"TARGETED SERVICE CO-DESIGN THEORY"

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Citation: Tuunanen, T. and K. Peffers, "Targeted Service Co-design Theory," working draft, The University of Nevada Las Vegas, 2011.

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24 February 2011

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Journal:	*MIS Quarterly*
Manuscript ID:	Draft
Category:	Research Article
Keywords:	design science, participation, IS development, need identification, case study

TARGETED SERVICE CO-DESIGN THEORY

Abstract: This paper uses two theoretical developments, the service-centric logic of marketing and design science research, as the bases to rethink the relationship between service designer and customer. It justifies the need for such a rethinking by noting that service customers and potential customers may lack the requisite motivation, ability, availability, or knowledge to participate effectively in co-design activities. It develops a targeted service co-design theory, i.e. a theory for targeting service co-design activities to specific populations, to address this problem. The elements of the theory are based on four reference theories: personal construct, diffusion of innovation, social actor, and information theories. We use five case studies to demonstrate the efficacy of the theory elements and use multiple case studies to evaluate the effectiveness of the theory is for its intended purpose. The paper contributes to both service and information systems literatures by presenting a theory that can serve as the basis for the design of methodology to accommodate particular target user populations and enables co-creation of value for these by engaging the users to the service design activities. It also shows how design science research methodology can be used to develop an applicable theory to address an identified problem.

Key words: Theory development, targeted population, service co-design, requirements discovery, analysis, integration, personal constructs, diffusion of innovations, social actors, information, design science research methodology.

TARGETED SERVICE CO-DESIGN THEORY

1. INTRODUCTION

The confluence of two theoretical developments provides us with a new opportunity to rethink the relationship between designer and customer for information systems development. Firstly, the emergence of a new logic to govern marketing theory, based on intangible resources, the co-creation of value, and relationships between supplier and customer (Vargo and Lusch 2004), creates opportunities to take fresh looks at the involvement of the customer in the co-design of IT-based services for her use.

Understanding and selecting the best features for new systems has long been recognized as an important problem and one that is difficult for firms to solve (Neill and Laplante 2003; Ravid and Berry 2000). Many important systems have been designed, implemented, and rolled out only to fail because users found that they didn't meet customers' functional needs, required time-consuming, frustrating behavior to make them work, or required awkward work-arounds to complete work (Keil et al. 2000). Researchers sought to resolve the problem of misunderstood requirements by advocating elicitation of requirements from end-customers, the use of elicitation techniques to help customers to express their needs, and techniques to present customer needs in ways that helped developers understand them well (Byrd et al. 1992).

Now, along comes an understanding of the outcome of system design as a service that we co-create with the customer (Vargo and Lusch 2008) and the logic of intimate customer involvement in design becomes obvious and urgent. Firms can gain profound insights into what creates value for the customer by engaging the customer early and intimately in the explicit co-design (Flint and Mentzer 2006) of new systems to deliver these services (Payne et al. 2008). Co-design goes beyond listening to the voice of the customer, e.g., via customers surveys, to a

process where both the firm and the customer are learning about the needs and preferences of the other and involved in understanding, prioritizing, and deciding about the design of the co-produced services (Jaworski and Kohli 2008)

Secondly, the design science research paradigm (Hevner et al. 2004; Peffers et al. 2008), and more specifically, IS design theory, (Gregor 2006; Gregor and Jones 2007), offers a vehicle with which to address this. IS design theory is a type of "theory for design and action (Simon 1996)," concerned with how to do things well in order to achieve goals in designing new systems (Gregor and Jones 2007). Examples of design theories include systems development life cycle and structured systems analysis, according to Gregor (2007), i.e., Hevner et al.'s (2004) "constructs, models, and methods" for design. Here we employ IS design theory to design a new theory for population targeted co-design of IT-based services.

Defining, understanding, and agreeing on the appropriate set of functionality, features, and intended benefits for a new service depends on effective participation from customers, potential customers, and others in discovery, analysis, and design activities. The most straightforward customers with whom to engage in the co-design activities are physically present, already engaged with the firm, and experienced and interested in products based on contemporary technology. Increasingly, firms develop services for which these conditions for effective participation in co-design activities cannot be easily assured for the services' primary intended customers, but for which the ultimate success of the systems and the resulting services, will be determined by these customers' satisfaction with the value, functionality, and usability of the results.

Many customers and potential customers are not easily or economically engaged in co-design efforts. For many, recruitment and effective participation in the development process may

represent high cost because of the state of their motivation, ability, availability, or knowledge of the organization, its products, or processes or of the technology that will be used in the system. Populations of such customers include, for example, potential participants who have little connection to the organization or its products, who are very remote from the loci of development, who are isolated by culture from active engagement in co-design activities, or who may be disabled. These customers present problems that have not been addressed completely in prior IS development literature and practice. Consequently, existing requirements elicitation (Davis 1982; Pohl 1994) methods may not fully support co-design activities with specific populations.

The literature suggests three major co-design activities for which the participation of customer populations may require attention by the developers: requirements discovery, analysis and integration into the business. In requirements discovery, participants may lack context in which to have ideas about desirable functionality because they have little or no historical relationship with the firm, product line, or technology (Orlikowski 1993; Salaway 1987), particularly when developers design new applications with features hitherto unavailable (Peffers et al. 2003) and where a technology offers the possibility of previously unknown features to be exploited. Remotely located potential customers are inherently costly to reach for data collection, compared with in-house users, and are likely to be unavailable for interactive consultation. Furthermore, lack of context understanding may result in a knowledge structure mismatches, between the requirements discovery participant and the organization, that limits the effectiveness of data collection and recording data in elicitation activities.

In analysis, the character of knowledge among potential customers may differ sufficiently from that of the developers, so that it becomes difficult to aggregate their preferences to present

meaningful, aggregated views for decision-makers. In addition, differences in perspective and culture between customers and managers may make it difficult for managers and designers to understand and evaluate user data to make decisions about which features to incorporate and how to do so.

In integration, customers may often not be readily available for iterative participation in co-design activities, so follow-up data collection may be impractical. In addition, mismatch of knowledge structure between the customer participant and the design professional may inhibit effective validation activities. Once managers understand potential customer preferences, they still must make effective decisions about the value and feasibility of externally preferred features and attributes. Literature offers ways of reaching consensus, e.g., (Nunamaker et al. 1991) and prioritizing requirements, e.g., (Ravichandran and Rai 1999; Zultner 1993), however, little in the literature connects this to a comprehensive co-design effort with these harder-to-reach customer populations (Peffers et al. 2003).

This is an important problem in IS research and practice. First, many new applications involve external customers for whom extensive in-house training and involuntary participation are clearly not options. Secondly, increasingly short development cycles make it impractical to diffuse application knowledge to the public before development. Consequently, firms must develop such applications before potential customers have a chance to understand and accept them. Thirdly, inadequate requirements discovery, analysis, and business planning is known to be a leading cause of system failure, as voluntary users refuse to use applications with flawed functionality or usability or insufficient value.

Here we propose a new IS design theory, *targeted service co-design theory* (TSCT). This research has been informed by the design science research guidelines (Hevner et al. 2004) and

has been carried out using a design science research methodology (DSRM) (Peffers et al. 2008). This means that the objective of the paper is to present a relevant problem, design and demonstrate an effective artifact for solving the problem and to do so in a rigorous manner. In this case, the design science artifact is an IS design theory. We develop the theory by identifying and justifying problems through examples and literature and by using identified problems to develop design objectives for the new theory. Next we bring to bear several existing theories, including personal construct theory (Kelly 1955), information theory (Daft and Lengel 1986; Dennis et al. 2008), diffusion of innovation theory (Rogers 1976), and social actor theory (Lamb 2005), as the bases for a new population-centric co-design theory, and justify the use of each. Finally, we use multiple case studies as evidence in support of the in-practice efficacy of theory elements.

2. THE NEED FOR POPULATION TARGETED CO-DESIGN AND SOLUTION OBJECTIVES

Specifying the problem

People who will use an information system, for play, as tools for work, as part of a product, or as communication appliances, play important roles in the co-design process. They provide ideas for new services and features, initiate change with ideas for new or improved processes, are interviewed and surveyed as respondents to reveal feature preferences and expected benefits, try out interface prototypes in experiments to determine what works, and test application and system prototypes to provide feedback on satisfaction. Involvement in all of these activities assumes a willingness and ability to effectively participate. This assumption seems likely to be realistic where the target participant is already a stakeholder in the organization that is developing a new system. Employees, customers, suppliers and other stakeholders have good reasons to act in the

role of co-design participants. They are likely to possess some appropriate knowledge of the organization and its services and they have some interest in the outcomes of co-design. Depending on their circumstances, one might expect that their availability could be arranged, albeit perhaps at the developer's expense.

Other customers and potential customers present challenges for service co-design because their effective participation cannot be readily assured. There are an almost limitless number of reasons why these other potential participants might not participate effectively in co-design. For example, there are potential customers with no connection to the organization, people remote from the loci of co-design activities, people who are culturally different than the developers and managers, and people who are disabled. People with no substantial current or past connection with the organization, may lack context in which to have ideas about desirable functionality because they have little or no historical relationship with the firm, its service lines, or technologies it uses (Orlikowski 1993; Salaway 1987). These potential customers have little basis for ideas or preferences about applications and features and their benefits to them, particularly when developers design new applications with hitherto unavailable features (Peffers et al. 2003) and where a technology offers the possibility of previously unknown features to be exploited.

People who are remote from the organizational premises or who are widely dispersed are likely to be costly and difficult to engage for participation in co-design activities. Some co-design activities benefit from iterative participation and remoteness may make such iteration impractical. Culturally different people may not understand organizational representatives and the organization may not understand them. Problems with involvement across culture may come from a lack of understanding of differences in the structure of personal constructs (Kelly 1955)

across cultures. Participants who are mystified by the structure of knowledge expected by requirements analysts may be unable to respond well to elicitation efforts.

Customers who are disabled may be largely excluded from co-design activities, both because of the cost of accommodating their needs in co-design process and because of implicit assumptions that the needs of customers who are disabled can simply be accommodated *ex post* with accessibility features. This resulting exclusion from the co-design process means that their unique preferences for new features, applications, and systems are not considered.

Solution objectives

Having identified a problem for which we want to design a theoretical solution, the DSRM suggests that we next define the solution objectives, because we recognize that designed solutions generally achieve incremental, not perfect, performance improvement.

While there are likely to be some commonalities in the solution to support participation in co-design activities for various populations, a general methodological solution seems unlikely to succeed. For example, a requirements discovery technique that is effective for a person who is blind might be ineffective for someone who is deaf. Likewise, accommodation of the cultural differences between systems developers and retail automobile salespersons might be very different than such accommodation between a developer from Bangalore and a customer from Indiana. Consequently, a general approach is to design a theory that guides methodological selection and invention to accommodate the specific target population.

The overall objective of the TSCT is to enable the design of an effective co-design methodology, through the selection and/or design of methods and techniques, for a particular target population. We have structured these objectives under a generic co-design process, e.g., (Kotonya and Sommerville 2002; Mathiassen et al. 2007; Pohl 1994), that starts with

requirements discovery, continues with analysis, and finally ends with their integration into business. In the sub-sections below we infer objectives for each of these activities to guide us in the design of the TSCT. Table 1 summarizes the problems and objectives.

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In discovery, context of use affects how we perceive an information system. Users who have no experience with a product or service, have not already been the firm's customers, or have never experienced the use of a technology, have little basis from which to imagine or express feature preferences (Orlikowski 1993; Salaway 1987; Sutcliffe et al. 2005). As firms develop more systems similarly intended for direct use by infrequent and new customers, this issue becomes more critical for development.

Reaching geographically dispersed external customers (Hirschheim and Newman 1991; Keil and Carmel 1995; Tuunanen et al. 2006) can be costly, particularly for iterative activities. Other potential participants can be difficult to engage, even if their locations are proximate to co-design activities, because of mobility and motivational constraints that result from disability. For example, for people who are blind, travel to a hitherto unvisited site can be very inconvenient or even frightening, if not hazardous. This may result in reluctance to participate in co-design activities altogether (Hebler et al. 2007) because such participation is not essential to their happiness and welfare. Many new systems are targeted to potential new customers (Bouwman et al. 2008; Lin et al. 2008; Tuunanen et al. 2010).

Similarly culture influences the way people perceive new systems (Myers and Tan 2002; Tuunanen et al. 2006; Walsham 2002) and the value of their features. Consequently, researchers have argued, that it is important to go well beyond adapting new systems to regional users, to consider what effects culture has on the design of systems' core functionality and logic (Kersten

et al. 2002) for such users. To accomplish this we need a way to explicitly handle cultural practices and values within the co-design process (Thanasankit and Corbitt 2000).

Once participants are reached, recording data procedures should accommodate worldviews, reasoning, and knowledge structures that differ from those of the analysts. Participants from different cultures or with differing knowledge bases from those of the managers and designers may not be able to express their preferences using the developers' preferred structures. The suitability of communication modes may also affect participants' effective participation.

Objective: methodology that addresses these problems would gather data in a manner that does not require participants to have prior knowledge of predecessor systems, the firm, or the technology, that motivates and enables participation where barriers to it exist, and that encapsulates reasoning and context to enable cross-cultural understanding.

In analysis understanding customer preferences may require studies involving dozens or hundreds of individuals, resulting in thousands of individual requirement preferences and accompanying reasoning (Lamb 2005; Tuunanen et al. 2006; Walsham 2002). Structural diversity of individual preferences and reasoning among participants is likely to be extensive, creating challenges for the aggregation of data across individuals (Lamb and Kling 2003). Nonetheless, service requirements cannot be conveniently specified using thousands of individual preferences, so to be useful for co-design, the data collected across many individuals, must be meaningfully aggregated.

Analyzing requirements also involves modeling to enable representation of aggregated individual views of what is valuable and why in a manner that is useful for design. Modeling techniques typically impose rigid structures and specific notation rules that inhibit the communication of widely differing participant perspectives. Organizational outsiders are

unlikely to be motivated to learn a language like UML in order to successfully participate in co-design activities. Furthermore, the structures of their ideas may differ dramatically from those of developers (Salaway 1987), with whom they are unlikely to share an organizational culture (Lamb 2005; Lamb and Kling 2003; Rowlands 2006).

Analysis should also enable two-way information sharing (Daft and Lengel 1986; Tuunanen 2003), i.e., so participants can understand the results of the analyst's work. For some participants, it may affect how requirements are presented. Without this consideration disabled people may not be able to take part in analysis activities. Similarly, for an engineer, a procedural representation of requirements, such as a data flow diagram or use case model, may be very effective, while for another participant, such a representation might be thought to miss the main point of interest, e.g., social justice, that might be an important issue for disabled people.

Objective: a methodology should support aggregation of data collected from participants in a ways that are efficient, yet adequately retain the rich meaning of data collected from participants with different knowledge structures. In addition, it should enable requirements to be effectively represented to the co-design process participant without forcing them into any structure that would distort its meaning to any of the key participants, such as users, managers, and system designers.

Integration of requirements into the business requires feedback to validate, prioritize and evaluate, the requirements. Co-design participants may experience barriers in providing feedback-using techniques currently in use by the firm. For example, people who are sighted can easily hop among requirements in a long list to rank-order their preferred features, but people who are blind quickly exhaust working memory resources while trying to accomplish the same task. Other co-design participant populations might be expected to experience similar limitations.

Organizational outsiders may not be familiar with concepts, e.g. business and technical jargon, used in the specification validation activity. The key is that participants to the co-design process each understand requirements in their own contexts of culture and application.

Prioritization and evaluation of requirements is essential in any co-design project, because every organization has limited resources, e.g., cost, technologies, skills, and time. This makes it important to decide which requirements to focus on immediately and which may be left for future versions of a system or dropped altogether (Mathiassen et al. 2007). Across cultures this task is of heightened importance because of differences in participants' value systems. For example, mobile phone users in Hong Kong place high value on fashion and city-life related features, while Las Vegas users look for hints for last minute deals on shows and seek travel support. Helsinki users place more value on features that help them to be more efficient at work (Tuunanen et al. 2006). Understanding the connection between features, functionality, and values, therefore, becomes essential when dealing with customer populations.

Objective: A methodology should enable and motivate effective participation in activities to validate, prioritize and evaluate discovered and presented requirements, by anchoring such participation in contexts of culture and application, where necessary. It should also enable integrating a shared understanding of customer and firm requirements into decision making about business and systems feasibility and value.

3. DESIGNING A THEORETICAL SOLUTION

In this section we review four theories: personal construct theory, diffusion of innovations theory, rich information theory and social actor theory, as the bases for a new TSCT. We first briefly review each of the four theories and show how elements support a new theoretical solution for targeted service co-design. TSCT uses elements of the four theories to support

requirements engineering activities, in discovery, analysis and integration that address the objectives developed above and shown in Table 1. The relationship between elements of the theories and those of the designed theory is summarized in Table 2. The application of TSCT implies techniques and methods, either to be taken from the existing portfolio of RE techniques or to be custom designed, to be incorporated in designed RE processes for specific target populations.

Personal construct theory (PCT) was developed by George Kelly (1955), a practicing school psychologist, to model how his patients saw the relationships between states of the universe, the consequences of those states, and the impact of those consequences on their individual values, in order to better understand how they and their teachers understood the world differently. These relationships, or personal constructs (Pervin 1993, p.228), result from our individual observations and interpretations of events . Each of us has individual multi-dimensional models (constructs) that describe the attributes and behavior of objects and events, their resulting consequences, and their effect on our values. According to PCT, an individual observer notes that the state of a system has certain attributes. The observer uses his/her own constructs to conclude that these attributes have expected consequences. The consequences, in turn, have certain values for the observer (Kelly 1955).

PCT-based data gathering methods have sought to elicit information about peoples' knowledge structures by observing how they differentiate among stimuli and have been used to model consumer value structures related to preferences for products and their features (Olson and Reynolds 2001; Reynolds and Gutman 1988). In one such technique, "laddering," the analyst uses structured interviewing techniques to collect chains of features, reasons, and values from a number of participants. The chains are aggregated across participants to produce network models

of how participants interrelate the constructs (Gengler and Reynolds 1995). Laddering has been extended from matrix and text-based illustration to incorporate graphical maps that illustrate consumers' cognitive structures, in order to improve communication of the results of laddering data analysis (Gengler et al. 1995; Gengler and Reynolds 1995) and better support information processing by the intended audience for the analysis. This provides a well-structured way to elicit 'hidden' requirements of users (Browne and Ramesh 2002; Browne and Rogich 2001; Peffers et al. 2003; Peffers and Gengler 2003).

In discovery activities, techniques, such as laddering, provide reasoning and values data, so that downstream information users can understand users' **mental models** for why particular service attributes might create value for the customer. This is likely to be particularly important because managers and designers may very likely hold quite different mental models for the consequences and values of particular service attributes.

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In analysis it is important to efficiently aggregate the many, perhaps thousands, of statements made by individual participants into a manageable number of constructs and models, while minimizing the loss of information contained in the individual preferences and reasoning. Aggregated personal constructs become ***socially constructed normal systems*** (Kelly 1955; Peffers et al. 2003). PCT-based network maps portray both preference and reasoning information, with the structure of participants' knowledge largely intact, helping downstream managers and designers understand what the participants want and why they want it without forcing a specific structure to represent the requirements information.

In integration activities, retention of **attributes, consequence, and values** information in presentation is useful both in decision-making efforts, e.g., which applications or features to

adopt, as well as development efforts, e.g., how can we implement the preferences to satisfy the participants' desired consequences and underlying values and thus convert requirements into application and features ideas. Of course, network models of feature and application preferences do not constitute actionable ideas for applications and systems. To carry ideas forward to downstream processes it is useful to bring the downstream participants, e.g., managers and engineers, into the process at this point to transform the network preference and reasoning information into feasible ideas for new systems.

Diffusion of innovation theory (DOI) is intended to represent and predict the patterns of innovation adoption over time by populations of potential customers (Rogers 1976; Rogers 1995). A key element of diffusion of innovation theory is the S-shaped cumulative adoption curve. Among adoption researchers, substantial interest has focused on the small group of people, *lead users*, who tend to adopt innovations very early in the curve (von Hippel 1986), compared to the remainder of a population. Lead users enthusiastically embrace and use innovations, the knowledge of which lies in the future for most others. In consequence, they can be used as a need or preference-forecasting laboratory (von Hippel 1986) for what large numbers of a population might adopt in the future. Focus on the lead user has found appeal among academic and business researchers in such disciplines as marketing and management (Lüthje and Cornelius 2004; Morrison et al. 2004), because research has shown that using lead users can lead to higher performance in product development (Lilien et al. 2002). The key argument has been that by recognizing what lead users demand from innovative products can lead to good forecasts for what the masses will eventually desire.

For discovery activities to be successful requires that participants understand or be able to imagine the capabilities of hitherto inexperienced new technologies. The **lead-user** (von Hippel

1986) provides a practical way to approach the issue a sampling problem, i.e., that members of a target population may have few ideas or preferences about products based on technologies that they haven't hitherto experienced. By definition, lead users are well motivated and capable of imagining the potential value of previously unavailable new technology. The lead user segment of a target population can therefore be useful in the discovery activity, because they are better able to imagine and express ideas and preferences for new applications and features for which the target population as a whole might have trouble. We can thus use lead-users to anticipate requirements preferences for a population and the use of lead users for discovery will result in more ideas about preferences and needs.

The recruitment of lead users is a problem that has not been entirely solved (Lilien et al. 2002), however, one approach has involved the use of the snowball-selection technique (Olson and Bakke 2001). The snowball technique assumes that, if we can find one or more members of an otherwise hidden subpopulation, e.g., lead users for advanced mobile applications, they will be acquainted with and can refer us to others in the subpopulation and the subject pool for the study will 'snowball' to a sufficient size. A knowledge-based screen validates the membership of each new potential participant in the lead user participant pool.

Information theory models the facilitation of communication though media richness and synchronicity of information (Daft and Lengel 1986; Dennis et al. 2008; Dennis and Valacich 1999; Dennis et al. 2002). Media richness refers to the capability of the media to carry complex, multidimensional information and cues that help message recipients to better understand the intended message (Daft and Lengel 1986). Information richness helps to manage uncertainty and equivocality in the decision environment. 'Media synchronicity' is an extension of media richness theory based on the need for conveyance of data and convergence of shared

understanding to accomplish meaningful action and the requirement for communication that supports both (Dennis et al. 2008; Dennis and Valacich 1999). The conveyance of sufficient information is essential for individuals in order to reach correct conclusions, while convergence is said to be necessary for the group to be able to act together with synchronicity and with a common understanding (Dennis et al. 2008; Dennis et al. 2002).

In discovery activities formation theory tells us that **data sufficiency** requires techniques that accommodate parallelism and multiple sources, i.e., to succeed at capturing enough data, we should maximize the data collection 'bandwidth' with techniques that permit data collection in parallel streams from a lot of sources thus facilitating better understanding among key participants, such as managers and designers, how attributes can be implemented. **Rehearsability** refers to the extent to which an author can take time to prepare and edit a communication before sending it. Greater rehearsability slows down the communication but may make it more precise and thus improve how other participants receive the information. The objectives of capturing the data with accompanying interactions, affiliations, culture, and environmental factors and that of capturing it in terms of the participants' knowledge structures are related. They require that the data be captured through the use of **rich media** that can represent reasoning, as well as preferences, to convey requirements information to all stakeholders and thus increase understanding of users' thinking.

In analysis, information theory suggests that with high levels of **symbol variety,** together with high **media richness**; leads to effective conveyance of understanding and message recipients better understanding as the message is coded in flexible language and structure. High symbol variety allows for high variety in the way messages are coded. Greater symbol variety can help message recipients to better understand the meaning of the message because some

information can better be coded in one structure or another. It can also facilitate the process of coming to a common understanding about the meaning of the message. Thus downstream recipients are better able to understand the meaning of preferences coded with a more flexible language and structure.

Rehearsability refers to the extent to which an author can take time to prepare and edit a communication before sending it. In integration activities, greater rehearsability slows down the communication but may make it more precise. **Reproducibility** refers to the extent to which a communication sequence in the media can be observed multiple times and be stored for future reference. Higher levels of reproducibility may assist in convergence by acting as a group memory (Dennis et al. 2002; Peffers and Tuunanen 2005). Together techniques that implement these elements of theory may help lead to plans to execute the populations preferences and to integrate them into the business, because they can result in a shared understanding of the customers' and business requirements for the service.

In integration activities, **immediate feedback** for validation efforts affects the level of participation interaction. If participants are provided with information supports their ability to rehearse and reproduce their own information products to the process, this also helps participants perform better in the validation process and develop a shared understanding of requirements. Rich information theory argues for two-directional feedback for validation efforts, using rich information. Rich information and reproducibility help participants better understand the requirements information, and assist them to validate the collected requirements (Dennis et al. 2008; Dennis et al. 1988; Dennis and Valacich 1999).

Social actor theory (SAT) incorporates a new, four dimensional view of the service customer (Lamb and Kling 2003). Studies that have been based on the bounded rationally concept for how

humans use, participate and are otherwise involved in the use of information systems (Simon 1955) have produced contradictory results. Researchers agree that customer participation is important to information systems development and especially the requirements engineering phase of the development life cycle (Bjerknes and Bratteteig 1995; Byrd et al. 1992; Holtzblatt and Beyer 1993; Kautz 2001; Kujala et al. 2001; Kyng 1994; Mathiassen et al. 1995; Watson and Frolick 1993), but challenges remain in scaling up the findings of user studies (Baldwin and Rice 1997; Baroudi et al. 1986; Lamb and Kling 2003) and determining exactly how customers should be involved in co-design activities (Kujala 2003; Mathiassen et al. 2007; Tuunanen 2003). SAT is intended to help researchers resolve these issues by re-thinking the role of the customers, i.e., as social actors within their own organizations and communities, and asserting that new services should be designed to support customers in these roles.

The **affiliations** dimension depicts the networked nature of current work habits; we are connected to different individuals and organizations in our daily life in different layers of involvement with the surrounding society, e.g., organizational, national, and international. Organizational networks shape social actor networks that are dynamic in their nature, which affect the way information is communicated, and which in turn have an impact of the needed resources, such as capital and labor (Lamb 2006; Lamb and Kling 2003). In discovery activities, affiliations provide cultural context for requirements data. Consequently they can result in more sufficient and richer data, as the preference and reasoning data is encapsulated in the cultural and organizational context. In addition, affiliations can be leveraged to provide motivation and enablement for more effective individual participation.

Three other SAT dimensions, environments, interactions and identities are fundamental to understanding the social context of requirements. **Environments** portray the surrounding world

of the organization, where social actors influence each other in terms of regulations, practices, associations and locations, thereby affecting the environmental reality. Organizational environments exercise technical and institutional pressure on other organizations and individuals. IT-based services are part of the organizational environment and of the more macro level view of the environment; industry, national, global level. **Interactions** extend service involvement in SAT because that is how information, resources and media are used to engage communication among organizations members and with networks of their organization. Organization members seek out media for legitimate communication that they use to build, design and develop interactions to enable information flow. Services are a crucial part of the interaction process as people utilize and innovate ways of using resources to communicate and interact. The interactions involve socially embedded and role-based actions for the actors' organization(s). Identities are the acknowledged presentations of the "self" and recognized profiles of organization members as individuals and collective entities. Users use services to construct these identities and control perceptions of them, consequently, they have a service component. Service enabled networks, further, highlight cultural identities and connections among social actors heighten role perceptions.

In analysis, understanding the customers' social context, including her organizational affiliations, the environment in which she acts, how she interacts with others, and the identity roles she assumes, all lend social context to the preferences and linked reasoning in the aggregated and modeled information.

In integration, the use of identities can create advantages for the firm and the customer, as requirements are developed and understood targeted to the specific population. As service co-designers, the firm and the customer can see requirements and the reasons that pertain to them in

terms of the cultural identity relationships of the customer.

4. DEMONSTRATION OF ELEMENTS OF THE THEORY

Here we present five studies that demonstrate elements of the TSCT. The initial study, involving Rutgers University, is followed by two major studies with corporations, Digia and *Helsingin Sanomat*. The last two cases describe research done with a Nokia led research consortium and the Royal New Zealand Foundation of the Blind. Altogether these studies involved 215 individuals who were interviewed and who have participated in various service co-design activities during years 2000-2007. In section 5 we will use elements of these cases to evaluate elements of the TSCT.

Case I: Strategic Information Systems Planning at Rutgers University (Peffers et al. 2003)

We were engaged by Rutgers University Camden Provost, Roger Dennis, to conduct an IS planning study to discover a set of new applications with high value across the campus. We used this project as an opportunity to show that we could engage in a 'bottom-up' planning process, where participants across administrative and professional occupations were able to think strategically, instead of proposing new services that narrowly benefited themselves.

We began by inviting participation from 18 employees: four senior managers (the provost, an associate provost, and two deans), 11 middle managers (associate deans, assistant deans and department directors), and three faculty members. To develop a list of viable projects to serve as stimuli for data collection, we asked each participant for suggestions, i.e., to briefly describe the functionality of a system that would benefit the organization. Most of the participants had already thought of at least one idea for such a system and were eager to tell us about it. Just one of the participants was unable to think of any idea.

The interviews were scheduled for completion within one hour, although two took slightly

longer. In each, we showed the participant descriptions of three randomly assigned systems, suggested by other participants, and asked him or her to rank-order them in terms of their importance to Rutgers. For the highest ranked system idea, the researcher asked the participant "why is that system important to Rutgers—Camden?" When the participant responded with a reason, the interviewer asked, “Why is *that* important to Rutgers?” The questioning was repeated several times until the participant was unable to continue because he or she had reached an ultimate value or goal for the organization. Next, the participant was asked, with respect to the first reason given, "what was it about the system that makes you think it would do that?" The questions were repeated for the second most highly ranked of the three project ideas. The third ranked idea was ignored. The data from each interview was recorded as one or more chains, representing the participants’ models of the relationship between system attributes or features, performance consequences, and the relationship of these consequences to organizational goals. The performance consequences represent the organization's critical success factors (Rockart 1979) in the view of the participant. The data collection resulted in 149 chains containing more than 1000 individual statements.

To analyze this data we employed a two-stage hierarchical clustering procedure. First, in an interpretive, agglomerative clustering process, we clustered the participant statements into 81 constructs, including descriptive system attributes, performance outcomes, and goals. Next, we used a minimum variance quantitative clustering procedure to aggregate the constructs into clusters and mapped the clusters into graphical network maps, a separate map for each cluster. Each of the five network maps represented a system of features and reasoning that could be interpreted as a new IT-based service.

In two, half-day ideation workshops with Rutgers IS professionals, the professionals worked

to transform the network models into four feasible IT-based service ideas. The models, describing attributes, features and consequences for new services, helped workshop participants understand what the participants intended, although more richness would have been desirable.

Case II: Digia Corporation Mobile Financial Services (Peffers et al. 2003; Peffers and Tuunanen 2005)

Digia chairman, Pekka Sivonen, approached us in 2000 with a request to identify a set of "killer cocktails" for mobile financial services, i.e., services that would be so well embraced by customers that they would ensure the acceptance of the next generation wireless devices, just as VisiCalc ensured the acceptance of the personal computer. Researchers worked with prototypes and sketches of such devices, as well as ideas of what the technology might enable consumers to do with their devices. Digia had conducted a strategic analysis of the potential market and decided that it would be lucrative for the firm to develop services for consumers of yet-to-be-launched third generation smart phones.

To elicit participation in this study, we developed two lists of potential participants: experts and lead customers. For potential expert participants, we worked with Sivonen and a staff assistant to develop a list that included a cross-section of Finland's most relevantly knowledgeable scientists, professionals, and managers. For customers we decided that it would be desirable to elicit participation from sophisticated communications technology customers, people who would be likely early adopters of attractive new mobile commerce services. To avoid excessive analyst influence in the selection of participants, faculty members at the Helsinki School of Economics, not including us, were asked to nominate professional, managerial, executive, and other sophisticated end-users for participation. The resulting combined list of nominated participants contained 40 names.

We attempted to contact each of the nominated participants to elicit participation in the study, schedule an appointment, and elicit a service idea for use as stimulus. 32 of the nominated participants could be reached by telephone and agreed to participate, while eight could not be reached. The resulting participants included 18 outside experts and 14 potential customers. The experts included 3 IS managers, 4 researchers, and 12 m-commerce industry executives. The end-users included 5 managers and executives industries, 4 professionals, and 2 students. All were from the Helsinki, Finland vicinity. All, but two of the participants contributed service ideas, which we aggregated into four bland service descriptions for use as stimuli.

The majority of the interviews was done at the participants' work premise and averaged 50 minutes. Participants were shown the four system descriptions and asked to rank order the best two. Generally the participants volunteered ideas about system features. The analyst then asked the participant a series of questions to collect chains of attributes, consequences, and firm objectives, as in the Rutgers study. If they had trouble visualizing the technical environment, they were shown pictures depicting a number of prototypes for next generation wireless equipment. A total of 147 chains were recorded, including more than 1000 statements.

As at Rutgers, we used an iterative, qualitative clustering process to cluster the statements into concepts, representing system features, performance consequences and personal values. Then we clustered the chains and developed graphical network maps. Each map represented a service concept with a consensus features, attributes and goals.

We organized a five hour ideation workshop that included Digia's highest level business and engineering executives and other business and engineering managers, to translate the network models into feasible ideas that could be considered by decision-makers and implemented by developers. The objective was to examine and discuss each graphical network map as a group,

then come up with a project idea that would address the desired consequences and values expressed in the models, including a name, short description, architecture, a list of supply chain players, our customer segment(s), benefits for players and customers, our profit model, and risks involved, all at a "back-of-the-envelope' level of detail. In addition, they were to produce a rough graphical business model that showed the relationships among customers and supply chain participants, including the flow of information, value and revenue. The rule of the session: participants should rely on their own knowledge, not using resources from outside the room.

Each map was described and discussed, one at a time. Participants discussed the models with animation, with every member participating and participants taking turns leading discussion at the flip chart, taking notes, and writing out and drawing models of the project. Discussion of the first model took 2.5 hours, but the remaining discussion moved more quickly, completing work on all of the models in the five-hour session. For each of the network models for which an idea was developed, the participants first drew a business model on the flipchart. Participants in the workshop agreed to proceed with further analysis on three service ideas from the five models.

Case III: Helsingin Sanomat advertising design & purchase self-service (Tuunanen et al. 2004)

We were engaged by the business development team at *Helsingin Sanomat (HS)*, Helsinki's major newspaper and Finland's leading advertising media, to develop the functional requirements for version 2.0 of Medianetti, a service that allows customers to design and purchase display advertising for the newspaper, its *Nyt Weekly Supplement* and its classified on-line service. Medianetti is targeted to six customer segments: regular and infrequent small-scale advertisers, medium scale and large-scale advertisers, ad agencies, and internal users. Version 1.0 of the service was ready for release, but no customers had seen it.

We began the discovery phase by identifying potential participants and we selected a sample

of 30 potential outside and inside customers, with whom we conducted interviews using the Laddering technique. The interviews resulted in the collection of 244 individual chains of data, containing 2566 individual preference statements. Each interview participant expressed his/her preferences and reasoning, using unique language. It was important to aggregate this data to produce a meaningful, but smaller, set of rich, unified aggregated models that managers and designers could grasp. At the same time we wanted to preserve the integrity of the individual chains because each chain represented the reasoning of an individual participant. We designed a technique to cluster the chains qualitatively into *themes* without breaking them up, i.e., without clustering some of the individual statements from a particular chain into different clusters. The objective was to create an aggregated representation of participant models, i.e., network value maps.

Two researchers worked independently to sort the 244 chains into five themes and then they created a graphical network value map to represent each theme. The resulting maps contained 60 individual features, 40 reasons why customers wanted the features, and 16 values related to the reasoning. Next, the researchers examined the themes to determine what *subthemes* could be found in them. These were recognized by consensus. Finally, graphical network models were developed through rounds of sketches.

These network value maps were implemented as the top level in a three-dimensional spreadsheet-based presentation package for use by decision-makers and designers. The media package included links to allow the user to drill down from each of the top-level network maps, to the chains from which it was constructed, and further down to listen to recorded segments of the original participant statements.

We used the presentation tool to facilitate integration activities, including a

manager/developer workshop, validation and evaluation of the requirements, the development of a business report recommending specific actions, and an application roadmap to plan a specific, sequenced, and timed set of future service updates. The full-day workshop was held on the *HS* premises and featured participation by senior business, marketing, and development managers and executives. We demonstrated use of the tool to managers and developers, so that they understood it as an expression of customer preferences and how to use it to obtain rich information.

The workshop program began and ended with surveys, intended to observe the usefulness of the tool and the workshop and the features presented in the tool. In general participants expressed pleasure with the tool's richness and interactive design as well as its potential contribution to understanding in development activities of the nuances of the customer preferences. The data collection, analysis and presentation tool provided managers and developers with rich information about customer preferences and reasoning, but we could not use it to argue much about the importance of the ideas it contained. To measure the value of the requirements items, we conducted a survey with an independent sample of 33 people.

The results of the survey were used to develop the business report, which described the most valuable subthemes or "features," in rank-order. The business report recommended that the firm focus resources to develop the top ten features list and the top three themes. These are the features and themes most valued by the customers. Using the presentation tool, the Medianetti project team developed the three-year upgrade Roadmap for Medianette that described features, priorities, and development schedules. The Roadmap called for the release of version 2.0 by February 2004, version 2.1 in fall 2004, version 2.2 in winter 2004-2005, and version 3.0 in late 2005. Almost all of the features included in the roadmap can be traced back to the study data,

including 42 of the 59 (71%) functional features that were specifically recommended in the business report, as well as with seven that came from other sources.

Case IV: Nokia Research Consortium (Cassab et al. 2010; Tuunanen et al. 2006).

The Consortium study was a 2004-7 joint venture of more than twenty Finnish organizations interested in digital marketing. Nokia, the key participant, wanted to ascertain how consumers might want to use "presence" status information in new mobile services. Customers would be able to include "presence" status in their mobile phone contact list, enabling subscribers to the list to know their availability for a voice call or other interaction. Presence information was a technology that was not available to public at that time. Consequently, the firms had only a limited understanding about which potential service features would be worthwhile or how that might differ in various cultures or locations around the world.

We collected data from potential service users in three locations: Finland, China, and the US. To develop a sample of lead users, we used the "snowball" method to recruit participants, starting with a small sample of known lead users. We obtained referrals from each participant to others that he or she thought might also be lead users and then we used a knowledge and technology-use screen to validate each participant's status as a lead user. This recruitment process resulted in a panel of 80 participants: 28 from Helsinki, 27 from Hong Kong, and 25 from Las Vegas.

We conducted interviews using the laddering technique. In each location we asked users to think about ideas for new services, using presence and location data, which would be valuable to them. The interviews began with a presentation of a stimuli list, where the stimuli were intended to suggest ideas about possible service applications. We asked the participants to rank-order the stimuli in terms of importance. Then, one at a time, for the two highest ranked stimuli, we asked

each participant to describe useful services and to describe desirable features for each service. We proceeded to ask subjects to explain why each particular feature would be important, so as to elicit the consequences that the participant expected from the feature. The data was recorded in the notes as chains of feature, consequences, and values and resulted in 663 chains and nearly 3500 individual statements.

We analyzed this data and developed network models to describe and illustrate each service idea. There were a very wide variety of ideas and we could notice a differentiation according to geographical location. The service ideas clustered into six themes. For example, a service developed from the "information access for special interest groups" themes, could support the activities of a pick-up hockey league in Helsinki or for an inter-denominational church youth group in Nevada. A service from Presence Messaging theme could be the basis for an application to support safety and productivity among members of a police department or for the coordination of a deer hunting party.

The cities were selected because they are thought to represent very different cultural settings. Hong Kong, the trading city, represents a high density, tri-lingual Chinese city and a well-known economic miracle; Las Vegas represents a well known leisure and entertainment capital, with 21 of the largest 28 hotels in the world (Vegas 2011), but perhaps less well known, a high proportion of practicing religious adherents (Sys.com 2006); and Helsinki represents a very well educated, technically sophisticated, and wealthy Northern European city in a country with a very low population density. To some extend residents of the three cities might also represent, respectively, Asian, North American, and European cultures, as well.

Participants in the three cities differed substantially in their interest in the six themes. The researchers used descriptive analysis to indicate whether the data shows differences among the

cities. T-tests showed significant differences among the three cities in all but one of the themes, "Shopping Assistant", which seems to be a globally interesting service concept. Each of the other themes were specifically concentrated in one of the geographical locations and context.

Case V: Royal New Zealand Foundation of the Blind (Tuunanen et al. 2011)

The study designed a method to discover, analyze and present requirements for mobile services for the blind, so target participants for the study included blind users. It was carried out in New Zealand and Germany in 2006 with the help of the Royal New Zealand Foundation of the Blind and *Trierische Tonpost*, a monthly "spoken magazine" for more than 850 blind and vision-impaired German subscribers. The study addressed the special needs that people who are blind have for participation in co-design activities, as well as the importance of their participation, i.e., whether blind customers require different service functionality than sighted people do.

We anticipated that recruitment would be challenging because the target participants would be very scarce among the general population and because we had no reason to think that they would be particularly interested in participating. The objective was to recruit at least 20 participants, the minimum necessary to make the study results meaningful (Peffers et al. 2003). To recruit participants in New Zealand the researchers employed communications channels of the Royal New Zealand Foundation of the Blind. Several hundred invitations were emailed to the foundation's lists, inviting list members to take a short screening survey. An announcement was posted on the foundation's telephone oral newspaper service. In addition, the researchers asked willing participants to nominate other likely participants and contacted them, either by email or through the referring participant. After four weeks, these efforts yielded five participants.

The recruitment process continued with a presentation about the study at the foundation's training-center by one of the researchers. This yielded five more participants. Foundation staff

contacted some people directly, yielding three more and one staff member agreed to participate. In all, this resulted in 14 potential participants in New Zealand. At this point, our attention turned to Germany and to *Trierische Tonpost*. With strong organization support, particularly the support of the editor-in-chief, a solicitation in this medium yielded nine, for a total of 23 participants. To screen for lead users, we used a two-part screen that included use and knowledge questions about technology. One participant was screened out of the study, leaving 22 participants.

By analyzing the discovered requirements with the thematic clustering methods, as in the *HS* and Nokia cases, we developed aggregated models of user preferences. We used these to seek post-analysis feedback from the blind participants, in order to learn what every participant in the discovery activity thought about the features contributed by all of the other participants. We telephoned each participant to conduct a short feedback interview and were able to engage 18 of the 22 participants for this follow-up activity.

First, we wanted to understand which were the most important themes, so the initial challenge was to represent each theme and its associated features, without overwhelming participants with verbose descriptions. To limit complexity, each theme was given a brief description that included a refined name of the theme, followed by a summarized enumeration of the related features. The theme summaries were read to the participants. After each summary the participant was asked to indicate, on a scale between 1 and 10, the value of the theme to him/her.

Second, we needed to understand which features of each theme were most important. Each theme was broken down into written scenarios to summarize groups of features. The narratives introduced participants to the features. Each scenario started off with "Imagine…", then described the features and what one could accomplish with a particular feature or features. Participants rated the scenarios for value, on a scale of 1 to 10. Finally, using the data from the

feedback interviews, the researchers used the likert ratings for themes and feature groups, normalized for the number of items rated, to compute rank order ratings for each theme and feature cluster.

The results of requirements discovery and analysis were used for ideation efforts in two ways. Firstly, to clarify which of the ideas proposed by individual participants were most valued by others. Secondly, to verify whether the system suggestions derived from interpretive analyses, which were carried out by the researchers, accurately represented users' needs.

During the original individual laddering interviews the participants were asked to rank-order their top three ideas, according to their importance. This provided the researchers with a first round of value data. The top three themes, out of seven, 'navigation & routing', 'traffic & public transport assistant' and 'shopping assistant' accounted for 70% of the total of post-analysis rating scores. We noted that the preferences most highly rated by individual participants in the original data collection, were also the most highly rated by all participants.

In the model evaluation section, all participants were made familiar with all seven themes to get feedback on them. A considerable portion of the participants stated that the themes *"Navigation & Routing"* and *"Traffic & Public Transport Assistance"* are highly related and that they would like to see them combined. The two themes together would allow blind people to explore unfamiliar areas. Overall, these two topic areas were rated first and third. Combining them to one system would certainly yield a service that would be highly valuable, specifically for the population of people who are blind.

The *"Shopping Assistant"* theme, ranked second, caters for short-range navigation in stores. A shopping assistant service would announce a shop that a customer is passing, guide him/her to the correct aisle and identify a product on the shelf. A shopping assistant would fit to the wide-

range navigation solution explained above. The name of a shop would be announced while a user is navigating through the streets. All three themes would enable a more "independent lifestyle," a value that was expressed many times when discussing features in these three categories.

In our business report, we proposed design of a mobile service, the Virtual Voyager, which would integrate all three themes. The Virtual Voyager would include a city navigation guide that navigates a blind person through cities and that takes care of routing and storing of routes. In addition, it would integrate public transport information. Secondly, it would announce certain shops a person is passing, which relates to the next building block, shopping assistance. Thirdly, the personal safeguard assistant would warn of barriers on the footpath or elsewhere, so as to ensure hazard-free routes.

The shopping assistant concept is currently being developed by a consortium of researchers from the University of Nevada Las Vegas, Arizona State University, and Oulu University, with cooperation from the National Federation of the Blind (US). Their objective is two-fold, (1) to develop requirements discovery techniques for people who are blind, so that they can fully participate in co-design activities, and (2) to design technology to support fully independent retail shopping for people who are blind (University of Nevada Las Vegas 2011). Achievement of a fully functional commercial shopping assistant service will require an intensive and sustained co-design effort by researchers, technical entrepreneurs, retailers, customers who are blind, and the National Federation of the Blind.

5. EVALUATION OF THE THEORY

Here we have justified, designed, and demonstrated a targeted service co-design theory. It is a theory for design and action, that is to say that it is a theory that purports to show how to do something in an effective manner. In this case, that 'something' is the design of co-design

methodology, by assembling appropriate methods and techniques and designing new ones where necessary, to accomplish service co-design for targeted populations. Next we evaluate whether the theory is effective for its intended purpose.

An evaluation of the theory requires some kind of evidence or proof (Peffers et al. 2008). This evidence could come from observation, analysis, experiment, testing, or description (Hevner et al. 2004). Since the TSCT is about prospective, macro-level organizational behavior, i.e., what an organization should do, some of these evaluation methods seem clearly unsuitable, e.g., experiments, testing, and analysis. Descriptive evaluation, e.g., argument and scenarios, are, by definition, weaker forms of proof, so they would be our last resort. That leaves observational research, of which multiple case studies is a strong and an appropriate choice.

In the previous section, we briefly presented five case studies, each of which is more fully presented in a referenced published paper. In this section, we use elements from the cases to show how constructs developed from the reference theories, which together make up the TSCT, impacted performance in the case through the implementation of a method or technique. The connections between the co-design stage, reference theory, construct, implementation, and impact, and case reference, are summarized in Table 3.

It is important to note that the essence of the theory, as summarized in table 2, is the reference theories and the constructs. The implemented techniques and methods, described in the cases and used to demonstrate the theory in these specific instances, are not a part of the theory. While the methods and techniques demonstrated are thought by the authors to be good ones, different designers, in different contexts, would likely use or design different methods and techniques.

-- insert TABLE 3 around here

Discovery

At Digia (Peffers et al. 2003; Peffers and Tuunanen 2005) we used the lead user concept (von Hippel 1986), developed from diffusion of innovation theory (Rogers 1976; Rogers 1995) to motivate a very high participation rate in discovery activities among our selected participant sample and to gather many ideas from each participant. We used a context-specific version of the snowballing technique to select the lead user panel. The use of a lead-user sample resulted in a very high participation rate, of 32 potential participants contacted, out of 40 nominated, all participated. Their enthusiastic participation resulted in sample data that included more than 1000 statements of preferences and reasoning.

At Rutgers University (Peffers et al. 2003) we used personal construct theory (Kelly 1955) to discover participant mental models of their strategic system preferences and the reasons for those preferences. To capture the mental models, we used the laddering technique for individual interviews and flexible structured data recording. This resulted in data that captured the participants' system preferences, the consequences that they expected to pertain to each preferred system, and the value to the university that they expected would be achieved thereby. Downstream users of the data, in the integration activity, said that the richness of the data helped them to understand its meaning.

In the Nokia case (Tuunanen et al. 2006) we used the information theory (Dennis et al. 2008; Dennis et al. 1988) to support data sufficiency, rehearsability, and rich data in the discovery activities. We involved 80 participants, in Helsinki, Hong Kong and Las Vegas, in intensive individual interviews, the purpose of which was to extract as many ideas about the topic of focus from each participant as possible and, in addition, to collect exhaustive data about each participant's reasoning about each idea and the value attached to it. This activity resulted nearly

3500 individual statements from the participants, which were later successfully used for analysis and thus enable managers/designers to relate to the needs of the users across all three geographical locations and different cultures.

In the Royal New Zealand Foundation of the Blind case (Tuunanen et al. 2011) we applied the affiliations concept from social actor theory (Lamb and Kling 2003) to support participant recruitment. We made extensive use of a relationship with the Foundation and with a similar relationship to the *Trierische Tonpost* in Germany, along with potential participant roles in these organization, to enable and motivate participation in discovery activities. The strong support of the local organization, along with the importance of the organizational affiliations to the members, was a key to success completing discovery activities.

Analysis

At Rutgers University (Peffers et al. 2003) we used personal construct theory to aggregate across all of the participants in the study, data about their preferences, reasoning and values. In doing so, we developed aggregated network models of socially constructed normal systems. The developed graphical network models simplified the data, while retaining representations of individual preferences and reasoning. That helped managers and system developers understand the preferences and mental models of the participants.

At *Helsingin Sanomat* (Tuunanen et al. 2004) we applied the concepts of symbol variety and rich media from information theory to support the development of qualitative multi-level models of aggregated preferences and reasoning. The spreadsheet tool developed for this case enabled down stream users to drill-down to follow the reasoning of participants from the top-level aggregated network models down to transcriptions of original interviews and even to audio recordings from where they were derived. Feedback from project participants showed that the

tool improved greatly the communication and understanding among the downstream users.

In the Nokia case (Tuunanen et al. 2006) we applied the social actor theory to analyze requirements data from the perspective of the social context. The results showed that there were substantially and significantly different customer needs among the three locations: Helsinki, Hong Kong and Las Vegas. The finding argues for the importance of identifying context-based social value that affects customer preferences.

Integration

At the Royal New Zealand Foundation of the Blind (Tuunanen et al. 2011) we used personal construct theory to model the requirements data explicitly for the target population, the blind and visually impaired mobile service users. The discovery, analysis, and integration activities, all undertaken with a participant sample of people who are blind or visually impaired, resulted in a distinct set of requirements, targeted to that population, and with explicit value that is population specific, that would not be likely to emerge in a sample of participants that was representative of the general population.

At Digia (Peffers et al. 2003; Peffers and Tuunanen 2005) we used the interactions concept, based on social actor theory, to develop innovative ideas for new financial mobile service concepts. In the one-day workshop, the client organization staff produced descriptions, benefit, profit, and risk analyses for feasible applications, based on the models developed from the discovery data, as well as business models to support the applications. Feedback from the client on the usefulness of the approach was very positive.

At *Helsingin Sanomat* (Tuunanen et al. 2004) we applied the rehearsability, rich media, and reproducibility concepts from information theory to prioritize features and functionality and to use them to develop an application development roadmap. Participants provided their individual

and utility-based rankings of the service features they preferred, which rankings were aggregated into the network models and later became the basis for the three-year development roadmap for the application. The implementation of the roadmap ensured that the earlier upgrades to the service contained most of the value for customers.

At the Royal New Zealand Foundation of the Blind (Tuunanen et al. 2011) we used the feedback immediacy and reproducibility from information theory in a service co-design effort with participants who are blind. Starting with representations of the modeled preferences, the participants engaged in discussions to create ideas for an integrated set of applications that they referred to as the Virtual Voyager, i.e., a bundle of applications for around-town navigation, family and group coordination, as well as retail shopping.

Together the elements of the five cases that we related in section 4, have provided support here in section 5 for each of the construct elements of the TSCT described in section 3.

6. CONCLUSIONS

In this paper we identified a substantial opportunity that has been created by the confluence of two theoretical developments. One of these is the emergence of the new dominant logic of service co-creation in marketing and the other is the emergence of design science research and, specifically, the concept of a design theory. Together they provide us with the conceptual tools with which to address a long standing problem: while internal users and other stakeholders are most straightforwardly able and motivated to participate in the co-design of new services, quite often the most interesting targets for such co-design are less able, less motivated, more costly, more inconvenient to so engage.

Here we designed, to address this problem, using the design science research methodology, a new IS design theory: TSCT. We developed six objectives for a theory; reviewed four literatures

as reference theories; and used them to develop a new theory for design and action. Next, in a demonstration of the use of TSCT, we applied it to the development of service requirements in five case studies, where service discovery, analysis, and integration activities were targeted to customer populations. Finally, we evaluated the demonstration in terms of its efficacy of use of the theory elements and the reference theories.

This paper makes several contributions to the IS and services literatures. It identifies involvement of populations of potential customers in the co-design of new services as a research problem. It reviews four major literatures to recognize potential solutions to the co-design participant problem. It explicates the design of a theory that can serve as the basis for the design of methodology to accommodate particular target participant populations. It demonstrates the use of the new theory through multiple case studies that support the efficacy of theory elements in practice. Finally, it demonstrates the use of design science research methodology (Peffers et al. 2008) to develop an applicable theory to address the identified problem.

The essence of the TSCT is contained in the relationships among the reference theories and constructs and the expected impacts that pertain to their employment in co-design activities. Throughout this paper, we have described specific methods and techniques that we have used to implement the constructs. These are intended as exemplars; they are not the essence of the theory. While they represent good examples of the implementation of the constructs, it is not the intent of the authors to suggest that these methods and techniques are the only ones or the best ones to use. Circumstances, the context, and the purpose of the study may often suggest that other methods are better suited for the purposes at hand. The literature contains a vast inventory of methods and techniques, e.g., (Davis 1982; Keil and Carmel 1995; Mathiassen et al. 2007; Pohl 1994), that have been employed in various circumstances, many of which may be suitable

for use with TSCT in the right context.

The successful use of TSCT at five different case studies show that the theory can be used to develop a portfolio of service co-design activities that worked effectively for different target populations. This success suggests that TSCT can be employed for use with other target populations, with appropriate adaptations to both the intended objectives of the systems, applications, or services for which the co-design activities are intended and the characteristics of the target population. For example, the authors are currently engaged in research to develop methodology to enable and motivate service co-design activities for the blind, as well as to determine culturally specific feature sets for mobile services, and smart interactive television services targeted for Google TV type devices that may find their way to our living rooms.

For practicing managers and developers, TSCT provides a framework for understanding what techniques to employ at each stage of the service co-design process and why they should be used. For researchers, TSCT provides the basic framework for the study of service co-design, centered on its use to engage different target populations, each of which will require unique consideration.

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TABLES

Table 1. Problems engaging population participants in co-design and objectives of a theoretical solution.

Stage	Problem	From	Objective
Discovery	Lack basis for ideas/preferences (Orlikowski 1993; Salaway 1987).	lack of experience with technology, lack of ties to the organization, differences in culture	Facilitative, motivate ideation.
	Barriers to participation in data collection.	Lack of proximity, disability, differences in world view	Motivation and enablement for participation
Analysis	Difficult to create meaningful, aggregated view	knowledge structure different between users and developers	Efficient aggregation that retains meaning across knowledge structures
	Difficult for managers to understand and evaluate user ideas	Differences in perspective and culture	Model requirements without forcing structure to enable knowledge sharing
Integration	Difficulty of providing meaningful feedback	Unavailability for iterative participation; data complexity	Facilitate evaluative feedback—contextually anchored
	Prioritization: need to make decisions about which functionality to address	Not possible or worthwhile to do everything	Reconcile preferences, value, feasibility, business model for the firm, so that co-designers are able to understand what creates value for the customer

Table 2. Theory for population targeted co-design of services.

Stage	Reference Theory	Construct	Proposition	Justification
Discovery	Diffusion of Innovation Theory	Lead Users	Better able to imagine functionality leads to more ideas	Lead users naturally curious and enthusiastic about new products and technologies
	Personal Construct Theory	Mental Models	Downstream users better able to understand	Designers & Managers with different mental models understand preferences
	Information Theory	Rich data, sufficient data, rehearsability	Understanding of user thinking	Manager/designer better understand how attribute can be implemented.
	Social Actor Theory	The social context: affiliations	Affiliations result in more sufficient and richer data	Social affiliations provide cultural context for data.
Analysis	Personal Construct Theory	Socially constructed normal systems	Retaining rich preference data with reasoning helps managers understand needs	Managers/designers with different mental models use reasoning to better understand.
	Information Theory	Symbol variety, rich media	Leads to effective conveyance of understanding	Message recipients better understand when message coded in flexible language and structure.
	Social Actor Theory	The social context: affiliations, environments, interactions, identities	Understanding users' social context contributes to richer preference data that conveys more meaning	Social context of preferences linked to reasoning and values.
Integration	Social Actor Theory	The social context: identities	Identity focused requirements leads to target population satisfaction	Co-designer customers see requirements in cultural context, in terms of their social identity relationships
	Personal Construct Theory	PCT: attributes, consequences, values	Modeling preference data with reasoning contributes to understanding of customer held structures of service related value	Actionable requirements through interaction among user preferences, business requirements, and technical feasibility.
	Information Theory	Rehearsability, rich media, reproducibility	Leads to plan for satisfactory execution of the population's preferences and integration into the business	Implement a shared understanding of business, customer requirements.
	Information Theory	Immediacy of feedback, reproducibility	Leads to sufficient understanding for the production of feasible system ideas for functionality; features that meet the needs of users, business.	Media capable of expressing preferences with modeled reasoning with detail enables managers and designers to explore business models and architectures to meet needs.

Table 3. Applying five case studies to the theory

Stage	Reference Theory	Construct	Implementation	Impact	Reference
Discovery	Diffusion of Innovation Theory	Lead Users	Snowball recruitment	High participation rate High number of ideas per person	Digia
	Personal Construct Theory	Mental Models	Laddering interviews	Preference data with reasoning--downstream understanding	Rutgers University
	Information Theory	Rich data, sufficient data, rehearsability	Intensive data collection	Better understanding of how preferences create value	Nokia research consortium
	Social Actor Theory	The social context: affiliations	Recruit subjects through organizations	Participant motivation	Royal NZ Foundation of the Blind
Analysis	Personal Construct Theory	Socially constructed normal systems	Aggregated network model of preferences, consequences, and values	Managers/designers understand preferences	Rutgers University
	Information Theory	Symbol variety, rich media	Qualitative, multi level models aggregate preferences/reasoning	Improved communication and understanding among downstream information users	Helsingin Sanomat
	Social Actor Theory	The social context: affiliations, environments, interactions, identities	Aggregated preference models in social context, with reasoning and value information.	Identification of context-based social value	Nokia research consortium
Integration	Personal Construct Theory	PCT: attributes, consequences, values	Requirements modeled explicitly for the target population	Population specific value creation.	Royal NZ Foundation of the Blind
	Social Actor Theory	The social context: interactions	Use of rich data in manager/designer workshops	Emergence of ideas for valuable, feasible services	Digia
	Information Theory	Rehearsability, rich media, reproducibility	Prioritized features/functionality. Application development roadmap	Enable creating optimal customer value	Helsingin Sanomat
	Information Theory	Immediacy of feedback, reproducibility	Ideation effort with users, using modeled preferences.	Co-created ideas for new services	Royal NZ Foundation of the Blind