What Stories Inform Us About the Users?

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Abstract. Storytelling has been used to elicit subconscious schemas that were formed from user experiences. Subjects were required to construct a working model using external and internal sources of information. Known methods of performing narrative analysis included Projective Tests, Narrative Analysis, and Cognitive Tasks Analysis. Three studies using storytelling methods were done with these methods. One with older adults, two with kins of older adults, and three with refinery operators. In the case of older adults, users were asked to make up stories for a fictitious person to extract cultural norms and knowledge. For the refinery study, we can look into real stories for more reliable data. Many types of design information were extracted: (1) emotional and functional needs, (2) functional dependencies, and (3) expertise. Arguably, these information will be hard to come by if a direct interview technique is conducted. Reasons due to the richness of information embedded in stories.

Keywords: Storytelling, Projective Test, Cognitive Task Analysis, Interview Method.

1 Background of Story Telling for Requirements Elicitation

Narration has been used since ancient times [1]. Despite the amount of work put into ordering the world into distinct variables and behavior, interestingly, narratives remains indispensable. An example is the paper you are reading! Some authors suggest that human thinks in a narrative fashion, in a chain of events in a chronological order [1, 2]. Arguably, narratives contain richer informational contents which variables cannot portray. This paper attempted to review lessons learnt from three cases of using storytelling method to identify design requirements, and what we can learn from them.

1.1 Extracting User Needs from Stories

Storytelling have been used to extract user needs. User needs may be in a form of basic needs, motivation, goals, and their relationship with people and artifacts found within the community.

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A form of studying true stories within a communal settings, known as Narrative Analysis, has been used in social ethnographic studies of culture and social issues. These were frequently done in situation where sample size was too small for quantitative analyses [2].

Another form of storytelling, of fictitious but socially valid stories, is the Thematic Apperception Tests from the family of Projective Techniques. In marketing, it was used to understand users' needs [3]. In one study, pictures of cheap versus expensive cosmetic were used. Users subconsciously see the cheap cosmetics as "greasy and oily" and the expensive cosmetic as leaving the skin "clear, refreshed and young-looking." In another study in 1950s, pictures of "housewife who used instant coffee" versus "housewife who used ground coffee" were compared. The former was viewed as "lazy" while the latter as "thrifty." This impression disappeared in a replicated study done in 1970s.

Using fictitious stories may imply loosing external validity of the findings. However, if a product is truly innovative, it is difficult to find any users with prior use experience. What people claim to be needs may merely be false assumption based on social desirability biases. In addition, some potential users may not be aware of that they have certain needs.

1.2 Extracting Tacit Knowledge from Stories

Stories may also be used to elicit tacit knowledge through revisiting certain parts of a story a multiple levels of details. This is known as "Sweeps" in Critical Decision Method (CDM) [4]. This was most effectively used to probe expensive or life threatening incidents that required good judgment from expert users (known as Subject Matter Experts in CDM). Since incidents cannot be simulated, interviews were conducted to investigate recent cases of interest. Users were asked to narrate what happen and important chain of events were revisited in several level of details.

CDM utilizes four "sweeps" [5]. In Sweep 1, the Subject Matter Expert (SME) selects a challenging incident that recently occurred. He describes the chronological sequence of the incident in Sweep 2 and progressively deepens the story in Sweep 3. Finally, the SME discusses the expert-novice difference using what-if scenarios in Sweep 4.

2 Theories Substantiating User Requirements Found Beneath Stories

Stories contain rich information about users and their environment. The projective hypotheses state that stimuli from the environment are perceived and organized by the individual's specific needs, motives, feelings, perceptual sets, and cognitive structures, and that in large part this process occurs automatically and outside of awareness [6]. Users were thus guided unknowingly by a set of rules known as Schemas. In storytelling, users and their environment were reverse engineered out of such schemas by consulting external and internal sources of information [7]. In constructing stories, many subconscious processes were utilized, explaining why direct interviews cannot be used to elicit the same types of information.

2.1 Schema Theory

Schema theory predicts that people are aware of what to do next in familiar circumstances as if these are autonomic reactions. Schema theory has similarities with RPD (recognition primed decision making) in human factors, decisions for which action alternatives are derived from recognition of critical information and prior knowledge. Human uses intuition in what they are doing well [8]. Klein [1] further explained that intuition allowed experienced firefighters to see a new situation as typical, thus automatically generating a course of action. This is unlike inexperienced firefighters, who may be lost when facing new situations. Schemas may be applied to stereotypical identities associated with groups, such as information about social positions and stratification statuses, such as gender, race, age, or class [9].

2.2 Dual Theory of Information Processing

Dual theory of information processing claims that human process information using both rational and experiential systems of thought [10]. The rational system is deliberate, effortful, and analytical, while the experiential system is emotional, autonomous, and subconscious [7]. Dissociation between rational and experiential thinking is evident in hedonic psychology. Berridge [12] noted that a person find an object attractive (like) yet denying the desire to own it (want). For example, recovering drug addicts could, through the experimental system, actively seek drugs without consciously being aware of such tendency. In TAT, it is believed that narratives can be used to assess implicit needs or "likes" though indirect reporting [7].

2.3 Information Contents Within Stories

According to Klein [1], stories contain information such as agents, predicaments, intentions, actions, objects (tools), causality, context, and surprises. In analyzing user activities, Carroll and Rosson [13] observed that stories contain the following elements: setting, actors, task goals, plans, evaluation, actions, and events. Similarly, in Thematic Apperception Test, stories are believed to contain: dilemma, intention, complications, means, and outcome [7]. Besides information content, mediation between elements within stories reveal: causal relationships, temporal dimension, and themes or lessons behind each story, states of the objects, chronological order of events and actions, actors, causal relationships between pairs of states where each pair can be consider as events, and actions transforming states [1], [2], [11].

2.3.1 Knowledge Within Stories

One of the key strength of studying narrations is in identifying user knowledge. There are two types of knowledge: cultured laws and learnt expertise [2].

Cultured Laws. At noon time, most Chinese would inevitably think about lunch. But a question posed by the author to some Americans asking, "When is lunch time?" was returned with the question, "Are you hungry? We can get a sandwich!" Sandwich is not the author's concept of lunch. In any socializing situation, dining is the standard Chinese activity that binds people in a conversation. These is a case of cultured laws

governing our lives. Narrations can act as a valuable window to understand social laws and motivations of actors [2].

Learnt Expertise. Stories can uncover learnt expertise but some of which are deeply hidden away from user consciousness. Such expertise, when uncovered, can be valuable to training or aiding of newer users, or automation of knowledge. Rasmussen uncovered three levels of learnt expertise: Rule-based expertise (If/Then), knowledge –based expertise (analytical), and tacit expertise [14]. Tacit expertise are resistant to being articulated, and is often used subconsciously due to pattern recognition or perceptual motor feel [14]. Tacit expertise are the prime candidate of storytelling technique which differentiate itself from direct interviewing methods.

3 Case Studies

Three separate studies were conducted using storytelling.

3.1 Study 1: Identifying Needs of Older Adults Using Innovations

The objective of this study is to identify the needs driving usage of technologies by older adults. Identified technologies were either very new or unavailable. Therefore, the technique has to cater for future scenarios based on socially valid scenarios. The researchers were interested in what cultured laws and personal interests will be involved in technology usage.

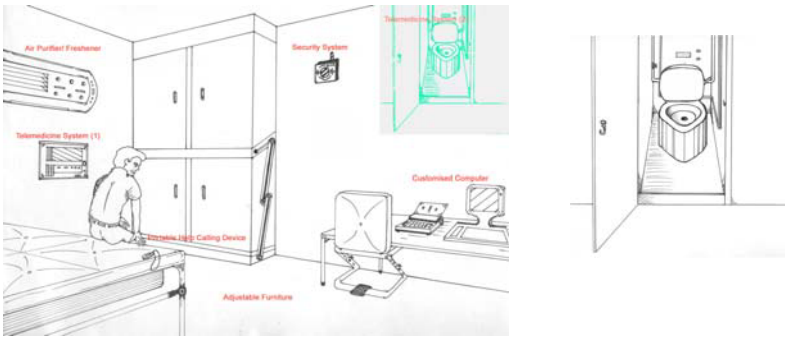

Fig. 1. Illustrations of stimuli used in the projective tests

Sixteen older adults were interviewed at their home. Their characteristics varied widely. Pictures of a person using several home technologies were shown to each older adult, see figure 1. Care was taken that the picture was sufficiently neutral and do not lead the users into predetermined conclusion. This was followed by a question of “how is the man using the device?” After the users had provided a few examples of using a tool, it was sometimes possible to probe the circumstances surrounding

examples. Questions asked included: "Who is he," "what kind of person is he," "what sickness does he have," "where is he going," "how old is he," and "why does he use it in this way?"

Altogether sixteen residents were interviewed. Some were staying with their spouse or children under fifty-five years old. They were mainly middle class. Many were in touch with their children who might give them allowances periodically. Their characteristics varied widely.

Two categories of these data were observed: (1) usability concerns and (2) projected needs. Usability concerns were elements that would enable the products to be more accessible. These were features such as "to be used by children," "fear of using due to lack of knowledge," "to use without being literate," "using conversation to communicate (with sales assistance in teleshopping)," and "to pay (the tools) by installment." There were also projected objects, persons, or characteristics of which users associated with the products in order to come to their conclusions. For example, "(the teleconferencing system) is costly and not for family," "person (who uses teleshopping) is old and uses cane." For the sixteen users, the total number of different needs registered were one hundred and eighty-six.

3.2 Study 2: Identifying Relationships Between Functional Needs of Older Adults

The objective of this study is to identify the causal relationships between smart home functions. Although seven functions were identified out of a previous card-sorting exercise, its unknown how, in the context of activities, these functions would become dependent or overlap with each other in needs satiation. In this case, a third person interviewing technique was used to tell stories of older adults. Since real activities were warranted, stories told were real accounts.

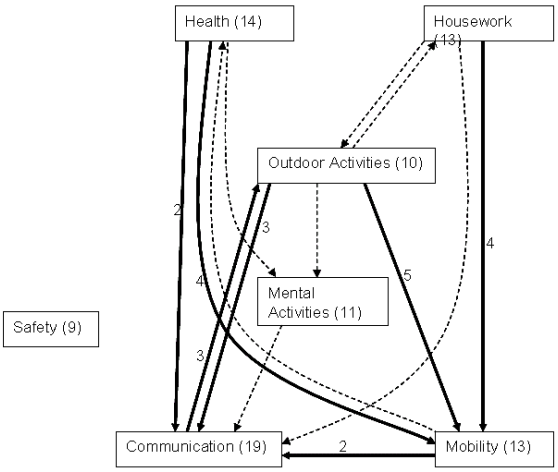

Fig. 2. Causal structure of smart home functions

Nineteen university undergraduate students, eleven males (58%) and eight females (42%), were interviewed. They were in touch with their kins, all above 60 years of age, of which seven were males (37%) and twelve were females (63%). They met their kins at least once every month for the past three years. The subjects were told to write about their kin based on their true experiences [7]. The story should comprise of a series of connected events. The entire story must contain at least one of each seven functions of smart home, namely mobility, communication, safety, housework, mental activity, outdoor activity, and health. But there was no limitation of the number of times each might appear.

A causal structure between functions was identified as shown in figure 2. Each type of relationship, for example communication function causing outdoor activity, outdoor activity causing mobility, or health causing mobility needs to arise, was counted separately. The number beside each arrow shows the number of occurrences in each pair of causal relationships. Many of the relationships were weak with only one case.

3.3 Study 3: Identifying Tacit Expertise Required in Solving a Refinery Incident

The objective of this study is to identify tacit expertise used by a team of refinery operators in solving a particularly refinery incident. Process operations within a refinery is highly team work based. A team of operators worked in differing roles as leader, computer operator, and field operator. A leader is in charge of the entire operation and make major decisions. A computer operator monitors the sensor readings and process conditions. A field operator walks into the plant, monitor the physical instruments and does manual operations. Eight operators in differing roles experience were asked to recall the same incident of how they go about solving the problem.

To explain how things work, the operators tell the story of actions and explained the rationale of these actions [15]. These stories were expressions of the operator's expertise. In order to identify key expertise, the operators were asked to revisit certain parts of the incident. For example, one of the field operator identified a leaked pipe. In an attempt to find out how he did that, he was asked to revisit and deepen that part of the incident. When the operators have difficulties deepening stories, probes were used. Some of these probes were such as: "What were you seeing, hearing, smelling….," "Were you reminded of any previous experience," and "How long did it take actually to make this decision?" [5]. Finally, the operators were asked if they are doing things differently from a novice operator. If so, how is it different. Such as a deepening attempt to elicit critical skills from stories.

4 What Stories Can Tell Us While Direct Questioning Methods Cannot

In some situations, storytelling technique is superior over direct interviewing methods. In direct questioning method, users are asked for their comments on certain issues, such as, "Why do you buy a cellphone?" This question was asked by one of

the master student and he got pretty homogeneous response such as: to make calls, to call someone, to use in emergencies, and so forth. However, there is a good chance these are merely what the users 'believe' and not their real needs. Following are some knowledge which stories are found to elicit but not in direct questioning.

4.1 Personas and Social Undesirable Biases

While most direction questioning techniques were directed at the interviewee, storytelling is especially useful in identifying social norms and realities within the society. In study 1, the response towards a telemedicine device was two widely different personas. In one, the user was "literate" and had "knowledge of computer." In another, he was "old, aching, and walked on cane, and there was no one to help him." Similarly, he could also be sick and "could not walk." Such social realities were inevitably elicited from real experiences surrounding the subject and cannot be dismissed lightly. They can be a start to identify cultural factors that impact on product usage.

Another advantage of third person approach naturally used in storytelling is that users will be forced to use some aspects of their tacit knowledge, which are otherwise difficult to articulate due to reasons such as habituation and social undesirability [1], [7], [8], [16]. For example, people overestimate their willpower, and underestimate their desire to spend, vulnerability to social pressure, and sexual desire [17] Social or personal undesirability means that the respondents reply in a manner that creates positive impression of themselves [16]. Although not all interviews contain social-desirability bias but they were known to be present in socially sensitive issues. These include, but are not limited to: causal factors of charity donation, personal willpower, desire to spend, vulnerability to social pressure, sexual desire, job satisfaction, and sales effort [18], [19], [20]. Nonetheless, since the focus of storytelling is on the story and not on the person, there may be less reporting of personal feelings, especially those related to the character of the person.

4.2 Needs, Goals, and Context

Users inevitably brought up design factors assumed upon the product being discussed. This is because stories forced the storyteller to piece together a coherent and chronological sequence of events which will include the contexts of use. In study 1, usability and projected needs were unintendedly identified. The richness of data that was uncovered by the method provided an opportunity for its complimentary use of SBD (scenario-based design). Storytelling as third person could act as an early endeavor by designers to analyze how products might be used by users, what needs they satisfy, and consider the various design factors to construct usage scenarios for development purposes. From the narration of a culturally ingrained individual, scenarios would be more concrete and realistically bound to real world experiences.

In study 2, one student recalled the scenario where his grandfather had a heart attack at night, and was admitted into the hospital. Due to boredom in hospital, he developed the habit of carrying a cellphone. The cellphone also make it possible for him to assume several of his roles from the hospital bed. From a simple story, we identified the needs, goals, and contexts surrounding a communication technology (cellphone).

4.3 New Themes and Knowledge

Due to the larger degree of freedom for the storytellers, and the challenge of sewing a coherent picture, the storyteller has to inject new sub-themes from cultural personas, actions, artifacts, and cognitive themes to complete the story. Unlike in direct questioning, where the themes are pre-fabricated, interviewees are less likely to bring up unobvious themes. Also the analyst will tend to follow their preconceived thoughts and not venture out to other themes.

In study 3, many operators began with very generic story surrounding the refinery incident. For example, one operator started by saying he heard and saw a leaking pipe in a large multi-level and noisy plant. Only through detailed probing did the interviewer found that he first felt an amount of unnatural vibration in one part of the plant, which prompted him to stop, look and feel around the location. Its only because of his proximity to the leak that he is able to hear the hissing sound and found the leakage. If he had not been an experience operator, he would not be accustomed to the amount of natural vibration within the facility. The location of leakage vibrated more than normal, which first aroused his suspicion.

In order to encourage the insertion of additional themes, interviewers have to encourage the storyteller by suitable probes that trigger the deepening of storylines.

4.4 Activity Scenarios

While products are often designed in accordance to functional needs, these functional needs seldom take into consideration of its relation to the activity it is supporting. Identifying how artifacts mediate within an activity is important to product design. Due to the tight progression of events within stories, there are often enough elements to construct activity scenarios.

In study 2, mobility was found to support most of the current functional needs within the home. It was an end by itself only in one case. But it was the mean to other functions in fifteen cases. Thus enabling the mobility of older adults arguable free them to perform other tasks of daily living. If an older adult has the facility to travel to the nearby clinic, telemedicine devices are being challenge for their usefulness. Similarly, communication function was to be the end in only three cases, but the mean in nine cases. Due to storytelling technique, communication and mobility were found to be the top two enablers of older adults daily living.

As a storyteller develops a story, the interviewer is free to probe other themes relevant to her study. For example, other variables important to construct activity scenarios were personas, artifacts, goals, and cultured laws.

5 Conclusion

Many storytelling methods are still being evolved and we examined only three different methods and their advantages. In these methods, only the principle of having the users constructing story remains, but variations were applied to the technique so that from the stories, the interviewer can achieve her information needs. Some of the variations include, first versus (3) third person perspective (1/2), high level scan (1/2) versus deepening stories (3), and fictitious (1) versus actual events (2/3). Each method has its own strengths and weaknesses and they require further refinement.

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