self by others, which may indirectly be related to goals if achievement is frustrated, leading to a decline in self-esteem. Motivations of self- and peer-esteem can indicate designing systems to suit individual needs; for instance, in e-commerce, marketing tools can be customised to praise customers [5] and thereby improve their self-esteem (positive well being). Self-efficacy is realising one’s potential, hence increasing abilities and responsibility.

Altruism and sociability are social motivations driving group behaviour, the need to belong to groups and undertake selfless acts, which incidentally increases peer esteem and hence the sense of belonging to the group. People with high sociability motivation will collaborate and cooperate with others in group working. Motivations can be measured by questionnaires; however, in most RE simple question checklists of motivations are sufficient to direct requirements investigation.

IV. APPLYING EMOTIONS AND MOTIVATIONS TO RE

Emotions and Motivations are used as tools for thought in scenario based RE for personal RE. Motivational analysis complements goal-based requirements approaches; in contrast, emotions are user reactions, and hence a means of assessing the implications of situations. The User-oriented RE process is summarised in Fig. 2.

The process follows two related pathways: first, the analysis path that starts from users’ needs where the motivation component in the method is applied; then, affective situations are considered by identifying scenarios for the user roles and stakeholders who may experience significant emotions, followed by analysis of the situations and events that may lead to emotional experiences. Obstacle analysis contributes by investigating barriers to achieving personal goals, motivations or in problems in achieving the desire emotional reaction. The second planning path has its origins in design goals or high-level system requirements to influence users and their personal goals. System agents and actions are specified in response to anticipated situations. The two pathways interact: the system goals planning pathway suggests situations for follow-up analysis, while affective situations identified in the domain may alter plans and system goals. Analysis of affect may be stimulated by the type of application; for example, games and entertainment applications aim to manipulate user emotions, while e-commerce applications have design goals to influence decisions of individual stakeholders and user groups. Design goals may arise from the need to motivate users to change their behaviour or persuade them towards certain decisions in

applications such as healthcare (lifestyle behaviour), marketing e-commerce (purchasing decisions) or social e-communities (persuade people to participate). Design goal are system requirements in the traditional RE sense, however personal goal pertain to individual ambitions, e.g. the goal of beating a personal best time for running, within an exercise health care system.

A. Analyse User Goals and Motivations

Analysis of personal goals will follow conventional interviews and scenario-based techniques augmented with motivation analysis using the taxonomy. At this stage user motivations are identified as an extension of personal goals. For example personal goals to improve one's diet and take exercise will be related not only to achievement but also to self esteem (feel good about oneself) and peer esteem (improve standing among friends having lost weight). Barriers to personal goals will often have motivational implications such as frustrated achievement, power and possession, which in turn may have knock on effects on self esteem and peer esteem.

Knowledge of user motivations is also applied to planning system responses to affective situations. Since emotional responses are frequently related to motivations as well as to our short-term goals and aspirations, analysis of motivations, goals and emotions is inevitably intertwined. A summary of motivations and possible obstacles to their realisation, and emotion responses to frustrated motivation, is given in Table

TABLE II. MOTIVATIONS, OBSTACLES AND RESPONSES

| Motivation | Obstacles | Potential emotion (possible response) |
|---------------------|---|---|
| Safety | Dangerous events, malevolent agents | Fear, hate (remove cause or relocate user, add defences and counter measures to events) |
| Power | Change to authority, responsibility | Anger, shame, resentment (compensation, change people, relationships) |
| Possession | Reduced resource control, monetary incentives | Anger, jealousy, resentment (reallocate resources, responsibilities, change people) |
| Achievement | Constraints on goals, actions | Anxiety, frustration resentment (change goals, remove constraints) |
| Self-esteem | Adverse events, goals not achieved | Shame, anger (re-focus goals, emphasise other achievements) |
| Peer-esteem | Adverse interactions, events | Rejection, loneliness (focus on +ve social relationships) |
| Self-efficacy | Limitations on actions and responsibilities | Disappointment, distress (improve opportunities, challenges) |
| Curiosity, learning | Excessive workload, time, resources | Disappointment, reproach (provide time, change workload) |
| Sociability | Group conflict, personality and authority clashes | Rejection, resentment, loneliness (negotiate problems, change group membership, responsibilities) |
| Altruism | Limitations on actions | Distress, disappointment (provide opportunities, rewards) |

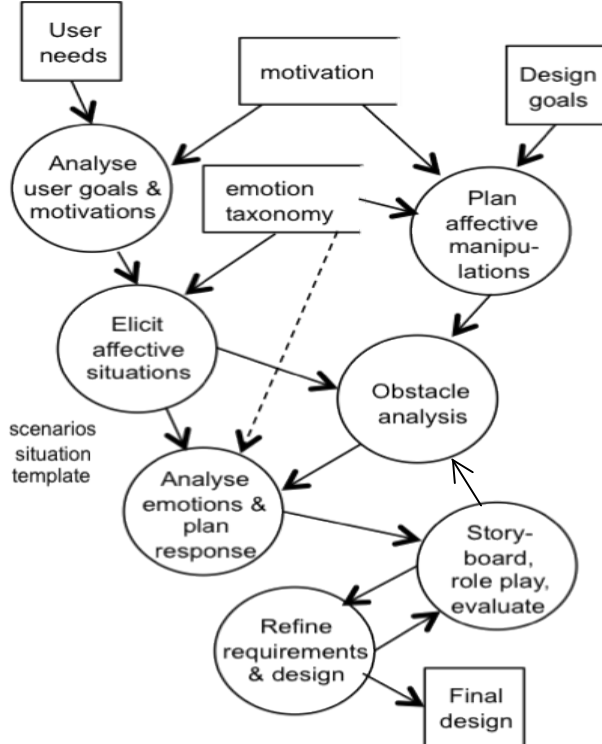


Fig. 2. Summary of the User-Oriented Requirements Engineering process. Circles = process step, open rectangles = method resources, square = external entities

II. These are used obstacle analysis to consider the interaction between motivation, emotions and personal goals. The motivations and emotions in Table II can be used to prompt questions in both directions.

Emotional reactions to a scenario may indicate motivational problems, while obstacles to personal goals and related motivations indicate emotional consequences which will need to be addressed either in the social system or design of information content and artificial agents.

B. Identifying Affective Situations

The first step is to identify the range of potential affective situations, then to trace the source responsible for emotional reactions in the system content or environment. Situation analysis is directed towards identifying the possible emotional response and its source, then establishing requirements for system agents and responses using the template illustrated in Table III.

Identifying agents and stakeholder groups is standard practice in RE analysis and modelling. Scenarios, use cases and storyboards, all commonly practised RE techniques, can be adapted for “affective situation” analysis with stakeholder groups and individual users.

Scenarios describing potential emotion invoking incidents

may be elicited from stakeholders or created by requirements analysts to explore user reactions to personal goals and

TABLE III. AFFECTIVE SITUATION REQUIREMENTS TEMPLATE, WITH NOTES

| Application | Situation ID |
|--------------------|---|
| Agents & actions | People in the scenario, possible actions and communication |
| Objects | Objects and design artefacts |
| Events (previous) | Expected events in the environment, with their source, when known. User memory of previous events |
| Expected emotion | As identified from the above and obstacle analysis |
| System response | Remove cause, mitigate effect |
| Agent requirements | Agents' actions for mitigation |
| Other requirements | Non-agent responses, avoid cause, etc. |

design features. Storyboards and sketches are used to illustrate scenarios and presented to users to capture their responses. Since agent-based technology is now cheap and easy to use, lightweight prototypes can be developed to explore design options with a range of emotional expressions by agents [6]. Some examples of facial expression of emotions using agent prototyping tools are illustrated in Fig. 3.

Facial expression alone is somewhat ambiguous, as might be discerned from Fig. 3, so it needs to be combined with dialogue, for example “you seem to have difficulty in placing this order, please select the product again” and “thank you for your order, please proceed to payment” in a typical e-commerce sequence. Emotional expression is even more effective when prosody (voice tone) is used, and text to speech output with limited tonal expression is provided by agent development tools.

C. Analysing Situations and Emotions

Tracing the source of emotions follows the template and OCC decision tree to elicit the reasons for the response, then identifying the source in the system environment, content or the design itself



“You seem to have problems; can I help you?”

“All is OK; please continue”

Fig. 3. Expression of emotion by agent's face with dialogue excerpts

The OCC decision tree helps to identify potential emotions and their causes by asking questions about the source of the problem (agents' actions, objects' attributes, events), who it affects (self, other stakeholders), and the consequences and impact of the problem as well as any previous related experiences (expectations). Affective reactions may be caused either by the system design, the content of the design, agents, especially people and other stakeholders, actions, or events in the system environment the user has to deal with. Poor implementation of requirements or missing requirements may evoke frustration and anger in more extreme cases. User reaction to the content of applications and websites may be more complex as the response may be caused by information and messages conveyed by text or speech, images of people or natural phenomena, or even sounds and music. Situations involving the system environment range from other people in computer-mediated communication and social software, to events in the world or user goals that the system has to respond to by advising, persuading or directing the user to take action.

Anger tends to be associated more closely with agents and people, so the presentation of characters, opinion and values that clash with the stakeholder's viewpoint should be investigated. Fear is related to events as well to specific agents, so events in the system environment or described in the system content (e.g. website information) should be questioned. Disgust is a strong, visceral emotion usually associated with content, for example images of putrefying food. Socially oriented emotions have roots in reactions to people and events, so in this case the stakeholder's relationship with others may need to be investigated, through the history of events involving the user and others in the system environment. Social emotions are also important considerations in social computing applications, with privacy and security implications. For example disclosure of secrets may cause shame (in own behaviour), jealousy (in others) remorse (in injudicious actions which have offended others) and so on. Scenarios of information disclosure and privacy controls can explore the types and strengths of emotional responses.

D. Obstacle Analysis

Planning system responses to user emotions can be helped by analysing obstacles to motivations and personal goals. If responses can invoke appropriate user motivations then potential negative emotions might be deflected or converted into positive responses (e.g. convert dislike into like by changing an object or design).

Obstacles to personal goals follow the established practice of inquiry into what assumptions, resources, and events may prevent a goal being achieved [18]. This is extended to investigate users' motivations. Since motivations are long-term goals, obstacles are more general and possibly more persistent than may be expected for short-term personal goals.

Table IV gives some guidance in analysing possible reasons for affective reactions for a sub-set of OCC negative emotions. This contributes to obstacle analysis since the causes

TABLE IV. EMOTIONS, POSSIBLE CAUSES AND RESPONSES

| Emotion | Obstacles, causes | Possible responses |
|----------|--|--|
| Hate | Actions of people or things, value clashes | Remove object, agent; change focus to self-achievement |
| Anger | Offensive events, people, things, values | Remove cause, mitigate reasons |
| Fear | Threats to self, dangerous objects, situations | Remove threat or user from situation, add protection |
| Disgust | Offensive objects, people | Remove cause, change location |
| Jealousy | People's actions, objects | Mitigate reasons, change focus to self |
| Shame | Own actions self-image | Analyse reasons, change focus to achievement |

(agents, people, events, etc.) may hinder the achievement of personal goals with limited guidance on countermeasures for the obstacles. Motivation obstacles indicate possible adverse consequences for human stakeholders. Motivational consequences may be mitigated by design in the social system, for example, poor self esteem arising from a lack of achievement may be alleviated by improving training, changing the organisation of work, or re setting targets to make them more achievable.

Emotional responses indicated from motivation obstacle analysis suggest further scenarios for situation analysis where the implications can be explored by role-playing situations in which the generic obstacles are made more realistic and concrete, e.g. being turned down for promotion is an obstacle to achievement and has a negative impact on self esteem.

E. Planning Responses

The source of the emotional response is traced back to the agent action or event, and response scenarios are planned to mitigate the anticipated negative emotion. Once the source is known, requirements to deal with the situation can be specified. There are three main routes: first to remove the source; secondly to reassure the users and diffuse the emotion by reducing the significance or impact of the reaction; and finally planning a system response to change negative affect into its related positive emotion, e.g. fear is converted into relief by explaining that the event's consequences are not what the user expected. Removing the source in content can be achieved by editing to remove the offending image, text or event; however, changing sources in the system environment may not be an option, so a mitigation strategy may be necessary. For example, if resentment is felt in response to the success of others, then a better outcome might be to convert this into satisfaction or deflect the negative emotion by urging the user to reflect on their own achievements. Resentment might be reduced by counselling the user to ignore the event as unimportant or reflecting on one's own success rather than envying others

Hate and its milder manifestation (dislike) may be encountered as a response to missing requirements, poor user

interface design, or when users are frustrated by poor design. With content, the causes may arise from a clash between the user's beliefs and values and information or opinions expressed in the content. Adverse reaction to personalities is another likely cause. Emotional responses to products and designed artefacts are usually easier to deal with since these can be traced back to the feature causing dislike. Disliked features indicate poor design or missing/inappropriate requirements.

Positive emotions are less of a concern in situation analysis since there are fewer implications for system requirements, although when goals for influencing user behaviour are present, then scenarios need to be developed that describe the desired positive emotion, e.g. pleasurable experience for persuading users. To illustrate, in an e-commerce application selling high-quality design goods such as jewellery, the high-level goal is to influence the user to buy the product. The user is a member of the public, objects are the jewellery products, and the intended emotions are curiosity, pleasure and desire. Requirements for a sales agent virtual character are to empathise with the user, using a smiling facial expression to communicate interest and pleasure in explaining the product, followed by actions to demonstrate product qualities, and use of gesture and gaze to draw attention to these features. In games applications there will be a sequence of affective situations, in which the user-player is led through situations with agents and events to evoke fear, anxiety, surprise and relief as the game sequence unfolds. Action scripts and sketches of the game's virtual world amplify the requirements described in the template.

V. ILLUSTRATIVE CASE STUDY

In this section application of the User-oriented RE process to the SAMS project is described. SAMS aims to detect early signs of dementia and Alzheimer's disease among the elderly by data/text mining logs of computer interaction and email texts. Unfortunately Alzheimer's disease is diagnosed too late in too many people, by which time there is little that medical science can do to help; however, if the disease is detected early, then treatments can delay its onset and ameliorate its symptoms. Early onset can be detected by memory tests, patterns of word use and motor reaction times, so the high-level system goal is to remotely and unobtrusively monitor people's use of home computers and text-based messaging via e-mail and social networking sites. There are many complex requirements involving data and text mining to produce early onset diagnostic indicators, which do not concern this paper; instead, analysis of the users' possible reactions to the system is described, with requirements to persuade elderly users to self-refer for follow-up tests and appropriate medical treatment. These messages are potentially disturbing so if the users reaction to the warning messages is adverse, the system may fail in its main objective- to persuade people to contact their doctor and self-refer themselves for follow-up tests.

The affective requirements problem is to analyse people's

potential reaction to system diagnoses. The diagnostic part of the system will not be perfect, hence there is uncertainty about the results and the danger of false positive diagnoses, which could provoke fear about the consequences. Scenarios based on these assumptions were explored. If the system detected signs of dementia then this information could be distressing to the user. This raises questions about how the information should be communicated to the user, and the appropriate system response to different diagnostic signs. Using the OCC model, the source of anticipated emotions of fear and distress are the event (message), which has consequences for self (the user) with a specific impact when the feared expectation (diagnosis of dementia) is confirmed. Relief or fear confirmed are also possible depending on the results of follow up tests. This may also have a general impact leading to distress and fear of the future. This is summarised in the template shown in Table V.

The next step is to specify the system response. In this case the mirror emotion (relief) can be explored since the diagnosis is uncertain, so suggestions for follow-up tests can be specified to confirm or negate the initial diagnosis with reassuring messages that many initial signs turn out to be false alarms. Consulting medical experts with explanations of tests in memory clinics is another system response. The social emotion of empathy is another means of dealing with distress, hence requirements for social support might be explored, for instance the acceptability of letting close friends know via a social network. A range of scenarios were developed to explore different means of communicating the potentially distressing message, with system responses ranging from no emotion (just the facts), to expression of empathy by agent characters. Other design requirements involve choice of media to deliver the message (text, voice, agent character plus voice/text), as well as the content and format of the message (polite, sympathetic tone). These scenarios personal goals and motivations were investigated with obstacle analysis to identify possible barriers to system goals (to encourage self-referral for follow-up tests), for example self-denial that the user has a medical problem. Requirements indicated from preliminary analysis of the storyboard scenarios showed individual differences in affective responses.

Users evaluated a range of prototype mock ups (e.g. Fig. 3). Some users preferred simple factual communications,

whereas others liked the empathetic agent. Older characters were suggested to match the user audience, also using a doctor to evoke more trust. Content requirements included simple explanations of the reasons for diagnosis, with limited disclosure of the information to close friends or kin in the user's social network. All users felt that, apart from letting their very best friend know if the follow up tests did confirm the problem, any disclosure would cause them distress and could unnecessary fear among friends.

VI. DISCUSSION

Presentation of situations to explore human motivations, emotions and attitudes is a novel contribution to RE. UCRE extends previous concepts of personal requirements [1] as well as addressing requirements for advanced UI technology where agent-character based interfaces are becoming more common [16], [17]. Motivation and emotion analysis are particularly pertinent to social computing applications where computer mediated interactions need to be considered. Even though the method is in its early stages of development, User-oriented RE does show some promise in producing insight into personal problems in applications where individual experience and goals are paramount. It also addresses requirements analysis for the new generation of user interfaces where character agent-based interaction is becoming widespread, and in applications where system goals aim to influence users [4]. The method fits within RE practices of goal-based and scenario-based RE, so it amplifies existing practices, especially in personally oriented applications.

While emotions and motivation are psychological constructs which require in-depth knowledge for analysis of human problems, the User-oriented RE method delivers a digestible sub-set of psychology, which could be used by non-experts. Experience to date has involved medical personnel who are conversant with the psychology of emotion from their training, so testing the method with non-experts is part of the future research agenda.

Knowledge of individual agents may help inspection-based analysis, while emotional analysis can help problem identification in scenario-based investigations. Analysis of emotions may also be applied to requirements monitoring of progress relating to personal goals. User-oriented RE could also extend games-based specification methods [7], [8] and requirements for interactive virtual environments such as SecondLife. In conclusion, User oriented RE has extended a theme in RE which started with a focus on personal goals [1], [3] and the user as a subject of requirements analysis. It also extends earlier work on emotion in RE [23] which analysed the socio technical implication of affective reactions to inappropriate features, tacit knowledge and managerial changes. In future work we will test the method in a more extensive case studies in different affect-related healthcare systems.

TABLE V. SITUATION TEMPLATE - COGNITIVE IMPAIRMENT DIAGNOSIS

| Situation: Diagnosis of problems, low confidence | |
|--|---|
| Agents & actions | User, possibly their kin |
| Objects | Text, graphs feedback presentation |
| Events (previous) | Message warning about possible cognitive impairment (patient history) |
| Expected emotions | Anxiety, fear, distress, relief |
| System response | Mitigate consequences, reassure user, empathise |
| Agent requirements | Agent sympathises with user, communicates |
| Other requirements | Supplementary information, communication with doctors, kin and friends. |

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