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A New Perspective on Requirements Elicitation Methods

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Abstract: We open a new area of discussion in requirements elicitation and we argue that a new category of end-users is emerging: wide-audience end-users (WAEU). We propose that current literature does not acknowledge the elicitation needs of WAEUs. To support our argument, we develop a framework consisting of two dimensions, reach and communication, in order to review the literature. Using this framework, we form a perspective on the state of research in the area, and determine that academia is moving in the right direction in the development of new elicitation methods. However, we argue that at the moment, no one method or technique presents an integrated solution. To fill this gap, we present three studies that enable us to argue that WAEUs are reachable, but that more work is needed in the field. We propose some suggestions on how this could be done, and identify three areas needing further research: selection of the participants, representation of requirements across stakeholders, and integration of risk in selecting the elicitation method.

Key words: requirements engineering, elicitation methods, wide audience end-users
**Contribution**

The study makes two contributions.

For academia, we present a framework that extends the discussion within the RE discipline. We present a gap in the literature: the lack of acknowledgement of wide audience end-users in elicitation of requirements. The use of the developed framework results in the state-of-research review. Our argument is that, at the moment, no one method or technique answers to the chosen task, however, we conclude that ideas are evolving in the right direction.

For practitioners, the review presents clear examples of how requirements elicitation can be done with WAUEs and the developed framework presents a simple way of making a rough selection of the elicitation method. We also show what kind of communication flows can be expected from elicitation methods in the six categories.
Introduction

Should not an information system meet the needs of those it aims to serve? To answer this question, researchers have struggled since the dawn of information systems (IS). A separate discipline has emerged from IS to answer these questions: requirements engineering (RE). We want to bring forward a new area of research for the RE community: wide audience end-users (WAEU). We argue that the community is facing a new type of end-users. Wide audience information systems are emerging, such as embedded Java applications for 2.5G and 3G mobile phones or digital TVs for consumer markets. These systems are developed for end-users who are not within organizational reach.

The traditional methods of requirements determination (Davis 1982) no longer assist software engineers in approaching the new type of end-users. To understand what WAEUs needs for IS are we need to include them in the planning and development process (Peppers, Gengler and Tuunanen 2003). Otherwise we will once again face the problems all too familiar with innovation: Prototypes within development process show great promise, but when introduced to markets the products are easily rejected (Peppers and Tuunanen 2002).

RE literature argues that one of the key reasons behind unsuccessful IS projects is a failure in RE (Lyytinen and Hirschheim 1987). Discussion of RE has been lively, focusing on issues surrounding problems in eliciting and managing changing requirements. Requirements are generally specified as something that the product must do or as an objective that it should reach with respect to quality (Robertson and
Robertson 2002). If considered in terms of IS, requirements can also be defined as
descriptions of 1) how the system should behave, 2) application domain information, 3)constraints on the system’s operation, or 4) specifications of a system property orattribute (Kotonya and Sommerville 2002).

Unfortunately, current RE literature does not acknowledge the elicitation method needs
of WAUEs. We will argue that the discipline lacks the means to reach WAUEs and to
understand their needs. We distinguish through a review of literature two dimensions for
filling the gap: reach and communication. Using these two dimensions, we recognize
three areas in the RE literature where researchers have tried to push the limits of the
discipline and reach WAUE needs. Focusing on these two dimensions, we also want to
emphasize the elicitation of requirements versus the determination aspect of previous
studies in IS literature.

We use three studies to form a perspective on the state-of-the-research in the area and
examine how they approached the issue of understanding and reaching WAUEs. As a
contribution of the work, we propose a new perspective on the requirements elicitation
methods discussion: eliciting the requirements of wide audience end-users. With the
perspective, we attempt to identify the future needs of research if it is to successfully
elicit the needs of WAUEs.

We limit our research to a discussion of the dimensions mentioned at a high level of
abstraction. We do not seek to establish a way to select distinct methods or techniques for
a specific type of IS project. Therefore, we exclude the risk (Mathiassen and
Munkmadsen 1986) involved in an IS project, even though we agree that it is an
important factor, as Davis (1982) has already argued.
The structure of the paper is as follows. We begin by reviewing the elicitation methods literature, and follow how the discipline has evolved along with progress in the discussion of information systems development. Then we confront the requirements elicitation needs of wide audience end-users, and examine three studies through a framework based on the previous paragraph. After the review, we discuss the results of our study, and present conclusions and future research topics.

**Review of Requirements Elicitation Methods**

Requirements engineering can, probably best, be described as a process. One good description is the overview by Pohl (1994): the three dimensions of requirements engineering. His framework assumes that requirement specifications are developed through a process that leads from vague ideas presented in textual languages and without consideration of agreed upon viewpoints into a desired end state, where there is a common agreement on a set of relatively formalized requirements that serve as a blueprint for IS design and implementation.

These three dimensions can be characterized as follows. The *specification* dimension deals with the methods used to gather and organize requirements from the stakeholders. It considers the viewpoints needed to understand the needs of various players and the capabilities of the methods. The *representation* dimension handles the requirements gathered using some form of either diagrammatical notation or natural language prose. In this dimension, the relevant issues are for example the ease of understanding of the representation, its compactness, etc. The third one, the *agreement* dimension, approaches
the issue of reaching a common agreement on the key requirements and the goals. (Pohl 1994)

Our paper examines the first phase of requirements engineering: elicitation of requirements or as Pohl (1994) described it specification. Various methods are used for elicitation. Textbooks often mention interviews, scenario analysis, use-cases, soft systems methods, observation and social analysis, ethnographic analysis, requirements reuse and prototyping. The number of techniques and methods developed for this is almost unlimited. Nuseibeh and Easterbrook (2000) have developed a classification of methods according to the needs of the project. They divided the methods into six metagroups of 1) traditional techniques, 2) group elicitation, 3) prototyping, 4) contextual techniques, 5) cognitive techniques, and 6) model-driven techniques. These are described in table 1.

Our purpose is to go through these six metagroups of the methods by examining how they fit the elicitation requirements of WAUEs. However, we need to set our own requirements for the methods first. We demand two things. The first is reach. As a meaningful tool in this task, we use a framework developed by Hickey and Davis (2003), which is based on the earlier work of Dean, Lee, Pendergast, McKey, and Nunamaker (1998). They have used three dimensions of reach: 1) user representation, 2) user groups, and 3) user community, with the analyst-designer team being the heart of the enlarging circles of user dimensions.

The second demand is communication. If we limited our research to a study of what elicitation methods are used for reaching end-users, we would not move from “capture”

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1 We prefer the term “elicitation” to “capture” or to “determination”, which are used commonly in IS, to avoid the suggestion that requirements can be collected by simply asking the right questions (Jirotka, M. and J. Goguen, Requirements Engineering: Social and Technical Issues, Academic Press, 1994).
to “elicitation”. We need something more. Pohl (1994) has described this with his presentation and agreement dimensions. We simplify this to a higher level of abstraction and discuss only communication. Furthermore, we see that two-directional communication should be emphasized with the elicitation of requirements. Pohl (1994) has emphasized this earlier with his representation and the agreement dimensions. Communication between the end-users and designers is a complex problem, and it is even more difficult to describe it. Hence, we settle on seeing whether the literature supports single- or two-directional communication between the stakeholders.

**Categories of elicitation methods**

Now we are ready to start our literature review through the six categories with the aim of finding elicitation techniques satisfying the two demands we have set for feasibility: reaching the user community level of reach (WAUEs) and two-directional communication for understanding wide audience end-users (elicitation).

**Table 1 Six categories of elicitation methods, extended from (Nuseibeh and Easterbrook 2000)**

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<tbody>
<tr>
<td>Technique examples</td>
<td>Questionnaires and surveys, interviews, and analysis of existing documentation.</td>
<td>Prototyping the early versions of user interface.</td>
<td>Group techniques: brainstorming, focus groups, and RAD/JAD workshops.</td>
<td>Ethnographic techniques such as participant observation.</td>
<td>Protocol analysis, laddering, card sorting, and repertory grids.</td>
<td>Goal-based methods and scenario-based methods.</td>
</tr>
<tr>
<td>Reach</td>
<td>Mainly user reps</td>
<td>User reps</td>
<td>User groups, User community?</td>
<td>User reps, User community?</td>
<td>User reps, User community?</td>
<td>User reps</td>
</tr>
<tr>
<td>Communication</td>
<td>Single-directional with the exception of interviews</td>
<td>Two-directional</td>
<td>Two-directional</td>
<td>Single- and Two-directional</td>
<td>Single- and Two-directional</td>
<td>Two-directional</td>
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We start our review of the categories of table 1 from the early days of IS, when the development style was generally called “code’n’fix”, i.e., some coding and later some
fixing. Designers were, in most cases, actually the end-users of the developed system. Hence, the need to actually elicit information from the end-users was limited. Even though much design work is probably still done this way, the IS discipline has at least made progress in methods developed for more productive ways of working.

**Traditional Techniques.** As projects became more and more complex, more needs to organize the development work also arose. The “waterfall” process was adapted, and development work was thought of a process; when one phase is concluded the next one begins in a linear timeline (Sommerville 2001). With the waterfall, we also started to see more actual attempts to elicit the requirements. These early elicitation methods are nowadays called *traditional techniques* (Nuseibeh and Easterbrook 2000). These include a broad class of generic data-gathering techniques such as questionnaires and surveys, interviews, and analysis of existing documentation such as organizational charts, process models or standards, and user or other manuals of existing systems.

If we look at these traditional techniques through the selected axis of reach and communication, we may claim that they are mainly single-directional. We see that most of them are based on the assumption that the analyst-designer team studies material already produced, or in the best case sends surveys containing predefined questions. Of course, interviewing is always a two-directional event between two or more persons. However, the question of how well the interview is transcribed remains open. This clearly affects the communication capabilities of the elicitation method with other stakeholders.

The traditional methods have a rather broad selection of reach. They range from research on the documentation to surveys sent to the user community. The user groups are not
specifically included in this category, although one can also argue that, for example, interviews can be made with both user groups and user representatives. However, with respect to eliciting information from user groups, we describe a situation in which many interviewees provide information simultaneously, and therefore we will not extend the reach of interviewing to user groups. Somewhat later, we will take up this issue more thoroughly with the group elicitation techniques.

At this time, researchers started to distinguish that involving the end-users within the organization boundaries would improve the quality of the information system delivered (Davis 1982). This also raised demands to make ISD methods more flexible and shifted the emphasis from heavily structured models to iterative process models that focused on evolving software specifications developed continuously with the software. Process models based on prototyping, increments, and spiral development (Boehm 1988) have evolved through this discussion.

These more modern methods provided an opportunity to reduce the redesign in a software process, which are typically present with the waterfall, and at the same time give customers an opportunity to delay some decisions on detailed requirements until experience had been obtained (Sommerville 2001). Hence, the process of development, validation and integration can continue until the delivered increments form a complete product (McConnell 1996).

**Prototyping.** The requirements elicitation methods started to evolve towards answering these new needs, and one of the early adaptations was *prototyping*. Prototyping is a good method for getting feedback from end-users. It is obviously a two-directional method, based on close interaction between the analyst/designer and the end-user. If viewed from
the formal perspective of requirements engineering, the issue can be fuzzier. The interaction situation with paper or a real prototype of the developed system may require low formality to be successful. However, with prototyping the requirements are clearly communicated between the participants of the sessions, but remain open if the same clarity can be achieved with other stakeholders.

The limitations of prototyping in the reach dimension are similar. The interaction needed for prototyping limits it to use with representatives of users, rather than with many users. It appears that prototyping can also be readily combined with other techniques, for instance by using a prototype to provoke discussion in a group elicitation technique or as the basis for a questionnaire or think-aloud protocol (Davis 1992). If so, prototyping’s reach could be extended to include user groups, but hardly to include the entire user community. We remain conservative with our categorization, and limit the reach to the user representation level. Next we move into the group elicitation techniques.

By using group elicitation techniques, organizations were able to include more people in the development of information systems. However, more was needed, and it was considered essential that the designers would receive support from the organization for the IS development project. Nevertheless, there was no common definition how users should be involved (Carmel, Whitaker and George 1993). To solve this problem, many discussions arose, one of them being participatory design (PD) (Bratteteig 1994) and another joint application development (JAD) (Clemont and Besselaar 1993). According to Carmel (1993), these both approach the same issues: user participation and involvement. In the following, we take a look at the PD- and the JAD-oriented techniques that have been applied to requirements elicitation.
**Group elicitation techniques** contain a wide range of methods, the purpose of all of which is to elicit requirements from groups of end-users. Group techniques aim to foster stakeholder agreement and buy-in, while exploiting team dynamics to elicit a richer understanding of the needs. They include, for example, brainstorming and focus groups, as well as rapid application development (RAD) / JAD workshops (Liou and Minder 1994) and group support systems (GSS) workshops (McGoff, Hunt, Vogel and Nunamaker 1990).

Communication is a combination of group dynamics and personal communications between participants, i.e. it is unmistakably two-directional. The variation between methods arises from the freedom of communication and the integration of the methods in systems design. The first examples, brainstorming and focus groups, are not specific methods for ISD, but commonly used techniques from within the marketing discipline for developing new products (McQuarrie and McIntyre 1986). The RAD/JAD, in turn, are more design-oriented techniques. The latest arrival in this category, GSS, has been developed to solve group communication problems by bringing efficiency and anonymity to group sessions. We will take a closer look at this latest arrival, as it seems interesting for our task of reaching and understanding WAUEs.

Many researchers (e.g. Herlea 1998 and Davison and Briggs 2000) have applied the GSS method to requirements elicitation. It is said to be very adaptable to this problem environment, but the integration of the GSS and software engineering process has been seen as a bottle-neck. For this, Briggs and Gruenbacher (2002) have created a solution that integrates the WinWin spiral model of developing software (Boehm 1988 and Boehm et al. 1998). The EasyWinWin tries to combine the integration and two-
directional communication that are the key features of a method for eliciting the requirements of WAUEs.

With all of these methods, however, we are reaching groups of people, but not reaching all of the user community, i.e. the WAUEs. If we select EasyWinWin, we would still not reach the desired level. Hence, we need to extend it with the research of Herlea, Eberlein, Shaw and Gaines (2000). They have reported using a commercial software package to create distributed GSS environment. Now we have found something that interests us. We will select this combination for a closer look and return to it in the next section where we discuss how to reach and understand WAEUs.

**Contextual Techniques.** Here, however, we return to the issue of how to enable a participative design process. The group elicitation methods have been one answer to the problem, but others have also been developed. These all try to obtain requirements information from end-users by enriching communication. First, we will take a general look at the *contextual techniques*.

Contextual methods emerged in the 1990s as an alternative to both traditional and cognitive techniques (Goguen and Linde 1993). These include the use of ethnographic techniques, and ethnomethodology and conversation analysis, both of which apply fine-grained analysis to identify patterns in conversation and interaction (Viller and Sommerville 1999). We will raise one above the others as an example of the genre, and take a closer look at it.

It may be argued that contextual design (CD) (Holtzblatt and Beyer 1993) draws a lot from both the American JAD/RAD and the Scandinavian PD literatures. We will not consider the methodological backgrounds further, but lift forward the core of the
contextual design thesis, which can also be used as a general goal of the contextual methods. Holtzblatt and Beyer (1993) have stated three general guidelines for their method: 1) the best product designs happen when the product’s designers are involved in collecting and interpreting customer data and 2) they can really understand what users and customers in fact need and 3) desire and see yourself as an apprentice of the customer and not as a teacher.

The previous theses bring answers to our two demands. First, the communication is clearly two-directional as the guidelines argue. The example technique also emphasizes the communication of requirements to the other stakeholders (Holtzblatt and Beyer 1993). The other methods mentioned originate from the social sciences, like conversation analysis, and take a more observing approach (Viller and Sommerville 1999). Hence, the contextual techniques may also be said to be single-directional.

Reach is extended to the individual user representatives, even though it may include as many end-users of the system as needed. Usually, however, the literature suggests that the number of participants is low (Holtzblatt and Beyer 1993 and Beyer and Holtzblatt 1995) and the target groups are within the organizational barrier. However, as with the GSS research at least one study shows signs of breaking out of this. Fouskas, Pateli, Spinellis and Virola (2002) have tried to take the contextual design’s elicitation method outside of the organization. In addition, Tuunanen, Nielsen and Mallat (2003) have dealt with this issue, and present a way to refine the selection of the participants. Hence, we see that we have to return also to this category in the next section, i.e., we will select this research from the literature review to consider whether it could be used for wide audience end-user requirements elicitation.
Cognitive Techniques. We already mentioned cognitive techniques in the previous section. These are a series of techniques originally developed for knowledge acquisition (Shaw and Gaines 1996). They include protocol analysis (in which an expert thinks aloud while performing a task to provide the observer with insights into the cognitive processes used to perform the task), laddering (using probes to elicit the structure and content of stakeholder knowledge), card sorting (asking stakeholders to sort cards into groups, each of which has name of some domain entity), repertory grids (constructing an attribute matrix for entities, by asking stakeholders for attributes applicable to entities and values for cells in each entity). The cognitive techniques have been traditionally used in marketing (e.g. Reynolds and Gutman 1988; Gengler, Howard and Zolner 1995).

The methods usually deal with individuals and the user representative level of the reach dimension is the most natural. The reach varies quite dramatically within the groups’ techniques, but it can still be argued that all the techniques are based on single-directional communication between stakeholders. One good example can be taken from laddering (Gengler, Howard and Zolner 1995).

Laddering would not attract our attention if researchers had not have tried to push the level of reach further. Peffers, Gengler and Tuunanen (2003) have experimented with the ideas of using lead-user (von Hippel 1986 and Rogers 1995), i.e., wide selection users who represent the “trend-setters” in the end-user target audience. By using these selected users, the requirements of the user community, i.e. WAUEs, can be elicited (Peffers, Gengler and Tuunanen 2003). Furthermore, the researchers (Peffers and Tuunanen 2002) have argued for making communication two-directional between stakeholders with improved visualization of the aggregated requirements (Gengler, Klenosky and Mulvey...
1995). We also select this piece of research for further inspection and will examine it more in the next section.

**Model-driven Techniques.** We have one more category to examine: *model-driven techniques*. We take up this one last, because it differs from the rest in its approach to elicitation of requirements. The techniques usually provide a specific model of the type of information to be gathered, and use this model to drive the elicitation process. Nuseibeh and Easterbrook (2000) have given as examples goal-based methods (e.g. van Lamsweerde, Darimont and Letier 1998; van Lamsweerde and Letier 2000) and scenario-based methods (Maiden et al. 1999 and Maiden 1998) as examples.

The nature of the approach of model-driven techniques makes it necessary to limit reach to user representatives. The technique, like KAOS developed by (van Lamsweerde, Darimont and Letier 1998), requires a thorough knowledge of the domain area of the system or a high level of knowledge of work practices. This is something that the end-users at community level will hardly posses.

The communication between the analyst and the user etc. is intensive, and can even be compared the previously mentioned CD method in some perspective, i.e. we categorize them as two-directional. The techniques requireformulating very exact descriptions of the requirements, as with use cases and Unified-Modelling-Language (UML) (Stevens and Pooley 2000). The techniques actually thrive in the communication of information between the developers. However, it may be questioned if the formal languages are comprehensible for end-users or other stakeholders.
**Confronting Requirements of Wide Audience End-Users**

Now, we confront the gap in the RE literature in acknowledging the elicitation of requirements of WAUEs. We do this by using the dimensions of reach and communication, which we defined earlier. Figure 1 represents the findings of our literature review. It combines the three levels of reach: user representative, user groups, and user community (WAEU), with the analyst-designer team in the middle. In addition, we have included the findings of the review by using single- and two-directional arrows presenting the communication capabilities of the technique categories.

The gap in the literature is depicted with dotted arrows. We claim that the current literature does not explain how we can move along the reach dimension as described in the figure. However, we argue that the three categories marked with the question marks offer potential for the elicitation requirements of wide audience end-users: group elicitation, contextual, and cognitive techniques. We base our argument on the two-directional communication capabilities of the categories that we found, and more importantly on the extended reach to user community level, i.e. wide audience end-users level.

In the next section, we take a closer look at the three specific elicitation techniques in the three categories that we found promising during the review: group elicitation, contextual, and cognitive techniques. We aim to examine how they have tried to reach WAUE and also understand their requirements by using two-directional communication.
Figure 1. Three prospects of elicitation methods for use with wide audience end-users based on (Hickey and Davis 2003), (Dean, et al. 1998), and (Nuseibeh and Easterbrook 2000).

**Group Elicitation Technique – EasyWinWin with an Extension**

The collaborative group requirements elicitation technique, EasyWinWin, consists of nine steps. A key goal of the method is reducing the cognitive load associated with complexity in the requirements definition task without losing or overlooking any of the richness of interrelationships among concepts incorporated in the requirements deliverables (Briggs and Gruenbacher 2002). Two-directional communication is achieved by using computers as information mediators. Briggs and Gruenbacher (2002) do not discuss distributed elicitation of requirements. However, Herlea, Eberlein, Shaw and Gaines (2000) have proposed a distributed way of elicitation by using World Wide Web applications.
Next, we will first briefly explain what a group support system is, and then go through more thoroughly how EasyWinWin is said to support the two-directional communication. After this, we will try to extend it by adding length to the method’s reach.

Group Support Systems are software tools used to focus and structure group deliberation, reduce the cognitive cost of communication, and ease the burden of information access as team members make a joint cognitive effort towards a goal (Davison and Briggs 1997). The use of GSS in eliciting requirements started in the beginning of 1990s with studies of joint application development (e.g. McGoff, Hunt, Vogel and Nunamaker 1990; Carmel, Whitaker and George 1993; Liou and Minder 1994). As a result of these studies GSS usage in requirement engineering is nowadays considered one of the work-horse methods in the field.

EasyWinWin is grounded on research done in the spiral method of developing information systems, and extends it with collaborative knowledge techniques and group support systems. In the WinWin negotiation model, the objectives of stakeholders are captured as win conditions. Conflicts among win conditions are recorded as issues. Options are proposed to reconcile issues. Agreements are developed out of win conditions and out of options by taking into account the preceding decision process and rationale. Then GSS is used to create repeatable patterns of group interaction in order to create collaborative methodologies that produce deliverables of consistent quality and detail.

EasyWinWin is argued to help a team of stakeholders to gain a better and more thorough understanding of the problem and supports co-operative learning about other's viewpoints. Briggs and Gruenbacher (2002) assert that development teams using the
method will produce a shared project vision, high-levels requirements definition, detailed requirements for features, functions and properties, and requirements for transitioning the developed system to the end-users.

The negotiation model of the EasyWinWin is described in table 2. The nine steps describe how requirements can be elicited with GSS. The initial step is to engage the most influential users. These are stakeholders who play a significant role in decision-making (Briggs and Gruenbacher 2002). This is a somewhat problematic issue if we consider that WAEUs as the end-users maybe very widely distributed. Who can we see as the key stakeholders? Clearly, this is a limitation of the method to be considered later with the reach dimension.

Next, the selected participants share an outline that is used as a basis for a brainstorming session to generate new ideas. Now we are actually approaching two-directional communication. Sharing ideas and then innovating new ones is something that will no doubt extend the understanding of all participants. The following step starts the process of choosing which requirements are the most beneficial. This process continues by development of shared key terms, and in step 5 by prioritizing the requirements. The process continues with dealing constrains and hidden agendas.

**Table 2 Nine stages of EasyWinWin, adapted from (Briggs and Gruenbacher 2002)**

<table>
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<tr>
<th>Step</th>
<th>Description</th>
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<tr>
<td>Step 0.</td>
<td>Engage the success-critical stakeholders. Identification of stakeholders –</td>
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<td>finding the correct participants for successful decision making. These</td>
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<td>should be defined for each cycle in spiral model.</td>
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<tr>
<td>Step 1.</td>
<td>Refine and Expand Negotiation Topics. Presenting participants a shared</td>
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<td>outline of the system that is further refined by the group.</td>
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<td>Step 2.</td>
<td>Brainstorm Stakeholder Win Conditions. Using GSS for brainstorming new</td>
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<td>ideas.</td>
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<td>Step 3.</td>
<td>Converge on Win Conditions. Reducing the number of artifacts by producing a</td>
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<td>concisely worded, non-redundant and unambiguous list of win conditions.</td>
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<td>Step 4.</td>
<td>Define a Glossary of Key Terms. Producing key terms, jargon, used for the</td>
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<td>particular project.</td>
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Step 5. Prioritize Win Conditions. Rating win conditions by two measures: a) business importance and b) ease of realization.

Step 6. Surface Issues and Constraints. Going through constraints and hidden agendas of participants for the requirements by using polling.

Step 7. The WinWin Tree: Win Conditions, Issues, Options, Agreements. The team goes through a shared outline, WinWin Tree, in order to resolve interdependencies with other win conditions.

Step 8. Organize Negotiation Results. Producing an aggregated taxonomy of individual WinWin lists.

The last two steps concentrate on representation of the requirements (Pohl 1994) if the previous ones were elicitation and agreement. The researchers (Briggs and Gruenbacher 2002) have therefore managed all the three dimensions (Pohl 1994) in their model. We conclude that the technique provides a rich set of different techniques to facilitate two-directional communication. We will now discuss the reach dimension.

The reach dimension of the group elicitation techniques usually comprises the user groups, as discussed earlier. We also notice that the EasyWinWin limit the participation to this level (Briggs and Gruenbacher 2002). Hence, we need to extend the scope of our research. Herlea, Eberlein, Shaw and Gaines (2000) have used a GSS software suite to do distributed requirements elicitation. The reported technique uses World Wide Web as a user interface for the participants. The study identified a particular distributed group configuration that significantly improved performance and was more conducive to negotiation than face-to-face meetings. We were not able to find literature discussing how to select participants for the distributed requirements elicitation process. We cannot, therefore, suggest how to choose the key stakeholders. This was a goal set in the previous section. Even though Herlea, Eberlein, Shaw and Gaines (2000) do not raise the issue of involving WAUEs in the requirements elicitation, we see the potential for expanding reach with the WWW technology.
By combining the two studies mentioned above, we assert that the two demands that we made can be met. The two-directionality of the communication dimension can be accomplished by following the EasyWinWin process (Briggs and Gruenbacher 2002). The intensive process described (table 2) surely creates potential for end-users and analyst-designer team to understand each other. Secondly, reaching WAUEs is possible with Internet technology like the WWW. Next, we make a move into contextual technique category and see how the researchers have approached the issues of communication and reach in that area.

**Contextual Technique – Contextual Inquiry**

For this category, we found a work that tries to extend the reach of the contextual inquiry (CI) (Fouskas, Pateli, Spinellis and Virola 2002). The CI was originally developed to collect contextual data from the end-users of the organizations while they work with real tasks in their workplace on a day-to-day basis (Holtzblatt and Jones 1996; Beyer and Holtzblatt 1995). With this technique, we concentrate on reach, and present that this area needs more attention, because the reach of the contextual techniques is usually the user representative level.

Contextual inquiry was developed to be part of the contextual design and as the primary tool in CD for elicitation method of requirements (Holtzblatt and Jones 1996; Beyer and Holtzblatt 1995). It collects the requirements by supporting end-user in explaining their work processes. This is done contextually by collecting information from the end-users while they work with real tasks in their workplace on a day-to-day basis. The cross-
functional design team conducts one-on-one field interviews with customers in their workplace to discover what matters in their work, taking the role of apprentice.

Apprenticeship is a key thesis of CI. Beyer and Holtzblatt (1995) have argued that only by being able to see the work and tasks done can the designer really understand the process; customers are experts in their own work. In turn, the designer has to be an expert in the structure of the work and the technology needed to support it. This all calls for use of the apprenticeship model, which address the problem of requirements definition by creating an effective relationship between designers and customers.

Later, CD was developed to address the full design process by including affinity diagrams for the whole team that is involved in the work process. The affinity diagram organizes individual notes captured during a session into a hierarchy revealing common issues and themes. After this stage, the process continues by work modelling and redesign and finally the design of the system or application itself. (Holtzblatt and Beyer 1993; Holtzblatt and Beyer 1998)

We can see that the communication dimension has been taken into account effectively with the technique. It has emphasized the relationship between the end-user and the designer. Nevertheless it can be asserted that the apprenticeship model of eliciting the requirements is single-directional, as the designer is the apprentice of the end-user. The CD process as a whole makes it more two-directional with the use of affinity diagrams and other group working techniques. Hence, we conclude that CI, with the inclusion of the group decision aspects of the later CD process, is a two-directional technique. We do acknowledge the limitation of pure CI, and argue that it should not be separated from techniques that provide feedback back and forth between the participants in the process.
Now we turn back to the main focus of the paragraph, and see how Fouskas, Pateli, Spinellis and Virola (2002) have tried to extend the reach of CI. The study extends CI from the user representative level to the user community level or to the wide audience end-users level as we prefer to call it. The main contributions of this study broaden the participation beyond a single focused group to a variety of actors and to simultaneous observations with different participants within same physical area. In addition, they divided the elicitation into two separate phases. We will continue by first reviewing the research done and then by discussing how the extended CI could help the IS community to reach the user community dimension. We also point out some limitations of the extended model and suggest how these might be overcome.

We start by looking at the setting of the empirical work. It was done in an exhibition area with the target of developing mobile services for both exhibitors and visitors of the fair in question. Both groups of research participants were first given a warming up interview, and afterwards their use of services was observed (phase A in figure 2). Observation was further divided into regular contextual inquiry style observation during working and shadowing, which was used with visitors. Shadowing involved following the visitor while he or she used the service during the fair.

The next step was post-observation interviews (phase B) with the same participants. These contained discussions of system propositions and questions raised by the earlier phase, in order to respond to four distinct areas: acceptance of proposed services and changes in these, services to be abandoned, and new service ideas. After the elicitation phases, the study continued with interviews of fair organizers to form a unified
requirements report according to IEEE standards, which was claimed to be an important feature of the method developed.

The extended model tries to accommodate the needs of two-directional communication. The view is, however, more of a designer than an end-user understanding. The validation is done by the analyst and the end-users during the research, in phase A with the post-observation interviews, and later in phase B when the requirements are stabilized and decisions have been made on services or on improvements of the old ones.

![Figure 2 Applying Contextual Inquiry for requirements elicitation, modified from (Fouskas, Pateli, Spinellis and Virola 2002)](image)

Figure 2 Applying Contextual Inquiry for requirements elicitation, modified from (Fouskas, Pateli, Spinellis and Virola 2002)

The extended contextual inquiry can be a useful tool for developing services targeted at wide audience end-users such as exhibition participants (Fouskas, Pateli, Spinellis and Virola 2002). This is in line with a study made earlier, which aimed to develop a mobile device with multiple applications, the Nokia Communicator 9000 (Väänänen-Vainio-Mattila and Ruuska 1998). However, they (Fouskas, Pateli, Spinellis and Virola 2002)
also distinguished areas of serious problems. One of the areas was that the visitors had a very limited frame of reference, knowing only what they have experienced, as suggested earlier by (Ulwick 2002). Similarly, they regarded the lack of knowledge of emergent new technologies as especially problematic.

The contextual inquiry, or observation, also proved difficult to do in practice as participants were reluctant to be followed. In addition, they emphasized the right selection of persons to do the contextual inquiry. According to the researchers, it should include a wide selection of members from the organization doing the development, such as business managers and software developers. Other researchers have also questioned the contextual design’s superficial look at work practice and attempts to develop a new system based on this (Hartswood, et al. 2002).

Now we return to the issue of reach. The reach of the contextual techniques has usually been the user representative dimension, i.e., a selection of key stakeholders. The limitations are the same as those with the group elicitation techniques: how we can select the key stakeholders to represent the distributed end-users? Tuunanen, Nielsen and Mallat (2003) suggest a theoretical way of doing this. Their research extends the CI study by using lead-users (von Hippel 1986). This research is based on the work of Rogers (1995), who showed that early diffusion of an innovation follows a pattern that can be used to forecast later diffusion. Recognition of what lead-users demand from innovative products could lead to forecasts of what remaining users will demand.

Now we move to the final section of our quest, cognitive technique, and see how researchers have dealt with the issues with which we are already familiar: two-directional communication and reaching the user-community.
Cognitive technique - Critical Success Chains

Here we present the third method we review: Critical success chains (CSC) (Peffers, Gengler and Tuunanen 2003). This method combines theories from the information systems and marketing disciplines to provide a solution for elicitation and analysis of requirements. We initially briefly review the research done in the area so far and see how this connects with the other two found elicitation techniques in terms of the two dimensions and the selection of participants.

CSC is based on two theories, critical success factors (Rockart 1979) and personal construct theory (PCT) (Kelly 1955). PCT is a social scientific theory, which asserts that we understand the universe through our individual observations and interpretations of events, and are therefore able to predict and control our individual environments (Pervin 1993).

The CSC method is divided into four distinct phases with two of the first ones concentrating on eliciting the requirements. The study begins with the selection of participants. With the first studies, the selection was made by choosing participants from all levels of the organization (Peffers, Gengler and Tuunanen 2003). In a later case involving the development of mobile financial services (Peffers and Tuunanen 2002) the perspective was altered as the target audience for the developed system was consumers. Researchers selected lead-users as participants. In this case, selection of participants was made with the snow-ball method i.e., known innovative lead-users recommended other ones. Even though this approach does not produce a random selection of participants, the results of the study were promising (Peffers and Tuunanen 2002), because the participants were thought to fairly represent the targeted group of lead users.
Consequently this method shows potential in extending the reach of cognitive techniques to the user community level and to WAUEs.

Now we return to the communication dimension. How is this handled with CSC? In general, data collecting methods based on PCT seek to elicit information about people's knowledge structures by observing how they differentiate among stimuli collected in the pre-study phase. The method used with CSC for observing the difference is ‘laddering’, which was developed in marketing. It has been used to model consumers’ value structures related to preferences for products and their features.

When using a laddering method, respondents are given a choice task; they are asked which of the three products they would most prefer to have. Then, they are asked why they prefer the one chosen. When the respondent replies with a reason, the interviewer repeats a series of “Why is that important?” questions. Typically, respondents reply with a series of concrete reasons why they prefer one object to another. These “why…” questions help uncover the more abstract values which are the bases for their rationales (Reynolds and Gutman 1988). These chains of features, reasons, and values uncovered through the laddering process are analyzed into consistent constructs across participants and used to produce network models of how participants interrelate the constructs (Gengler, Klenosky and Mulvey 1995).

After eliciting requirements, the data are analyzed by clustering the developed constructs in order to present an aggregated view of the system. The results of the analysis are called critical success chains maps. The maps are later introduced in a workshop where technical professionals use their expertise to produce feasible project ideas to accomplish objectives implicit in the CSC models.
The final system propositions resulting from the workshop are used in planning the development of new product features that have potentially high value for customers. By using rich, explicit models of the relationships between product features, expected consequences, and personal values, product engineers can develop ideas for new product features that target the most important such relationships for their customers (Peffers, Gengler and Tuunanen 2003).

Through the chain of refining the information, the CSC seeks to answer the needs of two-directional communication. We think that it does, but we note that it also raises a new issue: the use of rich information (Peffers and Tuunanen 2002). We should also raise a limitation of the CSC. Briggs and Gruenbacher (2002) and Fouskas, Pateli, Spinellis and Virola (2002) have pointed to the need for methods to be integrated with the general RE process. Until it is so integrated there remains a barrier to the widespread adoption of CSC by practitioners.

**Discussion**

Our study shows that even though the discipline is beginning to face the new needs in eliciting the requirements of wide audience end-users, it still lacks a common view of how this could be achieved. We argue that more is needed. In addition, we see that the issue is not simply a question of the two dimensions of reach and communication, but a problem that involves many perspectives.

The review of the elicitation methods presented us with a wide spectrum of different elicitation methods for which practitioners and academics alike can choose from. We selected two dimensions of the methods as our filtering tool to make visible those
categories of methods that could hold promise for our purpose. The dimensions of reach and communication proved usable in this task, and we found three categories of interest: group elicitation, contextual, and cognitive techniques. The methods in them in general fulfilled the demands that we presented.

We argue that for a method to be feasible in elicitation of the needs of WAUEs, it should be two-directional in communication so that the stakeholders will understand each other. We showed a gap in the literature regarding reaching of WAUEs, as not one technique or method is currently ready for use in information systems development. The three studies found show that academia seeks to extend the reach and grasp requirements of WAUEs. However, for now, they do not offer a complete solution for this. The research is not now coherently aiming at an integrated answer to these needs.

We present that any of the three elicitation techniques presented show potential for providing solutions to the two demands that we have raised. The reach problem has been tackled, and some promising results have been presented. The authors contend that, EasyWinWin, extended with the World Wide Web technology, is an interesting solution for reaching the highly distributed wide audience end-users. The problem of finding the right stakeholders is raised by the contextual study, which found that lack of knowledge on the part of the end-users blocks innovative ideas from the end-users. There, we proposed as a solution the lead-users concept, which researchers have later tested successfully in the cognitive study.

We also see limitations in using the lead-users. The problem of finding the right stakeholders will not vanish if we use the lead-users, far from it. The literature offers no good way of finding lead-users. The marketing literature speaks of customer
segmentation, and this makes the quest easier. Well, now we have may found the barn with hay in it, but it is still a major task to find the needle within the hay, i.e., the lead-users of the selected customer segment.

The literature shows that the two-directional communication task has also been well thought out. All three studies have emphasized trying to facilitate two-directional flow of information between the stakeholders just as Pohl (1994) argued they should. The agreement dimension (Pohl 1994) is clearly visible in all three, even though they approach the issue from different perspectives. The representation of requirements is tackled from two angles in the literature reviewed. The first two see the major problem to be the presentation of the requirements in a format which the analyst-designer team understands. They emphasize use of the standards confirmed by IEEE. The cognitive technique, in turn, has another approach to resolving the issue. The researchers argue for using rich enough information to facilitate information flow between the end-users and the analyst-designer team (Peffers and Tuunanen 2002). We do not consider this to be contradictory, but rather as a view that should be taken into account in the field in future to meet the complex demands of the communication.

**Conclusion**

We questioned in the beginning whether it is the task of IS to meet the needs of those whom they aim to serve. We discussed the RE discipline, which has sought an answer to this problem, but opened the community to face a new emerging problem: how to elicit the requirements of wide audience end-users. The current RE literature does not give direct answers to this question.
For this new perspective of requirements elicitation, we proposed using methods originating from the three categories of requirements elicitation: group elicitation, contextual, and cognitive techniques. We supported our arguments with a two dimensional framework: reach and communication. We have showed that all three ways of elicitation have potential for eliciting the requirements of WAUEs.

We have also pointed out that all these, even though seen as state-of-the-art research, have limitations that should be recognized in order to form a method or technique for understanding and reaching wide audience end-users. The fact that we were not able find a single method that would completely satisfy the demands we have raised is a major concern. The positive side is that the literature reviewed shows that the RE community has realized the new needs and that research is being done in the area.

Two limitations are important in using current methods to elicit the needs of WAUEs: the selection of participants and representation of the requirements. In both these areas, researchers have tried to present solutions. We see potential in the way that Peffers, Gengler and Tuunanen (2003) have tackled this issue. However, we also acknowledge the limitations of the way in which they selected the participants, i.e. snow-balling. This may still be one way of doing it, but we expect better ways to emerge.

We see the representation of the requirements, as another limitation in the literature. It seems that the views of the software engineers and information system scientists conflict here. Where IS researchers (Peffers, Gengler and Tuunanen 2003) are concerned about all stakeholders understanding each other, the software engineers (Briggs and Gruenbacher 2002; Fouskas, Pateli, Spinellis and Virola 2002) see the major concern to be
standardized requirements documents that integrates well with the current practices of RE. We see that the most beneficial way could be something between these two.

We present two results originating from our research as the contribution of our paper. Initially, we argue that the presented framework extends the discussion within RE community, and presents the gap in the current literature. Further more, we assert that the academic community is waking up to the challenges of the emerging wide audience end-users. However, no one method or technique at the moments solves the chosen task. In addition, we see that the limitations in the reviewed techniques also bring contribution to the area requirements elicitation.

For practitioners, our framework presents a straightforward way of selecting the elicitation method according to the reach dimension. It also easily shows what kind of communication flows can be expected from the six categories of elicitation methods. The use of the framework results in the state-of-research review that we have presented. This should also interest the practitioners as the review presents clear examples of how the elicitation of WAEUs can be done.

We acknowledge that the chosen theoretical approach is a limitation of our own work. We rely to the literature of the field. In addition, we have realized that the chosen dimensions of the framework may not be sufficient when practitioners try to select an elicitation method for an IS project.

We call for fellow researchers to join the quest and seek answers to these new areas of requirements elicitation. We see how to combine the views of the IS and the RE communities in representing the requirements as one of the interesting areas. However, it would also be equally important to seek further knowledge of how the lead-users concept
could be used in the area. In addition, we would like to see research done in the area of method/technique selection.

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References


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