Consumers’ Adoption of Information Services

Brad McKenna, Tuure Tuunanen, and Lesley Gardner

Abstract: The paper reports a design science research study that seeks to investigate how information service components affect consumers’ potential adoption of such services. More specifically, the paper develops a conceptual model that uses the theory of organizational information services (TOIS) and the unified theory of acceptance and use of technology (UTAUT) as a basis. The results show that individual constructs can be linked to service components. This, in turn, can potentially be an instrumental finding towards further understanding consumers’ adoption of information services and how this affects development of such services and systems that support them.

Keywords: theory of organizational information services, service components, consumer, adoption, unified theory of acceptance and use of technology.

Introduction

Today, the development and use of information systems is changing dramatically. Instead of being developed for (and used by) organizational “users”, information systems are more and more being developed for consumers. The over-riding concern when developing consumer information systems [50] (as contrasted with developing information systems for organizational users) changes from that of efficiency and effectiveness to that of facilitating consumers’ service encounter and how they experience it. The shift is creating new types of information systems, which provide services to consumers, such as Internet Protocol
Television (IPTV), or mobile services, such as Apple’s AppStore for iPhone. This new focus on the consumer therefore pushes services to the forefront of information systems research.

The growth of the Internet, globalization, and increasing automation has driven the reconfiguration of service value networks. There are new opportunities to develop innovative services, research and deliver new information services and business services [46]. A new dominant logic for marketing has been proposed, whereby the new logic focuses on intangible resources, the co-creation of value and relationships, as opposed to tangible resources, embedded value, and transactions [53]. There is however, a lack of formal representations of service systems which combine technology, business, and social aspects into the development of service innovation [46]. The current literature is also limited with regards to theories available that explain how information services are different to information systems, and how information services can be designed to support consumers.

The transition from products to services is a major driver in the current economy. This study focuses on understanding what this means from the point of view of developing information systems based services and specifically for consumers. This differs from the current mainstream of IS literature, which frequently focuses on developing systems for businesses or organizations [22]. Mathiassen and Sørensen [33] have been one of the first to suggest a service approach to and they have developed a theory of organizational information services (TOIS). They argue that we should view organizational information systems as services. Others have suggested a more scientific approach to the design and development of services [46].

Many of the studies concerning consumers’ adoption of services have used the technology acceptance model [54] as the basis for understanding the consumer behavior. For example, application of the Decomposed Theory of Planned Behavior has been used to help explain the adoption behavior of early adopters of mobile services [40] and consumers intentions to use
mobile services [37]. The unified theory of acceptance and use of technology has also been suggested for investigating the acceptance of mobile devices and services [5]. However, there are a limited number of studies that have tried to link consumer behavior to information systems development. Recently, this has been approached from the point of how consumers perceive and derive value from information systems they utilize [50]. More specifically, it has been argued that co-creation of value is an essential concept to recognize in order to comprehend differences between organizational users of information systems and consumers [50]. However, they do not provide insights of how to understand, e.g., how to measure, the perceived utility of the developed information systems or how different types of services influence to the co-creation activities.

Our paper is motivated by the above gap in the literature. We base our research on the theory of organizational information services and the way this theory differentiates services in terms of information processing capabilities of people, namely how we deal with uncertainty and equivocality of information. Secondly, we see that the unified theory of acceptance and use of technology provides a good starting point for understanding user behavior also in the consumer context. Our objective, thus, is to use these two theories to understand how users perceive value provided by different information service types. This leads us to our research question:

*Do service components affect how consumers perceive value from information services?*

Our paper uses the design science research methodology (DSRM) [41] for conducting and presenting the research and its findings. DSRM has been developed for providing a process and a mental model for presenting and conducting design science research [19] in information systems. Firstly, in *Problem Identification*, we review literature to provide basis for understanding the theoretical setting and the theoretical argument for linking UTAUT
constructs with TOIS component types. Next, we design and develop an artifact to operationalize the research model. The third section, *Evaluation*, provides findings from our experiment. Finally, we discuss the implications of our findings and propose future directions for research.

**Problem Identification**

Mathiassen and Sørensen [33] have provided a theoretical view of how we could begin to make the transition from a systems perspective, the artifact driven use of information technology, to a services driven approach.

The theory of organizational information services [33] draws upon the constructs of information processing and requirements to understand the design, consumption, and provision of information services. TOIS adopts Daft and Lengel’s [10] view that there are two fundamental information processing requirements: *uncertainty* and *equivocality*. Uncertainty relates to the availability and reliability of the information required to execute a task. Equivocality means multiple and conflicting interpretations about a situation.

Mathiassen and Sørensen [33] have synthesized these into a theory of organizational information services by applying contingency theory to describe the relationships between information services and work contexts, namely to four components of services: *computational*, *adaptive*, *collaborative*, and *networking*. *Computational Service components* support users in transforming available and formalized information into organizational stimuli by following standardized and repeatable patterns of information processing. *Adaptive Service components* interpret and transform available and emergent information into organizational stimuli by adapting patterns of information processing to specific work contexts. They rely on relationships and allow involved actors to explore and debate interpretations during task execution. *Networking Service components* help users to produce
information about phenomena in an organization and environment by following standardized and repeatable patterns of information processing. They typically connect users to relevant information sources through IT artifacts such as email systems, search engines, electronic libraries, mobile phones, and SMS messaging. Collaborative Service components support users to produce information about phenomena in an organization and its environment through interpretation of the specific work context [33]. This theory, however, leaves open the definition of what is a service if we think about information services for consumers.

In following we present six propositions of how theory of organizational information service components can be conceptually linked to the constructs of the UTAUT model. In a recent UTAUT study by Carlsson et al. [5] the hypotheses have been simplified to contain only the relationships between constructs without their moderators. We have taken a similar approach to this and used hypotheses similar to these.

**Proposition 1: Computational Service and Adaptive Service Components are tied to Performance Expectancy**

The first proposition presents that computational service components support stable processing information requirements and competent actors that cope with equivocal tasks through the use of available information execute adaptive services. Both service components fall under the category of the user’s need-to-do-something and the use of information [33]. In order to do something, a task should be perceived as useful, which using the definition from [11] can be defined as the degree to which a person believes that using a particular system would enhance his or her job performance. Usefulness is the key to allowing a user to do something which implies the belief in the existence of a positive use-performance relationship [11].

Within performance expectancy, usefulness can be considered similar to the other constructs which it is composed of [54]: extrinsic motivation [13], job-fit [48], and relative advantage
The usefulness of a computational or adaptive service components provides the extrinsic motivation for a user to perform an activity to achieve a valued outcome [11; 12]. This implies that if a service component were not useful, the user would not have any motivation to use that part of the service. The tasks a user may be required to undertake must be able to enhance the user’s job performance, hence there is a similarity between job-fit and usefulness [48]. Using a computational or adaptive service components should also provide some relative advantage to the user over the precursor of the system; hence there is also a relationship between the usefulness of this system over other systems [12; 35; 42].

Research relating to performance expectancy of information services has found that the possibility of obtaining information while ‘on-the-go’ is considered useful. This is particularly true if the information available can support ‘nomadic’ undertakings [27]. A nomadic undertaking implies an encounter relationship, and receiving information ‘on-the-go’ implies that the consumer’s need-to-do-something which fits the requirements of a computational service and adaptive service.

Therefore, we present that Performance Expectancy (PE) has an influence on behavioral intention (BI) [Hypothesis 1].

**Proposition 2: Computational Service Components are tied to Effort Expectancy**

Computational service components have low uncertainty and low equivocality, therefore information is usually always available and users would not be required to spend time interpreting the information available to them. Furthermore, computational service components have standardized inputs, processes, and outputs [33] and can be considered relatively easy for users to use. This definition alone leads us to propose that there is a link between effort expectancy and computational service components. Effort expectancy consists of three constructs, perceived ease of use, complexity, and ease of use [54], which has helped us to form our second proposition. Computational service components are free from
uncertainty and equivocality, and therefore should by their very nature be perceived as easy to use [11; 12; 35], and not difficult to understand [48]. Computational service components are also characterized by their use of information, and hence should require little effort to use. Therefore, we present that Effort Expectancy (EE) has an influence on behavioral intention (BI) [Hypothesis 2].

**Proposition 3: All four service components are tied to Anxiety**

Computer anxiety has been theorized in UTAUT to not have a direct influence on behavioral intention [54]. Anxiety can cause reluctance in undertaking specific activities of a computer system and can impact an individual’s performance [39], their perceived ease of use [1], the usage of the computer, and self-efficacy [9] and generally leads to the outcome that software is difficult to use [39]. We also see that anxiety is linked to all four-service components. We propose this based on the definition of anxiety, “an individual’s tendency to be uneasy, apprehensive, or fearful about the current or future use of a technology” [30]. Anxiety can impact an individual’s fear of computers, and hence would be less likely to use or would under use computers and their associated technologies and applications [28]. Therefore anxiety relates to consumers’ general perceptions about technology use and can be characterized by a negative reaction towards it. Since anxiety relates to the actual technology itself, it can be applied to all four service components, and hence towards the use of the artifact.

Therefore, we present that Anxiety (AX) has an influence on behavioral intention (BI) [Hypothesis 3].

**Proposition 4: Computational Service and Adaptive Service Components are tied to Self-Efficacy**

Self-service technologies have gained widespread interest in recent years, especially IT-enabled service encounters [16]. Self-service technologies can be defined as “technological
interfaces that enable customers to produce a service independent of direct service employee involvement” [34]. Examples of such self-services include ticket machines, electronic check-in terminals at airports, or online-banking. The provision of self-service technologies is perceived as being a major contributor to a company’s overall success, especially the ease of transaction processing in today’s fast paced world [34]. Businesses are continuing to implement self-service technology components to their service offerings in order to save costs, open up new channels for sales, and satisfy increasing demand [4]. Computational and adaptive service components are characterized by the need to do something; therefore we have classified these service components as containing self-service tasks.

In order to assess the general acceptance of a self-service technology, it is necessary to take a look at the different stages of the adoption process. An important pre-condition imposes the user’s awareness of the respective technology and is furthermore determined by their ability, i.e. the perceived capability (of the user) to perform the behavior [49]. Self-efficacy can be defined as a judgment of one’s ability to use a technology (e.g. a computer) to accomplish a particular job or task [54]. Therefore we can directly link self-efficacy to the adaptive and computational service components of TOIS. Furthermore, when we have services where the involved actor needs-to-do-something, we can conclude that these service components need to be self-efficient, in that the actor can perform the task at hand without seeking help from others, for example the service provider.

Therefore, we present that self-efficacy (SE) has an influence on behavioral intention (BI) [Hypothesis 4].

Proposition 5: Collaboration Service Components are tied to Social Influences

In recent studies of mobile technology usage, it has been found that social factors had a significant influence [14]. According to literature, subjective norm is particularly important for young users in the adoption of mobile services [32]. This group is easily influenced by
social norms, peers and their surroundings [14]. It has also been found that social norm had an influence on the intention to use a mobile service [20; 26]. Push to talk technologies are also affected by social norms and had an influence on usage of the technology for communication purposes [14]. Mobile services should also be able to enable users to express their personal and social identity [37].

Reid et al. [44] have investigated the psychology of SMS text messaging. It was found that text messages helped users to develop new and deeper relationships with “text mates”, and also altered the way they expressed themselves. Users were more comfortable saying things in a text message than they were in face-to-face conversations. Many text message users prefer to text their closest friends than speak to them on their mobiles, and a significant proportion prefer to text rather than meet up face-to-face. The immediacy, mobility, and perpetual contact offered through mobile phones allows for near conversational levels of texting, so that the mobile phone allows often resemble online chat. Reid et al. [44] also suggested that that the combination of the spontaneous sociability of the chat room, coupled with the artful editability of email makes texting appeal to key user groups. The researchers also established the existence of text circles, which is a well-defined and close-knit groups of contacts with whom texters regularly, and often continuously exchange messages [44].

This relates to the model of PC utilization in that Social Factors are the individuals internalization of the reference groups subjective culture, and specific interpersonal agreements that the individual has made with others in specific social situations [48] and to UTAUT in that social influence is defined as the degree to which an individual perceives that important others believe he or she should use the new system [54]. Therefore whenever users must collaborate together, we propose that there is an influence of social factors affecting the use of collaboration technologies.
Therefore, we present that social influence (SI) has an influence on behavioral intention (BI) [Hypothesis 5].

**Proposition 6: Networking Service Components are tied to Facilitating Conditions**

Delivering relevant information at the right time, to the right person and in the right place is always a key idea in mobile services. With mobile computing, mobile advertising can be highly personalized and can also easily be focused on a consumer’s current location [31]. Mobile advertising can take the form of a push (location-sensitive information is automatically sent to the users based on their location) or pull (user requests services based on their location) service. The most common form is mobile advertising is a service provider promoting their services by sending SMS text messages to users according to their location [31]. Attitudes towards location-based advertising among youth is often positive, but only if the user has the ability to control what kind of advertisements, and from whom they receive them [23].

Leung et al. [31] state that informativeness of mobile advertising is a key determinant of the underlying economic benefits in that mobile computing can include localization of the consumer and personalization. Localization describes the ability to locate the position of a mobile user through the use of positioning technologies such as GPS. Personalization is also a key factor because the mobile device can act as a personal assistant and offer unique opportunities in the user’s environment [31]. An individual’s knowledge or experience is a central psychological determinant of consumer behavior. Existing knowledge can affect the cognitive process relating to a consumer’s decision and also can affect their ability to understand the features and usage of an innovation. The innovation is considered to be less complex if the consumer already has a certain amount of knowledge about the innovation. In this case, the knowledge of mobile advertising is based on the consumers existing knowledge of mobile communications. Mobile communication is the technology behind the basis for
mobile advertising. Therefore the more experienced a consumer is with mobile communications, the less difficult the use of mobile advertising will appear to them [3].

Facilitating conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system [54]. Therefore, we can place our link *facilitating conditions* into the networking service components of TOIS. Users need to be aware of the conditions that are available to support their use. Users assume that there are adequately available services to suit their needs, as well as the technical infrastructure to support it, such as GPS technology and network infrastructure.

![Figure 1. Research Model](image)

Therefore, we present that facilitating conditions (FC) has an influence on use behavior (UB) [Hypothesis 6]. In addition to above six hypotheses that are conceptually linked to TOIS constructs, we will also test how behavioral intention (BI) has an influence on use behavior (UB) [Hypothesis 7] as suggested by the original UTAUT model.
Finally, based on the six propositions and subsequent seven UTAUT hypotheses, the research model has been constructed, (see Figure 1). However, we faced a challenge how to study these relationships. In following section, we propose a solution for this.

**Solution: Artifact**

In order to study how TOIS components affect consumers perceived value from information services, we decided to design and develop a software artifact. More specifically, we chose to develop a simulation of a mobile service that was targeted primarily towards consumers. The argument was that this enabled us to provide the means of making sure that the depicted propositions of TOIS components we built-in to the software artifact. This way, it would be possible to do an analysis of the UTAUT constructs to determine if the above propositions hold, and to determine how TOIS components affects service behavior and intention to use information services.

Secondly, at the time of the study it was difficult to find a suitable service that would encompass all the TOIS components and that would be available for empirical testing by us. Therefore, we turned into an earlier study where we had developed requirements for a suitable service: City Wanderer mobile service [51]. This study focused on how consumers perceive a new type of mobile service called Presence. For mobile service providers, handset manufacturers, mobile industry specialists, and mobile UI designers, mobile presence, and especially location-based presence, has become a hot topic. In Japan and South Korea, some forms of mobile presence are already implemented in commercial mobile services and handset devices [21]. According to Nokia, presence allows the following services:

- Show others your location, preferred method of communication, mood and availability.
- Show a different availability to different groups of people.
• Be in control of what information is displayed and to whom.
• Know where a person is and what they are doing before you call them [36].

The researchers used a specifically developed requirements engineering method [51] to discover the needs and the demands that potential consumers have. A series of 80 interviews were undertaken in Finland, Hong Kong, and Las Vegas in order to get a global perspective. The authors discovered six application areas for presence and were presented as a roadmap for presence services. For this study “City Wanderer” was selected as the application to be used in the study. In the following section, we elaborate how we operationalized our research model using the requirements data gained from the Presence study.

**Operationalization: Artifact Design and Development**

For this research, City Wanderer was designed as a desktop simulation of a mobile service rather than a real world artifact. There are two main parts to the artifact. On the left side of the artifact, there is a map layout of a fictional city. The participants are located in the city and their current location is indicated by the red dot. The user can “walk” around the city by using the directional arrows at the bottom of the screen. On the right hand side of the artifact, there is a mobile phone. Participants were asked to imagine that they were holding this phone as they walked around the city. The prototype works exactly as a mobile phone would operate, with the buttons performing the same actions as a real mobile phone.

In order to operationalize the research model (see Figure 1), we needed to consider the tasks and information services enacted by the user. Table 1 summarizes this task level analysis. The first task is about *making a ticket reservation* for a movie at a nearby cinema. This task involves the location-based service displaying to the user a nearby cinema and the movies showing. This task involves the selection of movies and session times and may vary based on the availability of session times depending on the movie and number of tickets requested and
it suits an adaptive service, because the number of conflicting movies, session times, and availability makes the equivocality of the task high. The uncertainty of the task is low as the information on movie times and sessions is always available. This task involves the use of information about movie and session times and implies a relationship service, as the user must previously have an account with the service provider in order to make a payment for the movie.

<table>
<thead>
<tr>
<th>Task</th>
<th>Equivocality</th>
<th>Uncertainty</th>
<th>Information Service</th>
<th>Component Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ticket Reservation</td>
<td>High</td>
<td>Low</td>
<td>Select a movie in a nearby cinema and make payment</td>
<td>Adaptive</td>
</tr>
<tr>
<td>2. Preferences and receiving automatic</td>
<td>High</td>
<td>Low</td>
<td>a) Selecting the services you want to receive</td>
<td>Adaptive</td>
</tr>
<tr>
<td>services</td>
<td>Low</td>
<td>High</td>
<td>b) Automatically receiving service messages when arriving at a location</td>
<td>Networking</td>
</tr>
<tr>
<td>3. Setting presence profile and finding</td>
<td>Low</td>
<td>Low</td>
<td>a) Setting your presence profile for other people to view</td>
<td>Computational</td>
</tr>
<tr>
<td>friends to meet</td>
<td>High</td>
<td>High</td>
<td>b) Negotiating with friends to meet</td>
<td>Collaborative</td>
</tr>
<tr>
<td>4. Seeing location and get information</td>
<td>Low</td>
<td>Low</td>
<td>User can see a map of where they are and receive local information</td>
<td>Computational</td>
</tr>
<tr>
<td>5. Finding something and getting directions</td>
<td>Low</td>
<td>Low</td>
<td>User needs to find a specific place and get directions from their current location</td>
<td>Computational</td>
</tr>
<tr>
<td>6. Find nearby attractions, festivals, and events</td>
<td>Low</td>
<td>Low</td>
<td>User can find nearby attractions, festivals, and events.</td>
<td>Computational</td>
</tr>
</tbody>
</table>

Table 1 Tasks and information services for City Wanderer

A second task is about choosing the preferences they prefer for receiving information once they arrive at a specific location. The user is provided with a list of possible service components to select from. These include services such as restaurants nearby, activities, local information, or events occurring in the area. Once the user has chosen their preferences, they are sent to the service provider. When the user arrives at a specific location, and have selected to receive services, then if that service is available at that location the service
provider will send the user a message saying that such service is available. The user can then decide to discard the message or make use of it, such as purchasing a ticket.

This task can be divided into two separate service types. The first task, selecting the services you want to receive, is suited to an adaptive service as user must decide which service types are the most desirable to receive, offset by receiving messages from the service provider which they don’t want. This task will involve the use of information as the user must select from a list of predefined service components they wish to receive and must have a relationship with the service provider to receive the services requested and implies that the user has a relationship with the service provider. The second task, receiving automatic messages when you approach a location is suited to a networking service. The user may have selected to receive a certain type of service but are uncertain that in a specific location, that information will be available. Networking service components will connect the user to relevant information sources through sending messages to the user. Information will be produced on the fly and sent to the user when they arrive at a specific location. Networking service components are encounter relationships, and this applies to this situation, as there is no ongoing communication between the user and the service provider.

A third task involves the user changing their presence profile and finding people nearby and viewing their presence profile. This task involves the user setting a presence status such as ‘looking for food’ and setting the status to available. Any friends of the user nearby can find the user on their map, view their status, and then negotiate to meet up. This task can also be divided into two separate service types. The first task, setting your presence profile, is suited to a computational service type. This involves the user selecting a standardized set of presence statuses such as ‘available’ or ‘not available’, and writing a brief statement about what they are doing. This can allow the user’s friends to view their current status and availability. The second task, negotiating with a friend to meet is suitable for a collaborative
service. This involves a user looking for a friend, finding one, viewing their presence status and availability, and sending a message to that friend asking to meet up. The two friends may negotiate via messages and arrange a time and place to meet. Information will be produced in this scenario as the users will communicate with each other and implies that there must be a pre-existing relationship between the two.

A fourth task involves the user wanting to view their current location, and receiving local information. The user will be shown a map on the screen in which they can view their current location. The user can zoom or pan the map to get a better idea of their location. If desired, the user can select to view local information, which will be shown on the screen in textual format. This process involves the standardized and repeatable pattern of information from checking the user’s current location, processing it, to displaying a map to the user. This task is suited to a computational service as there is no uncertainty in obtaining the map information and current location cannot be misrepresented. Here, the user will make use of information only for the time that it is needed for.

A fifth task involves the user requesting the location of a service and directions to get there. This task involves the user selecting an item to find the location of such as an ATM. The user’s current location will be determined, and the service provider will calculate which ATM is the closest to the user. The system will display a map showing the location of the ATM, which the user can zoom and pan to also see their own location. On the map will also be drawn a recommended route the user can take to reach that ATM. The user can also select to view a textual description of the route. This task is also similar to the previous task in that the user’s current location must first be determined, processing it, displaying the map to the user, with the addition of also displaying the location of the requested item and the suggested route to get there. Here the user will make use of information only for the time that it is needed for.
Finally, a sixth task involves the user requesting a list of attractions, festivals and events. This task involves the user selecting to find events near to their current location, or citywide events. The user will then be shown a list of events based on their selection and has the option to make payment for any event they wish to attend. This task is suited to a computational service, as the user must select an attraction, which will then be displayed on the screen. There is no interpretation of information required as the user is simply requesting and then receiving information. Here the user will make use of information only for the time that it is needed for.

**Evaluation: Controlled Experiment**

We evaluated the artifact by presenting the City Wanderer artifact to potential users of location based mobile services, i.e. consumers. According to Hevner et al. [19] a controlled experiment is a possible way to measure efficiency and utility of an artifact. Our experiment follows a scenario-based approach by first asking participants to complete a series of tasks in a laboratory session as described in the previous section. According Kjeldskov and Skov [25] it is possible to recreate and simulate significant elements of real life use situations in a laboratory setting and thereby increase the level of realism, but still maintain a high level of control and avoiding complexities of field experiments, such as physical user movement in an environment over which researcher have little control over [24].

In our experiment, the participants used the artifact and afterwards answered an online questionnaire about their use experiences. Initially, participants were shown a 2-minute video that explained how to use City Wanderer artifact and then they were asked to complete a series of tasks using the artifact. The questionnaire was based on the UTAUT constructs described in Figure 1. The questions used a 7-point Likert scale, with 1 being ‘strongly disagree’ and 7 being ‘strongly agree’.
Data for the study was collected from students in second and third year, and graduate classes at a university in New Zealand. The minimum required sample size based on our research model is 60 [8]. We reached a final sample size of 100. The gender distribution of the sample was 68% male and 32% female. The majority of participants were aged between 21-25 years (60%) with the next largest group being 16-20 years (25%). Potential participants were emailed a request to participate in the study and were provided with a link to download the City Wanderer artifact. Participants were asked to complete a series of tasks using City Wanderer, and upon completion of the tasks, were asked to complete an online questionnaire based on their experiences in using City Wanderer. All participants completed the same set of tasks and in the same order. It took the participants on average 20 to 30 minutes to complete the tasks and answer the questionnaire. The questionnaire used for this study is composed of items already used in existing literature [5; 54].

Partial least square technique was chosen as the analysis method for the evaluation. This is in-line with the UTAUT research [54]. It is also a useful technique to use when the sample size is small and the number of indicators is high [8]. We used SmartPLS 2.0 (M3) Beta [45] to perform the PLS analysis. PLS was used to test the whole sample. Before we ran the PLS analysis, we tested the sample for common method bias. We performed a Harman’s one-factor test including all items in a factor analysis [38; 43]. The data did not indicate any evidence for common method bias.

Item reliability, internal consistency, and discriminant validity were used as criteria to ensure that the model has acceptable measurement properties. Examining the loadings of the items assessed the individual item reliability. A minimum value of 0.7 is used as criterion to accept the reliability of individual items and as a cut off point for internal consistencies [2], however we took a slightly less conservative approach and included items with loadings close to 0.7.
All assessment values are shown in Table 2. It is commonly recommended that all average variance extracted (AVE) values should be more than 0.5.

<table>
<thead>
<tr>
<th></th>
<th>AVE</th>
<th>Cronbachs Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>0.605690</td>
<td>0.609296</td>
</tr>
<tr>
<td>BI</td>
<td>0.865208</td>
<td>0.846116</td>
</tr>
<tr>
<td>EE</td>
<td>0.637130</td>
<td>0.748543</td>
</tr>
<tr>
<td>FC</td>
<td>0.547775</td>
<td>0.606998</td>
</tr>
<tr>
<td>PE</td>
<td>0.636535</td>
<td>0.814093</td>
</tr>
<tr>
<td>SE</td>
<td>1.000000</td>
<td>1.000000</td>
</tr>
<tr>
<td>SI</td>
<td>0.649012</td>
<td>0.86422</td>
</tr>
<tr>
<td>UB</td>
<td>0.769406</td>
<td>0.710742</td>
</tr>
</tbody>
</table>

Table 2: AVE and Cronbachs Alpha values

In order to test for the discriminant validity, the square roots of the AVE values were compared to the correlations among latent variables as shown in Table 3. The square roots of the AVE’s are shown in the main diagonal. The off-diagonal elements are the correlations among latent variables. For adequate discriminant validity, the square root of the AVE should be greater than the off-diagonal elements in the corresponding rows and columns [2].

<table>
<thead>
<tr>
<th></th>
<th>AX</th>
<th>BI</th>
<th>EE</th>
<th>FC</th>
<th>PE</th>
<th>SE</th>
<th>UB</th>
<th>SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX</td>
<td>0.778261</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI</td>
<td>0.151584</td>
<td>0.930166</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EE</td>
<td>0.115941</td>
<td>0.266458</td>
<td>0.798204</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC</td>
<td>0.221140</td>
<td>0.406925</td>
<td>0.420629</td>
<td>0.740118</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE</td>
<td>0.106556</td>
<td>0.304916</td>
<td>0.678512</td>
<td>0.511740</td>
<td>0.797831</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE</td>
<td>-0.006587</td>
<td>0.297024</td>
<td>0.348693</td>
<td>0.097476</td>
<td>0.296635</td>
<td>1.000000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SI</td>
<td>0.237192</td>
<td>0.431241</td>
<td>0.177516</td>
<td>0.512635</td>
<td>0.379075</td>
<td>-0.053257</td>
<td>0.805613</td>
<td></td>
</tr>
<tr>
<td>UB</td>
<td>0.054506</td>
<td>0.662674</td>
<td>0.138378</td>
<td>0.409865</td>
<td>0.240068</td>
<td>0.104656</td>
<td>0.396270</td>
<td>0.877157</td>
</tr>
</tbody>
</table>

Table 3: Latent variable correlations & square roots of AVE. Bolded items are square roots of AVE

The structural model comprises the hypothesized relationships between latent variables. The bootstrap procedure of PLS was then used to test the hypotheses. We used bootstrapping, with 500 subsamples, to test the statistical significance of each path coefficient using t-tests [7]. The test results are illustrated in Table 4. Figure 2 illustrates the results of the PLS analysis and the completed research model.
<table>
<thead>
<tr>
<th>Path</th>
<th>Coefficient</th>
<th>t Statistic</th>
<th>P-value</th>
<th>Hypothesis</th>
<th>sig &lt; 0.05</th>
<th>sig &lt;0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX -&gt; BI</td>
<td>0.043</td>
<td>0.358</td>
<td>0.7207</td>
<td>H3</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>BI -&gt; UB</td>
<td>0.594</td>
<td>7.923</td>
<td>0.0000</td>
<td>H7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>EE -&gt; BI</td>
<td>0.090</td>
<td>0.758</td>
<td>0.4486</td>
<td>H2</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>FC -&gt; UB</td>
<td>0.168</td>
<td>2.145</td>
<td>0.0325</td>
<td>H6</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>PE -&gt; BI</td>
<td>-0.007</td>
<td>0.061</td>
<td>0.9511</td>
<td>H1</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>SE -&gt; BI</td>
<td>0.291</td>
<td>3.508</td>
<td>0.005</td>
<td>H4</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SI -&gt; BI</td>
<td>0.423</td>
<td>4.110</td>
<td>0.0000</td>
<td>H5</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Table 4: Outcomes of the hypothesis testing

Figure 2: Completed Research Model

The explanatory power of the model, or nomological validity, is assessed by the $R^2$ value of the endogenous construct in the structural model estimation. It is recommended that $R^2$ must be at least 0.10 in order for the latent constructs to be judged adequate [15]. All of the $R^2$ values satisfy this recommendation and as such, the nomological validity is satisfactory. Therefore, the model explains about 29% of the total variability of behavioral intention, and about 46% of the total variability of usage behavior. Finally, the results from the power
analysis for this research indicate that we are achieving a power level of 0.76 and it can be considered close enough to the recommended value of 0.8 [18]. Thus, we conclude that we have adequate power to support our research.

Based on the results presented, we can accept Proposition 4, and that computational service and adaptive service components are tied to self-efficacy. We can also accept Proposition 5, and that collaboration service components are tied to social influences, and finally we can accept Proposition 6, and that networking service components are tied to facilitating conditions. Furthermore, based on our analysis results, we also found statistical support to at least partly explain consumers’ behavioral intention on the usage of consumer information services. This is further explained by social influence, self-efficacy and facilitating conditions constructs from our research model (see Figure 2).

Our results show that social influences are important for understanding collaborative service components (P5 and H5). This is in-line with the theory of organizational information services as it calls for understanding and supporting the relationship with the consumer and the service. Furthermore, self-efficacy (P4 and H4) seems to explain that consumers also see computational service components as information processing, which is also similar the original TOIS. Self-efficacy also appears to have an effect on adaptive service components, but social influences seem surprisingly not to have any. This contradicts the original TOIS argument. The theory of organizational information services presents that collaborative, but also adaptive service components, are relationship based. Our findings indicate that consumers may not perceive this so. Furthermore, facilitating conditions (P6 and H6) has influence on consumer’s perception of networking service components and how they want to encounter service situations and utilize them for producing information.
We summarize the findings as follows. When designing and developing collaborating service components for consumers we should focus on social influences of the service, which support both high uncertainty and high equivocality needs of information processing. Furthermore, when designing and developing adaptive or computational service components for consumers we should focus on self-efficacy related features of services. In the case of adaptive service components, high equivocality needs of consumers’ information processing should be emphasized. Finally, with networking service components facilitating conditions should be the focal point of design and development efforts.

**Implications**

Our findings indicate that using the theory of organizational information services [33] and the unified theory of acceptance and use of technology [5; 54] can at least partly explain why consumers would like to use consumer information service components. This can potentially have several implications for research and may enable IS researchers to be at the forefront of designing and developing services for consumers and so advance the discussion of service sciences [46; 53].

First of all, we found that using concepts from TOIS enabled us to provide theoretical rationale for the development of the artifact. It was challenging to separate the distinct service components within the developed artifact due the heterogeneous nature of the features and because a task within one service type, may in fact impact a task in another service components. For example, the adaptive task of setting consumers preferences to receive automatic messages impacted the networking service task of receiving those messages. This implies that the boundaries between service components are blurred, which supports our argument for extending the view of IT enabled services for consumers [50]. The service development seems inherently to be a complex task and we do need to look at the use of the artifact more than merely the artifact itself [33].
Secondly, our findings show that when the theory of organizational information services is utilized within a consumer context it can potentially enhance the usage of such services. For services where the consumer needs-to-do-something (computational and adaptive service components), the designers need to ensure that these services are self-efficient, i.e. that consumers need to be able to complete the tasks on their own. Collaborative service components are impacted by the social influences of the technologies utilized in the service, and networking service components are impacted by the conditions that facilitate their use as well as the previous experience of the consumer.

Thirdly, we have demonstrated how design science research methodology [41] and design science research [19] in general can be used for theory development. We have used DSRM to conceptually justify the design and development of an artifact, which in turn is utilized for theorizing how consumers perceive services. This potentially opens avenues for other researchers to use the methodology for theory development within design science research community and perhaps also in the emerging service sciences field.

Finally, our findings may be of interest for researchers in service science. Our emerging theory shows that consumers perceive collaborative services as social. This is interesting when thinking about co-creation of services [17; 34]. Service marketing as a discipline has argued that we should engage consumers in co-creation activities in order to improve the service quality. Our findings present that this might not be the case with all consumer information service components. We see that co-creation would be important for situations where uncertainty and equivocality are high, i.e. in collaborative service components, and social influence has a strong impact on services. However, other service components may not benefit as much from co-creation efforts.
Conclusions

Our paper presents a design science research study that aims to understand how consumers perceive information technology based services and they potentially adopt these. We used design science research methodology [41] to guide our research and also present our findings in this paper. We extended the theory of organizational information services with the unified theory of acceptance and use of technology to develop a software artifact. The artifact was an innovative mobile service called “City Wanderer” for which consumer requirements were derived from an earlier study [51]. These were, in turn, linked to organizational information service types [33] and later in the evaluation phase to UTAUT constructs [5; 54] for a laboratory experiment.

Our study contributes in four ways. Firstly, the research provides further insights for understanding consumers perceived and derived value from information systems they utilize [50]. The results also promote a more heterogeneous view of information systems enabled services for consumers, which is in line with [33; 46]. Secondly, our results indicate that distinct service components can be potentially linked to specific UTAUT constructs, which in turn enables us to further explain how consumers perceive different components of information services and how these should be designed and developed. Thirdly, our research has attempted to use design science research methodology [41] for theory development using a software artifact for the purpose. Finally, we suggest that our findings may be of interest to service science researchers. Our work suggests that not all service components may equally benefit from service co-creation efforts [17; 34] and that perhaps these efforts should target primarily collaborative services.

There are various limitations of this work. First, one of the limitations relates to the scales we used to measure the core constructs in the UTAUT model [5; 54]. Based on recommendations from Chin et al. (1996) each of the core constructs was operationalized by using the highest
loading items from each of the respective scales. By eliminating low loading items, these items were no longer represented in some of the core constructs. Second, we recognize that there is a limitation in the current operationalization of how the UTAUT constructs are mapped to theory of organizational information services. Due to the research design, we had to rely on a conceptual linkage between the theories. Nevertheless, the results are encouraging, but we should also consider alternative ways for further integrating the theories.

Third, our artifact was a desktop simulation of a real mobile device. Despite the fact that the artifact was designed to work exactly as a mobile device would work, in reality, participants were using it on a desktop computer in a laboratory setting. This could remove some of the realism in the participants mind and hence could impact on their impressions while using the artifact.

Finally, we recognize a bias in our population sample in that the genders were significantly skewed towards males. We suggest therefore that some of the hypotheses may therefore be biased due the sample limitations and that a more balanced population sample may give different results. Furthermore, we also recognize that our sample mostly contains students and we acknowledge that this is a limitation. However there are several examples in the IS literature, which have presented results using students as the sample [29; 47; 52]. We note from Carlsson et al. [6], that mobile services are more actively used by younger people than older people, therefore we may have captured the usage patterns one would expect from this type of analysis and the general direction of the effect. Therefore, we see that this is not a major limitation to the current study as such. Nevertheless, we also recognize that in further research we should seek to use a larger representative sample in order to further test the model.

We see that our research opens a rich avenue for future research. First of all, we want to promote other researchers to use design science research methodology for theory
development. Our attempt was one of the first and we see that more work should be done here to address the challenges we found with this study. Secondly, although we were pleased that we were able to map theory of organizational information services and unified theory acceptance and use of technology together we are also first to say that further research should be done here. Linking theory development to design science research process is challenging, especially when using a software artifact to do it. Finally, our findings propose that co-creation may be more efficient for collaborative services and others may open very interesting possibilities for service science researchers.
References


