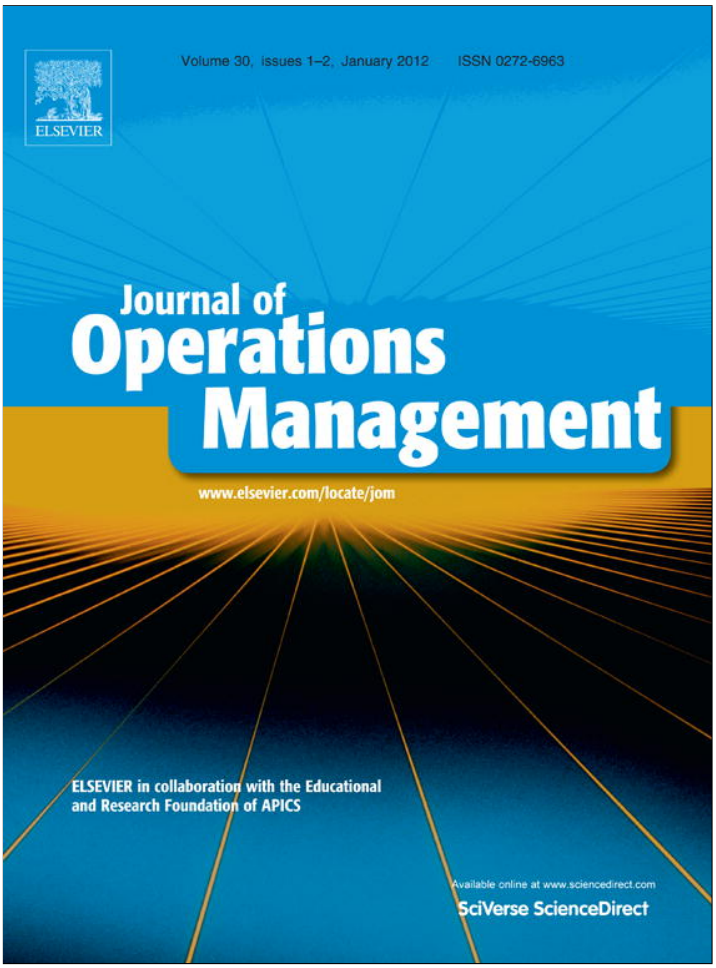

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Designing e-government services: Key service attributes and citizens' preference structures

Viswanath Venkatesh [a,*], Frank K.Y. Chan [b], James Y.L. Thong [c]

[a] University of Arkansas, Walton College of Business, Fayetteville, AR, USA
[b] Curtin University, Curtin Business School, Perth, WA, Australia
[c] Hong Kong University of Science and Technology, School of Business and Management, Kowloon, Hong Kong

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ABSTRACT

Advances in Internet technologies have led to the popularity of technology-based self-services, with the design of such services becoming increasingly important. Using technology-based services in the public sector as the setting, we identified the key service attributes driving adoption and use of transactional e-government services, and citizens' preference structures across these attributes. After identifying four key attributes, i.e., usability, computer resource requirement, technical support provision and security provision, we conducted a Web-based survey and a conjoint experiment among 2465 citizens. In a two-stage Web-based survey, citizens reported their perceptions about a smartcard technology for transactional e-government services before use, and their use and satisfaction 4 months later. Results showed that the key attributes (noted above) influenced citizens' intentions, subsequent use and satisfaction. In the conjoint experiment, citizens reported their preferences for key service attributes for two transactional e-government services. Further, a cluster analysis uncovered four distinct citizen segments, i.e., balanced, usability-focused, risk-conscious and resource-conservative, that can inform efforts in designing e-government services. A post hoc analysis confirmed the appropriateness of the market segmentation in understanding citizens' adoption and use of transactional e-government services.

1. Introduction

Self-service technologies have changed the way customers interact with firms. Prior work suggests that people prefer self-service over conventional, face-to-face service partly due to the considerable savings in time and effort, increased personal control and ease of use (Meuter et al., 2000). Advances in technology, such as the Internet, enable companies to redesign their self-service offerings (Berry and Lampo, 2000; Froehle and Roth, 2004; Hill et al., 2002; Rai and Sambamurthy, 2006; Yang and Park, 2011). To design effective offerings, firms need to understand their interactions with customers in the context of technology-based self-services (Cunningham et al., 2009; Ding et al., 2010; Meuter et al., 2000; Pullman et al., 2001; Venkatesh, 2006; Venkatesh and Agarwal, 2006; Venkatesh and Ramesh, 2006; Verma et al., 1999). The design of technology-based self-services is particularly important because it determines the key features of the services and consequently, affects customers' service experiences (Ding et al., 2010; Meuter et al., 2000). However, in practice, many of these services have been designed according to common sense or common practice, without paying attention to quality as defined by the customer, resulting in poor design and user dissatisfaction (Meuter et al., 2000; Rai and Sambamurthy, 2006; Robertson and Shaw, 2009). According to an industry survey, while firms have increasingly invested in self-service technologies to reduce operating costs and increase customer satisfaction, a majority fail to realize operating cost reductions and meet customer needs (Business Wire, 2010). It is thus necessary to understand what customers value in a particular set of services so as to maximize customer satisfaction and retention, and how service delivery systems can exploit customer differences versus their similarities (Cook et al., 2002; Roth and Menor, 2003).

One such technology-based self-service context is electronic government (e-government), defined as the delivery of government information and services to citizens via the Internet or other digital means (West, 2004). Government services are different from commercial services offered online or offline by traditional for-profit firms, as many government services must be used—e.g., filing taxes—with the choice now really being the channel. While prior research has focused primarily on technology-based self-services in consumer contexts (e.g., Cunningham et al., 2009; Ding et al., 2010; Meuter et al., 2000; Thong et al., 2006), this work focuses on self-services in the public context, specifically e-government services.

* Corresponding author. Tel.: +1 479 575 3869; fax: +1 479 575 3689.
E-mail addresses: vvenkatesh@vvenkatesh.us (V. Venkatesh), frankchan@curtin.edu.au (F.K.Y. Chan), jthong@ust.hk (J.Y.L. Thong).

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E-government services can be broadly categorized into informational and transactional services. Informational services refer to the delivery of government information via Web pages and transactional services involve two-way transactions between government and citizens (e.g., submission of electronic forms) that may require horizontal or vertical integration of multiple government agencies (Norris and Moon, 2005). On the one hand, there are many benefits to transforming traditional public services into e-government services, such as cost-effective delivery of services, integration of services, reduction in administrative costs, a single integrated view of citizens across all government services and faster adaptation to meet citizens' needs (Akman et al., 2005). On the other hand, governments face many challenges in deploying transactional e-government services (Al-Sebie and Irani, 2005; Gauld et al., 2010), and these challenges are reflected in the low deployment rate of transactional e-government services around the world. About 98% of the countries in the world have developed government Web sites, with less than one-third providing transactional services, such as online form submission (United Nations, 2010).

Prior work has noted the importance of service design to the success of services (e.g., Becker, 2005; Chase and Apte, 2007; Karwan and Markland, 2006; Menor et al., 2002; Narasimhan et al., 2005; Vassilakis et al., 2003). As electronic services (e-services) are considered technology innovations, previous studies have frequently adopted the technology acceptance model (TAM; see Venkatesh et al., 2003 for a review) to understand user acceptance and use of e-services (e.g., Featherman and Pavlou, 2003; Wang, 2002). While TAM has provided a theoretical basis to help identify and examine key factors that determine users' adoption and use of e-services (e.g., perceived usefulness and perceived ease of use), some research has noted that TAM cannot provide specific guidance to direct design and practice (e.g., Venkatesh and Davis, 1996). Thus, we will revisit the conceptualization of service in order to identify key service elements and specific service attributes that are more directly relevant to service design.

Further, while there has been progress in understanding users' adoption of services, little attention has been devoted to understanding users' preferences, particularly related to tradeoffs between different service attributes (for exceptions, see Iqbal et al., 2003; Verma et al., 2006). Understanding the tradeoffs is important, as designing a good, usable online service frequently requires tradeoffs across multiple design characteristics (Venkatesh and Agarwal, 2006). For instance, citizens may desire a high level of security for transactional e-government services, but may subvert the use of security mechanisms due to its complexity (Princeton Survey Research Associates, 2002). With the ongoing diffusion of information technologies within the public sector (Karwan and Markland, 2006), the design of user-centered e-government services will continue to be a challenging and complex task, as citizens' demands, needs and requirements for these services and resources vary, change and become increasingly sophisticated over time (Bertot and Jaeger, 2006). As every citizen is a potential consumer of these services, understanding citizens' requirements can have a major impact on new service development (Maruping et al., 2009; Roth and Menor, 2003) and yield insights into the design of self-services. It is thus of practical and scientific significance to examine key service attributes that affect citizens' pre-use intentions and subsequent use of transactional e-government services, as well as citizens' preferences across service attributes. Against this backdrop, this paper has the following objectives:

1. to identify key attributes of transactional e-government services;
2. to propose a model of citizens' adoption, use and satisfaction with e-government services (H1–H5);
3. to theorize about the relative importance and tradeoffs among the service attributes (H6–H8); and
4. to empirically test the proposed hypotheses using data from a two-stage survey, with data gathered four months apart, and a conjoint experiment.

This study examines service design using a variety of approaches. First, we draw on the services and the information systems (IS) literatures to develop a research model relating citizens' perceptions of service attributes to behavioral intentions that in turn predict service use and satisfaction. Based on Grönroos (1987, 1998, 2000) conceptualization of services, we define key elements of a service package and identify key service attributes in the context of transactional e-government services. We empirically test the model using data collected from a two-stage survey on citizens' perceptions about a smartcard technology for transactional e-government services. The results demonstrate the relevance and importance of the identified service attributes to citizens' adoption, use and satisfaction with e-government services. Second, we draw on the services literature to theorize the relative importance among the service attributes from a tradeoff perspective—a perspective that is lacking in prior research on e-services adoption. As services can be characterized along two dimensions—i.e., throughput time and degree of variation (Schmenner, 2004), users' expectations of the service experience, for example in terms of processing time and effort, are likely to differ across services. Thus, we further include service type as a contingency factor and argue that the relative importance of service attributes will differ across services with different throughput time and degree of variation. We empirically test our hypotheses using data collected from a conjoint experiment focusing on two e-government services—i.e., online appointment booking service and online tax filing service. Complementing the model testing results, the results of a conjoint analysis provide specific insights into service design by revealing the relative importance of service attributes and citizens' preferences for individual attribute levels. Third, based on the results of the conjoint analysis, we conduct a cluster analysis to identify major population segments that have different patterns of attribute preferences. We profile the major segments with demographic and socioeconomic characteristics to offer further insights into the design and deployment of e-government services.

This study contributes to the literature on service operations in four key ways. First, this study responds to the call for using behavioral science to improve service design and user experience (Chase and Apte, 2007; Cook et al., 2002; Stuart and Tax, 2004). We formulate a nomological network relating citizens' perceptions of service attributes to service use and satisfaction. Further, we assess citizens' preferences for different service attributes and profile major population segments. Collectively, this study uses a behavioral approach to gain insights into citizens' perceptions and preferences for key service attributes that are important in influencing service use and user experience. Second, this study builds on the notion that the service concept is the key driver of service design decisions (Goldstein et al., 2002). We apply Grönroos (1987, 1998, 2000) conceptualization of services to identify key service attributes and theorize about the relative importance of these attributes. The findings demonstrate the utility in applying this conceptualization of services to guide service design in the context of e-government. Third, this study investigates service design in an underexplored context, i.e., the public sector (Karwan and Markland, 2006; Narasimhan et al., 2005; Verma et al., 2005). We examine multiple e-government services—i.e., smartcard services, online appointment booking service and online tax filing service. The findings for different services provide insights into formulating a general service design strategy for public organizations (Karwan and Markland, 2006). Finally, this study adds to prior research that

advocates the use of the market-utility approach for service design in the public sector (Verma et al., 2006). We conduct a large-scale and comprehensive study on the design of e-government services by employing multiple methods of data collection—i.e., a survey and a conjoint experiment—and analysis—i.e., structural equation modeling, conjoint analysis and cluster analysis. This study provides support for the usefulness of the market-utility approach for service design in the public sector and further illustrates the potential use of this approach in combination with other research methods. The systematic methodological approach used in this study can provide guidance for the design of e-government services as well as other e-services.

2. Theory

In this section, we first discuss and define the key elements of a service package in the context of transactional e-government services. Next, we identify the key service attributes pertaining to the service elements and present a model of intention to use e-government services. Finally, we discuss hypotheses regarding relative importance of these attributes.

2.1. Key elements of a service package

One of the first steps in designing a new service is to consider all the elements of the delivered service from the perspective of the buyer and the seller (Roth and Menor, 2003). Early research defined a service package as a bundle of core and peripheral services (e.g., Normann, 1984; Sasser et al., 1978). In more recent work, these two types of services have been refined and expanded (e.g., Fitzsimmons and Fitzsimmons, 2004; Goldstein et al., 2002). One widely cited extension is suggested by Grönroos (1987, 1998, 2000), who divides the peripheral services further into facilitating and supporting services/goods. Following Grönroos (1987, 1998, 2000), this paper conceptualizes a service package as a bundle of core services, facilitating services/goods and supporting services/goods. Core services are the fundamental cause of the existence of services. Facilitating services/goods are essential services or goods that make it possible for customers to consume a core service. Supporting services/goods are optional services or goods that make the core service more attractive to users and improve the service experience. For example, airline service consists of a core service—i.e., transportation—facilitating services/goods—e.g., check-in procedures and air tickets—and supporting services/goods—e.g., cabin crew services and in-flight meals. In order to take a flight—i.e., be transported—customers must check-in and possess their air tickets, and good in-flight services and meals could improve the overall experience of the air travel. In the context of e-government, an online tax filing service consists of a core service—i.e., use the Internet to file taxes—facilitating goods—i.e., software and hardware needed to use the online tax filing service—and supporting services—i.e., security measures and technical support that improve citizens' confidence in using the service.

2.2. Key elements of transactional e-government services

Based on Grönroos (1987, 1998, 2000), the core services of transactional e-government services are defined as the delivery of such services to citizens through the Internet or other digital means—e.g., online tax filing. These government services are traditionally delivered offline—e.g., paper-based tax filing. With the evolution of technologies in general and the Internet in particular, they can now be delivered online. However, the switch in delivery channels does not necessarily change the nature of the core services. For example, citizens have to follow similar procedures, such as entering personal information and computing earnings, to file their taxes using either paper-based or online tax filing. The facilitating services/goods are defined as what is needed to make it possible for citizens to use an e-government service. One example is the need for plug-ins for Web browsers to use e-government services. The facilitating services/goods must be acquired by citizens usually from other sources in order to use the service. The supporting services/goods are defined as that which makes an e-government service more attractive to citizens. One example is the provision of online technical support to resolve citizens' problems in using e-government services. While supporting services/goods are useful to certain groups of citizens, they are often optional and e-government services can be used without supporting services/goods.

2.3. Model development

Following the conceptualization by Grönroos (1987, 1998, 2000), this paper identifies key attributes that will be important in the citizens' decision making, tied to the three elements—i.e., core services, facilitating services/goods and supporting services/goods—of transactional e-government services from the services and the IS literatures. Incorporating work from these two literature bases is important given that e-government is an e-service that transforms the way public services are delivered and, at the same time, e-government is a technological innovation. From a service perspective, e-government services exhibit characteristics, such as service delivery and public outreach (West, 2004), and are expected to be as good as traditional public services in terms of service quality (Teicher et al., 2002). From a system perspective, e-government services are expected to be just as user-friendly as existing Web applications (Becker, 2005). Thus, attributes identified from these two literature bases help develop a richer understanding of citizens' preference structures.

First, prior research on services has acknowledged the impact of technology innovations on the delivery of self-services (e.g., Froehle and Roth, 2004; Hill et al., 2002; Meuter et al., 2000, 2005; Rai and Sambamurthy, 2006). In particular, Meuter et al. (2005) found that innovation characteristics influenced consumer trial of self-service technologies. Hence, innovation characteristics are a source of key attributes of transactional e-government services. Second, prior work in the IS literature has found that the use of an innovation requires specific resources, such as specialized computer equipments, that facilitate its use (Venkatesh et al., 2003). Third, in the services literature, customer service is suggested to be an effective means to support the use of online services and improve the service experience (e.g., Parasuraman and Zinkhan, 2002; Surjadjaja et al., 2003). Finally, both the services and IS literatures have acknowledged that perceived risk associated with electronic transactions may hinder consumers' use of e-services (e.g., Surjadjaja et al., 2003). Therefore, citizens are likely to be concerned about attributes related to the risks associated with the delivery channels of e-government services.

Based on these previous findings, this paper identified four service attributes: usability (an attribute of the core service), computer resource requirement (an attribute of the facilitating good), and both technical support provision and security provision (attributes of the supporting services). These service attributes are hypothesized to influence citizens' intentions in the pre-use stage and the subsequent success of transactional e-government services, with intention influencing use that in turn leads to citizens' satisfaction. In prior research, intention has been shown to be a good predictor of behavior and also mediates the effect of other determinants on behavior (Venkatesh et al., 2003), whereas use and satisfaction are success indicators for technology innovations and services (Anderson et al., 2008; Chan et al., 2010; Froehle, 2006; Venkatesh and Johnson, 2002; Venkatesh et al., 2008; Zinkhan et al.,

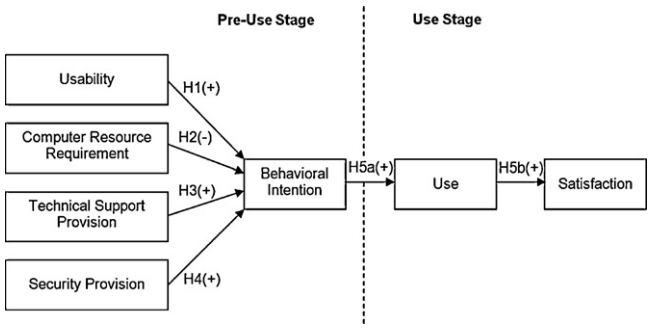

Fig. 1. Theoretical model.

1987). Thus, the model presents a nomological network relating service attributes to success (Fig. 1). Next, we discuss the rationale for the inclusion of each attribute in the model and justify their relevance to the three elements of transactional e-government services.

2.3.1. Usability

Usability is an attribute that reflects how easy an online service is to use (Flavian et al., 2006; Nelson, 1994). In the IS literature, usability has often been termed ease of use and is defined as the extent to which using an innovation would be free of effort (Venkatesh and Davis, 1996). Overall, the definitions of usability from different literatures capture the same concept, i.e., how easy it is to use an online service. Usability has been shown to be a key attribute of online services and a key driver of service use (Massey et al., 2007). It is the most important aspect in which users evaluate a service and the most significant determinant of service quality and user satisfaction (Flavian et al., 2006; Harris and Goode, 2010).

In the context of e-government, a transactional e-government service that requires a large number of steps and transactions is likely to be perceived by citizens as being complex and having poor usability. Citizens are likely to view usability as a hurdle so much so that it can influence the perceived effectiveness of the overall service (Venkatesh and Davis, 1996). There is evidence in prior research demonstrating the importance of usability even over effectiveness considerations (e.g., Venkatesh, 1999). Further, usability is an important antecedent to perceptions of effectiveness so much so that poor usability erodes effectiveness that in turn could lead to abandonment behavior (Venkatesh, 1999). Prior research on services suggests that customers are more likely to try and are more satisfied with self-services that are easy to use (Meuter et al., 2000, 2005). In the IS literature, previous research has widely recognized usability (or ease of use) as a key driver of adoption in various contexts both among consumers and organizations (e.g., Brown et al., 2006; Flavian et al., 2006; Hong et al., 2002; Thong, 1999; Venkatesh and Brown, 2001; Venkatesh and Davis, 1996). In prior research on citizens' acceptance of e-government, usability has been found to be a key attribute of a variety of e-government services (e.g., Becker, 2005; Gilbert et al., 2004; Wang, 2002). Given that usability captures citizens' assessments of the ease and the length of the process of using the electronic means to access transactional e-government services, it represents a key attribute of the core service. Usability is expected to be important because target users of transactional e-government services, i.e., citizens, have varying levels of technical knowledge. Thus, we hypothesize:

H1. Usability will positively influence citizens' intentions to use transactional e-government services.

2.3.2. Computer resource requirement

Computer resources, i.e., software and hardware, are necessary to use e-government services. Computer resource requirement reflects the extent to which users need to expend effort on acquiring the necessary computer resources to use a service. In the IS context, the ease of purchasing software and hardware upgrades can facilitate the use of a technology. On the one hand, the absence of facilitating resources represents barriers to using a technology. According to the dissonance theory (Festinger, 1957), in situations where the facilitating resources are absent, individuals may adjust their attitudes negatively to be consistent with that situation, resulting in lower intentions to use the technology. On the other hand, the presence of facilitating resources may encourage use. Given adequate facilitating resources, individuals are more likely to form positive attitudes toward using the technology as there are fewer reasons not to engage in the behavior. There is evidence in prior research demonstrating the positive influence of the possession of facilitating resources on intention and use (Sykes et al., 2009; Venkatesh et al., 2003, 2008).

This logic will also be applicable to transactional e-government services. Examples of software include plug-ins for Web browsers to support the use of e-government services and examples of hardware include scanners used for digitizing individuals' documents for online submission to government agencies. Without these specific computer resources, citizens will be unable to use transactional e-government services. Thus, computer resource requirement will be a key attribute of the facilitating good. Also, given that some computer resources (especially hardware) are not provided by governments and not offered for free, the computer resource requirement poses a barrier to using transactional e-government services because it requires citizens' time and money to acquire these resources. Thus, we hypothesize:

H2. Computer resource requirement will negatively influence citizens' intentions to use transactional e-government services.

2.3.3. Technical support provision

The services literature has noted the importance of customer service support in service delivery on the Internet (e.g., Froehle and Roth, 2004; Parasuraman and Zinkhan, 2002; Surjadjaja et al., 2003). For instance, technical support has been found to influence consumer loyalty (Parasuraman and Zinkhan, 2002) and satisfaction (Meuter et al., 2000). Further, real-time assistance from a knowledgeable customer service representative is particularly useful in electronic service operations. The importance of online support is mainly attributed to technology-induced transformation brought about by the Internet that has changed the way in which people communicate and organizations interact with their consumers (e.g., Parasuraman and Zinkhan, 2002).

In the context of e-government, technical support can be delivered in various forms, such as text instructions, interactive demos and phone. As users cannot obtain face-to-face assistance when they use transactional e-government services on the Internet, the effective design and delivery of online technical support is essential. As citizens may require different levels of technical support when using transactional e-government services, technical support provision represents a key attribute of supporting services. With adequate technical support, citizens will be able to gain more control over their use of transactional e-government services. The IS literature suggests that individuals differ in their abilities to use technologies and some individuals may require support from another person to perform a task on a computer (Thatcher et al., 2008). Thus, the provision of computer support makes a technology easy to use. Users usually use online technical support to get help about the user interface, or to find specific information. Prior research has indicated that technical support is critical for users at

home (Kiesler et al., 2000). Overall, the services and IS literatures have noted the importance of technical support for online service delivery. Thus, we hypothesize:

H3. Technical support provision will positively influence citizens' intentions to use transactional e-government services.

2.3.4. Security provision

Security refers to the technical safety of the network against fraudulent access by others, including hackers (Surjadjaja et al., 2003). Previous research has suggested that users cannot be satisfied with the core service, until they feel secure and safe (Cook et al., 2002). Security of online transactions is thus a critical criterion in electronic service operations (e.g., Surjadjaja et al., 2003). Security is also important to online consumer applications, such as Internet shopping (e.g., Bhatnagar et al., 2000). Online consumers are more cautious about the security of their personal information on the Internet than ever before (USA Today, 2006). Various types of online fraud, such as phishing, are growing rapidly and receiving attention in the popular media (Cards International, 2007), thus heightening the interest and concern about security. Such negative views conveyed through the media are expected to create an unfavorable awareness of online services that could discourage adoption.

In the context of e-government, security has been found to be an important factor affecting citizens' use of e-government services (e.g., Wang, 2002). There are rising concerns that while enjoying the benefits of e-government, citizens may be putting their privacy at risk as the information collected by governments is frequently highly sensitive (Yu, 2005). As a result, effective security mechanisms are required for protecting citizens' online privacy. For instance, an increasing number of government Web sites require users to register and use passwords, while more advanced security measures employing digital rights management and public key infrastructure are likely to be used extensively in the future (Kim et al., 2006). As a higher degree of security is usually achieved at the cost of increased number of authentication procedures, security measures should be designed in a way that can effectively protect citizens' privacy, and at the same time, minimally inconvenience citizens when they use the services. Given that security measures help enhance citizens' confidence in using the Internet to obtain government services and thus, make the use of transactional e-government services more attractive, security provision represents another key attribute of the supporting services. Thus, we hypothesize:

H4. Security provision will positively influence citizens' intentions to use transactional e-government services.

2.3.5. Behavioral intention, use and satisfaction

Behavioral intention has been well established as a good predictor of behavior that mediates the effect of other determinants on behavior (Sheppard et al., 1988), whereas use and satisfaction are the variables most often used as success indicators for technological innovations (Anderson et al., 2008; Chan et al., 2010; Froehle, 2006; Venkatesh et al., 2008; Zinkhan et al., 1987). Behavioral intention captures the motivational factors that influence a behavior and indicates how hard people are willing to try, of how much of an effort they plan to exert, in order to perform the behavior (Sheppard et al., 1988). In the IS context, behavioral intention has been consistently found to have a significant positive influence on technology use (Venkatesh et al., 2003). Recent research has provided further empirical evidence that intention is a significant predictor of different conceptualizations of technology use (Venkatesh et al., 2008). Further, the IS use has been found to have a significant positive influence on user satisfaction (Zinkhan et al., 1987). As the use of IS helps individuals satisfy their information needs, higher use will lead to increased satisfaction. While not the core of the model, inclusion of use and satisfaction in the model provides greater comprehensiveness and criterion validity. Thus, we hypothesize:

H5a. Citizens' intentions to use transactional e-government services will positively influence their use of the services.

H5b. Citizens' use of transactional e-government services will positively influence their satisfaction with the services.

2.4. Relative importance of service attributes

To better understand citizens' preferences across the attributes, we examine how citizens weight individual attributes and make tradeoffs among them. Specifically, we suggest that the four attributes are likely to differ in importance to citizens and propose an ordering of their relative importance. The rationale for the ordering is grounded both in the services and IS literatures. Prior work has suggested that a correspondence between customer needs and the service offering is crucial (Edvardsson and Olsson, 1996; Goldstein et al., 2002; Rai and Sambamurthy, 2006; Verma et al., 1999). Customer needs can be distinguished into primary, i.e., the reason why a customer experiences a certain need, and secondary, i.e., needs that arise after a customer chooses a service to satisfy his or her primary needs (Edvardsson and Olsson, 1996). In the context of e-government, for example, when a citizen decides to file taxes, he or she can file taxes using either a paper-based method or an electronic tax filing service. After the citizen has chosen the electronic tax filing service to satisfy the primary need in filing taxes, secondary needs will then arise—e.g., how can the citizen protect himself or herself from the risks associated with using the Internet to file taxes. To satisfy these secondary needs, one or more supporting services, e.g., security provision and technical support provision, will be necessary. Edvardsson and Olsson (1996) noted customers' primary needs to be related to the core service and their secondary needs to be related to supporting services.

Based on the ideas of Grönroos (1987, 1998, 2000) and Edvardsson and Olsson (1996), first, we posit that the service attribute relevant to the core service, i.e., usability, will be considered to be the most important by citizens, as it determines the ability of an e-government service to satisfy citizens' primary needs, i.e., to access public services online. Second, we posit that the service attributes relevant to the supporting service—i.e., security provision and technical support provision—will be considered the second most important as they help satisfy citizens' secondary needs that arise when citizens choose to use e-government services. Security provision is expected to be more important than technical support provision because the increasing volume of online fraud has raised users' concerns about their online security and privacy (e.g., Cards International, 2007; USA Today, 2006), and security protection is necessary for most Internet applications. In contrast, technical support provision could be considered less important because if the service is designed to be easy to use, the need for technical support should be minimal. Thus, technical support may be unnecessary and citizens should be less concerned about technical support provision than usability and security provision. Finally, we posit that the service attribute relevant to facilitating goods—i.e., computer resource requirement—will be considered least important as it does not directly address citizens' primary or secondary needs. It comes into play only when citizens do not possess adequate computer resources. Given the widespread diffusion of the Internet and people's familiarity with it, it is unlikely to be as important as the other three attributes. Thus, we hypothesize:

H6. The relative importance of service attributes for transactional e-government services will be ranked as follows: (1) usability; (2)

security provision; (3) technical support provision; and (4) computer resource requirement.

2.5. Tradeoffs among attributes across services

Services can be characterized along two dimensions: relative throughput time and degree of variation (Schmenner, 2004). Throughput time refers to the interval of time between availability for use and completion of the service encounter, and degree of variation refers to interaction and customization that occur in the provision of the service (Schmenner, 2004). In the context of e-government, throughput time can be defined as the time from when citizens enter an e-government Web site until they finish using an e-government service, such as booking an appointment or filing taxes, and degree of variation can be defined as interaction with the Web site and customization of service features that occur during the use of e-government services. Thus, simple services, such as online appointment booking, will have low relative throughput time and variation because citizens have to go through only a few steps to use the services and such use does not involve much interaction and customization, as all citizens basically go through the same procedures to book an appointment. In contrast, complex services, such as online tax filing, will have high relative throughput time and variation because citizens have to go through more steps to use the services and such use will involve more interaction and customization, such as updating personal information, tracing service progress and personalizing the layout of forms. In sum, given these distinctions, e-government services are divided into two main categories: (1) *simple services* with low relative throughput time and variation; and (2) *complex services* with high relative throughput time and variation.

The relative importance of service attributes and preferences for individual attribute levels are expected to vary across transactional e-government services depending on their relative throughput time and variation. Citizens are likely to weight attributes differently across services. Citizens will expect to spend less time and effort to use simple services. Citizens will then be more concerned with usability and computer resource requirement than when they use complex services, as these two attributes represent the time and effort they spend to use the services. In contrast, citizens will expect the use of complex services to be more difficult and expose them to more risks due to increased interactions. Citizens will then be more concerned with technical support and security than when they use simple services, as these two attributes can help resolve the difficulties and risks that may arise. Thus, we hypothesize:

H7. Usability and computer resource requirement will be more important for simple transactional e-government services; and technical support provision and security provision will be more important for complex services.

Next, citizens are likely to weight individual attribute levels differently across services. Specifically, citizens may have different preferences for features tied to each attribute (e.g., number of steps, amount of computer resources required and levels of technical support/security) when using different services. For simple services, citizens would prefer to perform fewer steps and need less sophisticated technical support. In contrast, for complex services, citizens would expect the use of the services to be more difficult and thus be prepared to perform more steps and avail themselves of more sophisticated technical support. Further, citizens are more likely to be exposed to risks during the use of complex services. Citizens would need more sophisticated security measures and thus, be more willing to acquire computer resources that support better security measures. Thus, we hypothesize:

H8. Higher usability, lower computer resource requirement, and less sophisticated technical support and security measures will be more preferable for simple than for complex transactional e-government services; and lower usability, higher computer resource requirement, and more sophisticated technical support and security measures would be more preferable for complex than for simple services.

3. Methodology

3.1. Overview

The research was conducted in Hong Kong where the government is actively pursuing e-government initiatives to provide better public service to its citizens. One major initiative is the smart identity cards (SmartID) that utilize a smartcard technology to facilitate citizens' use of a variety of transactional e-government services. SmartID can be used for authentication required for accessing transactional e-government services, such as voter registration and application for renewal of driving license. The use of SmartID requires access to workstations, with card readers available in public libraries and post offices. Another major initiative is an e-government portal that allows citizens to access a wide range of government services, including online appointment booking with various government agencies, online tax filing and linking to various government agencies' Web sites that provide detailed government information. This research was conducted at the time soon after the Hong Kong government had launched the e-government portal. Soon after, the government initiated a territory-wide exercise to replace old identity cards with SmartID. This presented us with an opportunity to conduct a longitudinal field study on citizens' perceptions of e-government services.

As Boyer and Swink (2008) noted, the use of multiple methods can provide a more complete understanding of the phenomenon of interest. In view of this suggestion, this research conducted a two-stage survey and a conjoint experiment to examine citizens' preferences for attributes of transactional e-government services. The survey was designed around the evaluation of SmartID. The survey was conducted to measure perceptions of the service attributes—i.e., usability, computer resource requirement, technical support provision and security provision—and perceptions of service use and service experience—i.e., behavioral intention, use and satisfaction with SmartID. The conjoint experiment was designed to assess the relative importance of and tradeoffs among the service attributes of two transactional e-government services—i.e., online appointment booking and online tax filing—and identify major population segments from the results. Conjoint measurement is often applied to determine the relative importance of attributes of a product or brand in consumer research (e.g., Green and Srinivasan, 1990; Ferjani et al., 2009). It can also be applied to solving public policy problems and designing public services (e.g., Verma et al., 2006). Also, in view of the strategic importance of understanding preferences and profiles of the major population segments, market segmentation was performed on the conjoint analysis results. Individuals with similar "importance" rankings of the attributes were segmented together using cluster analysis (Green and Krieger, 1991). This segmentation approach helps to evaluate the differences between the segments and to determine the appropriate service strategy (Pullman et al., 2001).

3.2. Sample

Participants were recruited via a banner on an e-government portal in Hong Kong. When participants clicked on the banner, they were directed to the SmartID survey and the conjoint

experiment that focused on either online appointment booking service or online tax filing service. The order was counterbalanced by randomly assigning the survey or conjoint experiment first. Four months after respondents completed the survey and the experiment, they were invited to participate in the second stage survey to indicate their use of and satisfaction with SmartID. Incentives, in the form of a random drawing to win consumer products, were offered to encourage participation in the study.

Of the 2465 participants, 1319 (54%) were women. The average age of participants was just under 30, with a standard deviation of about 5. More than 65% of the participants were educated beyond high school. The median monthly income was in the HK$10,001 to HK$20,000 range. More than 94% had at least 3 years of Internet experience. In the second stage survey, conducted 4 months after the initial survey, 746 (30%) of the original participants responded. Among them, 494 (66%) used SmartID for transactional e-government services. The participants in both stages of the survey had similar demographic characteristics—i.e., chi-square tests suggested that the participants in both stages were not different from each other in terms of gender, age, education and income at a 5% significance level. Similarly, for the conjoint experiment, the two subsamples had similar demographic characteristics in terms of gender, age, education and income. Further, the sample was compared with the population in Hong Kong based on census data. The chi-square tests showed that the differences between the sample and the population on gender and income were not significant, but the differences on age and education were significant. Although the sample was younger and more educated than the general population, they are representative of Internet users and potential users of e-government services in Hong Kong. To some extent, having a younger and more educated sample presents a more conservative test as one can expect that the effects of the attributes identified here will likely be more pronounced among those who are older and less educated, who are less likely to be able to contend with poor usability and are also likely to require more support in order to use e-government services. Further, in designing e-government services, the first target user group is those users who are already online, who tend to be younger and more educated than the general population (Seifert and Petersen, 2002).

3.3. Survey design

3.3.1. Data collection and measurement

The survey comprised two stages. In the first stage survey, prior to citizens' replacement of their identity cards, their perceptions of the four service attributes and their intention to use SmartID for transactional e-government services were measured. Also, citizens' knowledge of government services and demographics were measured as control variables. In the second stage survey, which was conducted 4 months after citizens replaced their identity cards with SmartID, citizens' use of SmartID for e-government services and their satisfaction with the use were measured. Appendix A provides the list of scales and their original sources. We used previously validated scales adopted from the services and the IS literatures (i.e., Curran and Meuter, 2005; Flavian et al., 2006; Karimi et al., 2004; Spreng et al., 1996; Venkatesh et al., 2003; Wilson and Lankton, 2004; Wixom and Todd, 2005) and adapted them to the context of smart cards. The scales for the four service attributes asked respondents to rate their pre-use expectations about using SmartID to access government services in terms of usability, computer resource requirement, technical support provision, and security provision. The scale for knowledge of government services asked respondents to rate their general knowledge of government services. The scale for intention asked respondents to rate how likely they will use SmartID to access government services in the next 4 months. The scales for use and satisfaction measured the respondents' use of SmartID after 4 months and their post-use satisfaction.

3.4. Conjoint experiment design

3.4.1. Operationalization of service attributes

The operationalization of service attributes, i.e., the selection of attribute levels, was based on a review of the features of existing e-government services. In particular, the operationalization of "usability" adheres to the definition of service complexity by Shostack (1987). The government often explicitly states the steps required for citizens to perform an e-government service. By knowing the number of steps required to perform a particular service, citizens will have a sense of how easy it is to use the service. For example, citizens may have to perform five steps to book an appointment for obtaining a marriage certificate, while they may have to perform more than 10 steps to file taxes online. Therefore, citizens can expect services with fewer steps to be easier to use than those with more steps. For other attributes, i.e., computer resource requirement, technical support provision and security provision, their attribute levels were adapted from the features of existing e-government services in Hong Kong such that these levels were perceived to be realistic. The four service attributes and their respective levels are presented in Appendix A.

3.4.2. Design of stimuli

Based on the above attributes and their levels, 192 service options were possible ($4 \times 3 \times 4 \times 4$) for each service. It is practically impossible for the participants to rank all 192 service options. Using Orthoplan in SPSS, an orthogonal design of 16 service options were generated, which was a fraction of all possible combinations. To perform the analysis at the individual level, the participants must evaluate a minimum number of stimuli. An analysis with four factors and a total of 15 ($4+3+4+4$) levels would need a minimum of 12 ($15-4+1$) stimuli (Hair et al., 2006). Therefore, it is adequate to present only 16 service options in the experiment. The number of levels across attributes was also balanced (except security with three levels) because the estimated relative importance of a variable increases as the number of levels increase (Hair et al., 2006). As the number of service options to be evaluated was large, holdout options were not included to avoid the problem of information overload and respondent fatigue (Herrmann et al., 2005; Murthi and Sarkar, 2003).

3.4.3. Type of service

The type of service was varied as a between-subjects factor with two options. Every participant evaluated service options for either *online appointment booking* or *online tax filing*. These two transactional services are among the top public services according to the access records of the e-government portal. Online appointment booking is the simpler of the two services studied that allows citizens to book appointments with various government agencies via the Internet. For instance, to book an appointment with the immigration office for replacing one's identity card, a citizen would enter his or her identity card number for authentication, choose one of the immigration offices, check for available timeslots and finally, make a reservation for his or her preferred timeslot. Online tax filing is a more sophisticated service that allows citizens to file taxes via the Internet. Citizens have to read the detailed instructions and fill in relevant information similar to the way they file taxes using a traditional paper-based method. Moreover, citizens have to go through additional procedures, such as authentication using digital certificates and installation of specific software (e.g., Java runtime environment) to use this service. Overall, these two selected services are representative of transactional e-government services with different degrees of government-citizen interaction

and service sophistication. In terms of Schmenner's (Schmenner, 2004) service matrix, online appointment booking represents a service with low relative throughput time and low variation, whereas the online tax filing has a high relative throughput time and relatively high variation. These two services facilitate the testing of predictions about the tradeoffs between attributes across different services.

3.4.4. Data collection

In the conjoint experiment, the participants were asked to imagine that they needed to use an e-government service, either to book an appointment with a government agency or to file taxes online. They were asked to rank the 16 service options according to their preferences. Ranked data were collected because it was easier for participants to determine their ranked preferences as opposed to expressing the magnitude of their preferences and consequently, ranked data are likely to be more reliable (Park, 2004). Additional socioeconomic variables were collected for segment profiling.

4. Results

This section presents the results of the: (1) model testing using data from the survey on SmartID; (2) conjoint analysis of citizens' preferences of service attributes using data about two transactional e-government services, i.e., online appointment booking and online tax filing; (3) segment profiling based on a cluster analysis of citizens' preferences; and (4) post hoc analysis of data from the survey and the conjoint experiment.

4.1. Model testing

Table 1 presents the descriptive statistics and correlations for variables measured in the survey. Partial least squares (PLS), a structural equation modeling technique, was used to test our proposed model. PLS places minimal restrictions on scales, sample size and residual distributions. The reliability and validity of the scales were first assessed. A confirmatory factor analysis was conducted using PLS. The results show that the factor loadings for all items exceeded .80 and were higher than the cross-loadings (Appendix B). Further, the composite reliabilities of all constructs exceeded .85 and average variance extracted (AVE) for each construct was greater than .75. Also, the correlations were all below the square root of AVE of either construct. In sum, these results provide evidence of both reliability and validity (Hair et al., 2006).

The structural model testing results are shown in Table 2. In a full sample test of the model, all four service attributes—i.e., usability ($\beta = .30$, $p < .001$), computer resource requirement ($\beta = -.12$, $p < .001$), technical support provision ($\beta = .12$, $p < .001$) and security provision ($\beta = .11$, $p < .001$)—were significant determinants of citizens' intentions to use SmartID for transactional e-government services ($R^2 = .26$), thus supporting H1 through H4. The results of modeling test also shows that intention was a significant determinant of use ($\beta = .24$, $p < .001$) and use was a significant determinant

Table 1
Descriptive statistics and correlations.

	M	SD	CR	AVE	Gender	Age	KNOW	USAB	REQ	SUPP	SEC	INT	USE	SAT
Gender	.52	.50	–	–										
Age	28.49	5.09	–	–	−.10***									
KNOW	3.92	1.22	.96	.89	−.06*	−.01								
USAB	5.27	1.16	.95	.85	.05*	.03	.36***							
REQ	3.52	1.20	.96	.88	.03	.00	−.52***	−.50***						
SUPP	4.59	1.14	.93	.81	−.06*	−.02	.55***	.54***	−.64***					
SEC	4.61	1.23	.97	.91	−.09***	.01	.48***	.50***	−.60***	.64***				
INT	5.24	1.50	.98	.95	.01	.01	.25***	.46***	−.39***	.41***	.38***			
USE	2.32	2.12	.87	.76	−.05	−.02	.19***	.18***	−.18***	.18***	.14***	.24***		
SAT	4.99	1.02	.97	.91	.03	−.05	.25***	.23***	−.27***	.29***	.37***	.16***	.37***	

Notes: M: Mean; SD: Standard deviation; CR: Composite reliability; AVE: Average variance extracted; KNOW: Knowledge of government services; USAB: Usability; REQ: Computer resource requirement; SUPP: Technical support provision; SEC: Security Provision; INT: Intention; USE: Use; SAT: Satisfaction. For gender, men were coded as 0, and women were coded as 1. Descriptive statistics and correlations for all variables (except USE and SAT) were calculated using the full sample in the first stage survey ($n = 2465$). Descriptive statistics for USE and SAT, and correlations involving USE, and SAT were calculated using the subsample consisting of respondents in the second stage survey ($n = 746$ for USE; $n = 494$ for SAT).

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 2
Factors predicting intention to use SmartID.

	Model testing	Post hoc analysis			
	All participants ($n = 2,465$)	Balanced ($n = 901$)	Usability-focused ($n = 807$)	Risk-conscious ($n = 634$)	Resource-conservative ($n = 123$)
	$R^2 = .26$	$R^2 = .27$	$R^2 = .28$	$R^2 = .21$	$R^2 = .40$
Gender	.04	.00	.08**	.01	.04
Age	.00	−.02	.04	−.07	.14
KNOW	−.04	−.07	−.01	.02	−.14
USAB	.30***	.25***	.41***	.13*	.29
REQ	−.12***	−.08	−.11*	−.06	−.49***
SUPP	.12***	.27***	.06	−.03	.10
SEC	.11***	.08	.04	.37***	−.08

Notes: KNOW: Knowledge of government services; USAB: Usability; REQ: Computer resource requirement; SUPP: Technical support provision; SEC: Security Provision; INT: Intention.

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 3
Relative importance and part-worths for the two samples.

	Online appointment booking service					Online tax filing service				
	Full sample (n = 1254)	Balanced (n = 484)	Usability-focused (n = 421)	Risk-conscious (n = 284)	Resource-conservative (n = 65)	Full sample (n = 1211)	Balanced (n = 417)	Usability-focused (n = 386)	Risk-conscious (n = 350)	Resource-conservative (n = 58)
Usability	(33.44%)	(24.27%)	(57.61%)	(16.86%)	(17.68%)	(32.16%)	(22.83%)	(58.17%)	(17.00%)	(17.70%)
1–3 steps	.899	.497	1.533	.230	.275	.778	.315	1.550	.256	.306
4–6 steps	.591	.130	1.098	.160	.220	.552	.122	1.132	.210	.238
7–9 steps	.319	.144	.561	.077	.118	.254	.079	.494	.113	.095
>9 steps	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
Security provision	(24.73%)	(23.38%)	(12.91%)	(47.82%)	(10.55%)	(27.05%)	(23.75%)	(12.66%)	(49.19%)	(12.81%)
Null	.000	.163	.000	.000	.012	.000	.000	.000	.000	.028
Password	.479	.300	.170	1.146	.052	.595	.426	.154	1.157	.089
e-cert	.387	.000	.122	1.161	.000	.545	.174	.130	1.217	.000
Technical support provision	(21.67%)	(29.59%)	(15.56%)	(19.53%)	(11.57%)	(22.10%)	(32.47%)	(15.58%)	(18.17%)	(14.61%)
Null	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
User instructions	.395	.842	.195	.318	.071	.387	.882	.182	.296	.044
Service demo	.374	.819	.148	.329	.090	.379	.858	.160	.309	.068
Enquiry hotline	.316	.597	.149	.325	.040	.343	.795	.135	.284	.017
Computer resource requirement	(20.16%)	(22.76%)	(13.93%)	(15.79%)	(60.20%)	(18.69%)	(20.95%)	(13.58%)	(15.64%)	(54.88%)
Null	.096	.150	.000	.000	1.485	.046	.000	.000	.000	1.578
Software	.109	.179	.014	.088	1.121	.067	.099	.009	.072	1.005
Hardware	.000	.000	.004	.036	.516	.000	.002	.022	.012	.531
Software and hardware	.035	.178	.006	.131	.000	.053	.249	.033	.071	.000

Notes: Numbers in parentheses are relative importance of service attributes. Part-worths are scaled for direct comparison across attributes and groups.

of satisfaction ($\beta = .37$, $p < .001$), thus supporting H5a and H5b. These results provided empirical support for the model.

4.2. Relative importance of and tradeoffs among service attributes

SPSS Conjoint was used to estimate the relative utilities of attribute levels for each individual. These relative utilities are called part-worths. The part-worth functions were evaluated at discrete levels for each attribute without assuming a linear or quadratic part-worth relationship within each attribute as there is no pre-established theoretical basis to make any assumptions. The part-worths estimated by SPSS were then scaled following the procedures recommended by Hair et al. (2006) so that the lowest part-worth was zero within each attribute and the total of scaled part-worths was equal to the number of attributes (i.e., 4). This conversion of part-worths to a common scale allows comparisons both across attributes for an individual and across individuals, and prepares the part-worths for multivariate techniques, such as cluster analysis (Hair et al., 2006). In this experiment, for example, if the part-worth of "1–3 steps" of "usability" is greater than the part-worth of "user instructions" of "technical support," it suggests that "1–3 steps" of "usability" contributes more to the utility of the participant than "user instructions" of "technical support." The relative importance of a particular attribute can be computed by taking the utility range for the particular attribute and dividing it by the sum of all the utility ranges.

To compare the two services, the average relative importance and part-worths for all participants were computed and scaled (Table 3). Kendall's τ for the samples of online appointment booking service and online tax filing service were .90 and .98, respectively, and significant at the 1% level, indicating a good fit. The relative importance, reported in Table 3, can be interpreted directly in a number of ways. First, the patterns of relative importance are consistent across both services—usability is the most important attribute, followed by security provision, technical support provision and computer resource requirement in that order. This consistent pattern supports the hypothesis regarding the ordering of attributes (H6) and suggests that usability of transactional e-government services is the primary concern of citizens. Usability is equally important in both services ($F(1, 2463) = 2.22$, $p = .14$). Second, citizens have a greater concern about security provision when filing taxes online as compared to online appointment booking ($F(1, 2463) = 10.90$, $p < .01$). This finding is reasonable because when citizens file taxes online, they have to provide much more information, especially that which is personal and sensitive. Thus, citizens may worry about their online privacy and demand better security measures. Finally, technical support provision is equally important in both services ($F(1, 2463) = 0.71$, p=.40), whereas computer resource requirement is more important in the online appointment booking service ($F(1, 2463) = 7.29$, $p < .01$). In sum, these results only partially support the hypothesis regarding the relative importance of attributes across services (H7). This indicates that citizens' preferences for certain service attributes, i.e., usability and technology support provision, are relatively less sensitive to service type than for other attributes, i.e., security and computer resource requirement. In order to draw further insights into citizens' preferences, it is necessary to examine the part-worths of individual attribute levels.

Part-worths were scaled following Hair et al. (2006). This enables direct comparison of part-worths within and between groups. First, the part-worth ">9 steps" of the attribute "usability" is zero in both groups, suggesting that it was regarded as the least preferred attribute level in both e-government services. The remaining part-worths of usability for the online appointment booking were greater than those for online tax filing. This finding suggests participants preferred that online appointment booking be easier to use (i.e., have fewer steps). Another interpretation is that participants realize the complexity involved in filing taxes and were willing to bear with additional steps to use online tax filing. Second, for both services, participants had the lowest utility when there was no technical support and had the highest utility when user instructions were provided. Enquiry hotline was more preferred when using online tax filing than when using online appointment booking. This finding illustrates the fact that when people use transactional e-government services of different levels of complexity, their preference for technical support may vary. Third, the preference for security provision also differed across both services. Better security is needed when people use the online tax filing service, as evidenced by the higher relative importance of security and part-worths of "password" and "e-Cert" in the online tax filing sample. Finally, participants preferred low computer resource requirement for online appointment booking and specifically, preferred to have no requirement or just installing the required software, as illustrated by higher values of part-worths of "null" and "software." In contrast, the participants were more willing to invest in resources to use the more sophisticated online tax filing service and were willing to install both the required software and hardware, as shown by higher part-worths of "software and hardware." These results supported the hypothesis regarding citizens' preferences for attribute levels across services (H8).

Further, the results showed that "hardware" had the smallest part-worth in both samples. This may be due to the fact that software and hardware are always regarded as being complementary. People may regard the acquisition of hardware alone as too costly to be useful, especially when the hardware does not possess other common uses and is not bundled with software that supports its use in other situations. As installing software (e.g., plug-ins for Web applications) usually does not cost a lot in terms of effort or money, people are willing to do it. However, when use of an e-government service requires specific software and hardware (e.g., printer and scanner), people will be more willing to procure these additional resources only if the service helps them perform sophisticated tasks that perhaps give them a great deal of convenience and provide monetary benefits—e.g., in the case of filing taxes online, it could save the need to spend money on an accountant, having to complete calculations by hand, mail the tax forms and/or have the opportunity to receive the tax refund more quickly.

Overall, the results of model testing and conjoint analysis supported the majority of hypotheses (except H7). The results of model testing showed that the four service attributes predicted intention, intention predicted use and use predicted satisfaction, thus supporting H1 through H5. The results of conjoint analysis showed that usability was the most important attribute, followed by security provision, technical support provision and computer resource requirement, thus supporting H6. However, the results showed that the relative importance of service attributes did not differ as much as expected for the two services, thus only partially supporting H7. Finally, the results showed that citizens preferred high usability, lower computer resource requirement, and less sophisticated technical support and security measures for simple than for complex services, thus supporting H8. In the remainder of this section, we present the results of segment profiling based on a cluster analysis of citizens' preferences to gain further insights from our findings. Finally, we present the results of a post hoc analysis that helps to validate the segmentation results.

4.3. Segmentation and profiling

The part-worths obtained from the conjoint analysis were used in a hierarchical cluster analysis to identify major population segments that have different patterns of attribute preferences. Ward's method was applied with squared Euclidean distance as the metric.

Three criteria drawn from prior research were used to determine the number of clusters (segments). First, the percentage change of the agglomeration coefficient was used as the criterion to determine the initial number of segments to be formed (Hair et al., 2006). The agglomeration coefficient increases going from a segment solution to the next solution with one less segment. If the percentage increase in the agglomeration coefficient, when going from the n-segment solution to the $n-1$ segment solution, was large relative to the moving average of previous increases, then the appropriate number of segments would be n. Second, two stability tests were performed to assess the validity of the segment solution (Wind, 1978). In the first test, the segment solution was validated with the *K*-means algorithm with two different sets of starting points. One set was selected at random, whereas the other set consisted of the centroids of the segments obtained from Ward's method. The second test was conducted by dividing the sample in half and conducting cluster analysis on each half (Punj and Stewart, 1983). Third, the resulting segments were examined to ensure that they were meaningful and managerially relevant. This criterion helps minimize the cost of reaching and managing segments and ensures that government can implement a different strategy for different segments (Kamakura, 1988; Pullman et al., 2001; Wind, 1978). After the segment solution was finalized, the average part-worths obtained from the resulting segments were scaled to facilitate meaningful and easy comparison both within and between segments (Hair et al., 2006). Analysis of variance and chi-square tests were used to examine differences between the segments on demographic and socioeconomic variables.

4.3.1. Sample 1: online appointment booking service

A cluster analysis of the online appointment booking service data was conducted based on the part-worths obtained from the conjoint analysis. First, the agglomeration schedule indicated a four-segment solution. When going from four to three segments, the agglomeration coefficient increased by 11.1%, with around 4%–6% being the moving average increase of the previous four to eight segment solutions. Second, in the first stability test, the segments obtained using two different sets of starting points were consistent with those obtained from Ward's method, while in the second stability test, the characteristics of the final segments were found to be consistent for both subsamples. In sum, these results provide evidence for the validity of the four-segment solution. Third, the four-segment solution had a clear and meaningful interpretation for all segments. Solutions with five or more segments were also examined, but the additional segments were difficult to distinguish from existing segments when interpreting the solution. Therefore, the four-segment solution was chosen for further examination. Table 3 lists the relative importance and part-worths for the segments, which are described below:

(1) *Balanced*: Compared to other segments, this segment is relatively balanced in terms of the relative importance of service attributes—i.e., 24.27% for usability, 23.28% for security provision, 29.59% for technical support provision and 22.76% for computer resource requirement. In particular, part-worths for the three technical support provision measures—i.e., user instructions, service demo and enquiry hotline—were the highest for this segment than they were for other segments. Also, the part-worths for "1–3 steps" and "password" are moderately high. These findings suggest that members of this segment seek substantial technical support and a moderate level of security.
(2) *Usability-focused*: Members of this segment prefer very easy-to-use services, as indicated by the large part-worths for fewer steps—i.e., "1–3 steps" and "4–6 steps"—and the high relative importance of "usability" at 57.61%. This finding means that usability is weighted more heavily than the other service attributes by members of this segment. The other service attributes play much less of a role in this segment.
(3) *Risk-conscious*: Members of this segment greatly value the security of transactional e-government services, as indicated by the high relative importance of "security provision" at 47.82%. They regard "e-Cert," a security measure based on PKI that provides a very high level of security, as being most important. The part-worth for "e-Cert" in this segment is the highest both within and across segments. In contrast, "e-Cert" is regarded as a worse alternative to a "password" in other segments.
(4) *Resource-conservative*: Members of this segment prefer not to acquire any software and hardware, as indicated by the large values of part-worths for "null" —i.e., 1.485—and relative importance of "computer resource requirement" at 60.20%. There is a trend where the part-worths become smaller when people are required to acquire more resources—i.e., "null" has the largest part-worth and "software and hardware" has the smallest.

Table 4 shows the demographic and socioeconomic characteristics of each segment. Two significant differences across the segments in terms of gender and education were found. First, pairwise comparisons show that the resource-conservative segment consists of proportionally more men than in the other three segments at 5% significance. Given that men usually have more experience with computer software and hardware than women (Bhatnagar et al., 2000), they may be better at assessing the effort required to acquire facilitating resources. As a result, this segment is more concerned with computer resource requirement than are other segments. Another significant difference is that the resource-conservative segment consists of proportionally more highly educated citizens—i.e., 60% with undergraduate and graduate degree—than do other segments. This finding indicates that highly educated citizens may prefer not to acquire any computer resources. However, this may be a reflection of the fact that men are overrepresented in categories of higher educational qualifications in the sample. The chi-square tests show no other significant differences between segments in terms of demographic and socioeconomic variables. The limited significant differences may be due to the fact that the e-government service being studied is somewhat simple. It is unlikely that, for example, individuals with better educational background will demand better security because they are not likely to see the appointment booking service as asking for sensitive and private information.

4.3.2. Sample 2: online tax filing service

Similar to the analysis of the online appointment booking data, a cluster analysis was performed on the online tax filing data. First, the agglomeration schedule suggested a four-segment solution. When going from four to three segments, the agglomeration coefficient increased by 10.2%, with 4%–5% being the moving average increase of the previous four to eight segment solutions. Second, the two stability tests were performed to assess the validity of the four-segment solution. Both tests confirmed the validity of the four-segment solution. Third, the four-segment solution had a clear and meaningful interpretation of all segments, whereas the additional segments identified in the solutions with five or more segments were difficult to distinguish from existing segments. Therefore, the four-segment solution was chosen for further examination. The resulting four segments had similar characteristics to those identified in the previous cluster analysis. The four segments, namely balanced, usability-focused, risk-conscious and resource-conservative, were classified based on the reasoning that was discussed earlier. Table 3 lists the relative importance and part-worths for each segment.

Table 4
Demographic segments for the two samples.

	Online appointment booking service							Online tax filing service						
	Balanced (n = 484)	Usability-focused (n = 421)	Risk-conscious (n = 284)	Resource-conservative (n = 65)	Test statistic	df	p	Balanced (n = 417)	Usability-focused (n = 386)	Risk-conscious (n = 350)	Resource-conservative (n = 58)	Test statistic	df	p
Age (mean)	28.1	28.8	28.8	28.7	F = 1.8	1253	.14	28.4	28.5	28.1	28.4	F = .4	1210	.77
Gender (%)					χ^2 = 22.0	3	.00					χ^2 = 3.5	3	.33
Women	49.8	53.7	60.9	30.8				57.3	51.3	55.1	50.0			
Men	50.2	46.3	39.1	69.2				42.7	48.7	44.9	50.0			
Occupation (%)					χ^2 = 16.6	18	.55					χ^2 = 19.4	18	.37
Professional	19.4	24.7	19.0	23.1				20.1	27.5	28.9	27.6			
Managerial	9.1	12.4	9.5	7.7				7.9	9.3	7.7	8.6			
White collar	35.1	30.9	38.0	38.5				36.0	32.4	27.1	34.5			
Blue collar/skilled	2.3	2.4	1.4	3.1				2.2	1.8	1.1	1.7			
Student	13.6	13.1	12.3	13.8				15.1	13.7	14.0	10.3			
Unemployed	6.6	5.2	4.2	3.1				7.2	4.7	6.6	5.2			
Other	13.8	11.4	15.5	10.8				11.5	10.6	14.6	12.1			
Education (%)					χ^2 = 17.0	9	.05					χ^2 = 31.5	9	.00
High school or below	37.4	32.1	33.8	32.3				41.0	32.9	32.0	24.1			
Associate degree	20.2	19.7	23.6	7.7				20.1	17.4	17.7	27.6			
Undergraduate degree	37.4	39.9	36.6	49.2				34.8	39.1	39.7	31.0			
Postgraduate degree	5.0	8.3	6.0	10.8				4.1	10.6	10.6	17.2			
Monthly income (%)					χ^2 = 17.1	15	.31					χ^2 = 27.7	15	.02
No	15.5	12.4	13.4	12.3				15.1	13.0	16.0	12.1			
HK$ 1–5 K	5.8	6.7	7.0	6.2				8.6	7.8	4.6	3.4			
HK$ 5001–10 K	27.5	23.8	25.4	24.6				30.0	25.9	21.4	19.0			
HK$ 10001–20 K	39.3	37.5	37.0	44.6				33.3	36.0	42.6	50.0			
HK$ 20001–30 K	7.2	13.5	11.3	4.6				9.6	10.9	9.1	6.9			
>HK$ 30 K	4.8	6.2	6.0	7.7				3.4	6.5	6.3	8.6			
Internet experience (%)					χ^2 = 11.4	9	.25					χ^2 = 12.0	9	.22
<3 years	6.4	3.3	5.3	3.1				7.0	5.7	4.6	6.9			
≥3 and <6 years	23.1	24.2	21.8	13.8				24.7	19.7	20.9	15.5			
≥6 and<9 years	36.2	33.7	37.0	46.2				34.5	40.4	33.7	36.2			
≥9 years	34.3	38.7	35.9	36.9				33.8	34.2	40.9	41.4			

Table 4 shows the demographic and socioeconomic characteristics of each segment. Results of chi-square tests show that there are two significant differences across segments in terms of education and income. First, pairwise comparisons show that the balanced segment consists of proportionally fewer individuals with graduate education and proportionally more individuals with high school education or below than the other three segments. These comparisons suggest that members of the balanced segment have relatively low education levels, thus needing more technical support. Second, pairwise comparisons showed that members of this segment have relatively low income, which is likely associated with their education level. Another interpretation is that citizens with lower income may be unable to afford the computer equipment and Internet service fees and thus have limited Internet experience. This is corroborated to some extent by their low levels of Internet experience compared to other segments, i.e., having the largest proportion of people with Internet experience of 5 years or less. Therefore, members of this segment may be less familiar with computers and the Internet, and may need more technical support.

4.4. Post hoc analysis

The SmartID sample was divided into four subsamples based on the segmentation results. Each subsample was then used to test the model (Table 2). For the balanced segment, intention (R^2=.27) was predicted primarily by technical support provision (β = .27, p < .001) and secondarily by usability (β = .25, p < .001). For the usability-focused segment, intention (R^2 = .28) was predicted mainly by usability (β = .41, p < .001). For the risk-conscious segment, intention (R^2 = .21) was predicted mainly by security provision (β = .37, p < .001). For the resource-conservative segment, intention (R^2=.40) was predicted mainly by computer resource requirement (β = −.49, p < .001). The results suggested that citizens in different segments consider a different key attribute when deciding to use a service. Further, pairwise comparisons were used to test between-group differences in intention, use and satisfaction across the four subsamples: members of the risk-conscious segment had higher intentions to use the service than members of other segments, whereas there was no significant between-group difference in use and satisfaction. Overall, the post hoc analysis validated the segmentation results.

5. Discussion

The results demonstrated the importance of the four service attributes in influencing citizens' intentions to use e-government services and intentions in turn predicted use of and satisfaction with the services. Also, the post hoc analysis validated the segments obtained in the conjoint experiment, thus suggesting that citizens' preferences may persist across services and contexts. These findings could potentially aid in the design of other transactional e-government services. The results of the conjoint analysis and cluster analysis provided further insights into citizens' preferences. Analyses based on the two samples yielded consistent results in terms of individuals' preference structures and characteristics of the resulting segments.

First, usability and security provision were the two most important attributes for transactional e-government services, based on the rank of relative importance of service attributes from the conjoint analysis. These two attributes each accounted for 47.82%–58.17% of relative importance when members of the usability-focused and risk-conscious segments evaluated transactional e-government services (Table 3). It should also be noted that the resource-conservative segment comprised about 5% of the sample in both services, suggesting that only a small number of citizens care much about the computer resource requirement, with the majority focusing on other attributes.

Second, the two separate cluster analyses each yielded four segments of similar characteristics. The characteristics of the resulting segments were expected to be quite different because the two e-government services involve transactions of different levels of complexity. However, although differences between the two services do exist, as demonstrated by the slight differences in part-worths for certain attributes (e.g., the balanced and risk-conscious segments have larger part-worths for technical support provision and security provision in the sample of online tax filing, indicating that more support and security are required respectively), citizens' preference structures are largely similar across the two services. This suggests that citizens' preference structure for a broad category of services (here, transactional e-government services) is rather consistent across individual services. There always exist groups of citizens who seek usability, technical support or security, or avoid computer resource requirements, regardless of the specific transactional e-government service.

There is little agreement on the ordering of attribute levels across segments, except in usability (Table 3). The results showed that citizens prefer e-government services to consist of as few steps as possible. Also, technical support is always necessary because no technical support is always the least favorable attribute level (which scores zero) among all identified target user groups in both transactional e-government services. For other attributes, such as security and computer resource requirement, the patterns of attribute levels are different across segments. As a whole, these observations imply that citizens generally agree on the core design of services, i.e., the level of usability and technical support, where citizens do not have much of a say. For other service components where citizens can choose their desired options, such as security measures and computer resource requirements, citizens have different preferences for the specific attribute levels. Another possible explanation is that citizens differ greatly in their technical background. While it is obvious to average citizens that the best choice is a service high in terms of usability and technical support, some citizens may not truly understand the pros and cons of using different security measures (e.g., password and electronic certificate) and acquiring different computer resources (e.g., plug-ins for Web browsers). As a result, differences in the ordering of these attribute levels are observed in different user groups.

Finally, although previous research has suggested that education, income and occupation are relevant to citizens' contact with government officials or services (e.g., Olsen, 1982), our results show that there are only a few significant differences in individuals' background variables, such as gender, education and income, across segments. To be more effective at profiling different population segments, additional variables should be identified. Future research can focus on supplementing the demographic variables with a broader set of background data, such as psychographic characteristics, which may be more closely tied to individuals' attribute preferences for transactional e-government services, to improve segment differentiation.

5.1. Theoretical contributions and implications

Prior research on self-service has primarily focused on consumer contexts and determining intention to use technology-based self-services (e.g., Curran and Meuter, 2005; Meuter et al., 2000, 2005). This work studied transactional e-government services that represent an area in which service design is complex and challenging, as governments have to help citizens with different backgrounds to overcome use barriers (Becker, 2005). The current work thus extends the understanding of self-service design in a new target market (Roth and Menor, 2003). Overall, this work responds to the

call for more theoretical grounding and more use of behavioral science in operations management research (Chase and Apte, 2007; Cook et al., 2002; Schmenner and Swink, 1998) by developing and validating a model for explaining and predicting users' intentions, use and satisfaction with e-government services. It also contributes to the service design literature in particular by evaluating users' preferences for attributes that can enable the successful design of public electronic services.

This study contributes to the service design literature by demonstrating the utility in applying Grönroos (1987, 1998, 2000) conceptualization of services to identify the major service attributes of transactional e-government services and predict citizens' perceived importance of these attributes. Future work could use the breakdown of core services, facilitating services/goods, and supporting services/goods as a guide in identifying other, additional service attributes to be studied. The preference structures can then be investigated using large-scale Web-based conjoint experiments. A Web-based experiment is a good way to obtain the large sample required to perform conjoint and cluster analyses, which often require a sample size in the hundreds to produce precise results (Murthi and Sarkar, 2003). Note that conjoint experiments are complex to conduct especially as the number of attributes and number of levels for each attribute increase. When faced with complex tasks with many attributes and attribute levels, respondents may resort to simplifying tactics and the resulting part-worth estimates may distort their true preference structures (Green and Srinivasan, 1990). Thus, a series of studies on subsets of service attributes will be useful to shed light on the key service attributes and their relative importance.

Also, the two transactional e-government services examined in the conjoint experiment are illustrations of two important types of services. In terms of Schmenner's (Schmenner, 2004) service matrix, the online appointment booking service is classified as a service with low relative throughput time and low variation, whereas the online tax filing service has a high relative throughput time and relatively high variation. Thus, an understanding of citizens' preferences for attributes of these two different services has implications for the design of these specific and similar services for public organizations (Karwan and Markland, 2006). Future work in this area can examine other types of services in the service matrix.

Further, our findings shed light on service design in other contexts. As the selection of the four service attributes is based on a broad review on the services and the IS literatures, these attributes can represent important user considerations for not only e-government services but also other e-services. For instance, usability and security are found to be important attributes for mobile e-commerce services (Soriano and Ponce, 2002) and online health-care services (Gummerus et al., 2004). Future research can examine users' preferences and tradeoffs among these attributes in other service contexts.

Finally, the findings of this study have implications for the technology diffusion literature. While prior research on technology adoption often focuses on identifying the most influential attributes in a large population, the results of this study indicate that the influences of attributes may differ substantially across citizen segments. However, as suggested by the results of segmentation and profiling, many of these differences may not be attributed to personal background variables. This highlights the need to go beyond the trait-based approaches and uncover major user segments with different preferences for attributes that drive citizen acceptance of technology-based services. Specifically, our post hoc analysis indicated that the segmentation approach may help identify users particularly interested in a new service. In this study, members of the risk-conscious segment, who look for supporting services (i.e., security measures) to enhance their service experience, have higher intentions to use SmartID than other users. Thus, citizens who are concerned with different service elements may differ in their intentions that in turn influence use of a service. Future research can confirm the underlying segments using other techniques, such as neural networks (Setiono and Thong, 2004; Setiono et al., 1998).

5.2. Limitations

There are a few limitations that should be noted. First, an online data collection may be subject to sampling bias. The participants of this study were relatively young and could be regarded as experienced Internet users, with more than 94% having at least 3 years of Internet experience. Thus, this sample may not reflect the preference structures of senior citizens and inexperienced Internet users. However, as the target users of e-government services are Internet users, these participants are very likely to be potential users of these services. Such experienced users also are essential to continued use of e-government services and the likely adopters of new services. Therefore, their preference structures will be helpful in designing and/or redesigning transactional e-government services. Nevertheless, future research could target senior citizens and inexperienced users to confirm the findings here. Second, our conjoint analysis focused on two transactional e-government services—i.e., online appointment booking service and online tax filing service. As they represent only two particular types of services in Schmenner's (Schmenner, 2004) service matrix, the findings may not generalize to other types of services, for example, those with high throughput time but low variation. Future research can focus on other types of services in the matrix. Third, this study was conducted in Hong Kong and is thus constrained to a particular cultural and socio-political context. Given the influence of socio-economic factors on technology use, future research can examine potential contingencies and generalizability across different settings. Fourth, our research model consists of four service attributes pertaining to different service elements. While all these attributes were found to be significant determinants of citizens' intentions to use e-government services, other attributes, such as reliability and flexibility, may also be of great concern to users. Future research can include other service attributes (which can pertain to core services, facilitating services/goods, or supporting services/goods) in the examination. Finally, this study was conducted at the time soon after the e-government services had been launched. Thus, we focused our examination on citizens' pre-use expectations or early evaluations of the services. When citizens have more experience in using the services, their preferences for service attributes may be adjusted based on their experiences (Thong et al., 2006). Future research can employ a longitudinal design to see how users' preferences change over time.

5.3. Practical implications

The findings of this study help identify and rank those service attributes that are considered important by citizens. In particular, as the selection of attribute levels in the conjoint experiment was based on a review of the features of existing transactional e-government services, the values of part-worths revealed citizens' preferences for these real-life features. For example, the results show that the general public has not yet realized the benefits of using advanced security measures, such as digital certificates, to protect their privacy, as most people still prefer passwords to digital certificates. Another possible application of the findings is to incorporate the attribute levels that have the largest part-worths within each attribute to create a service that is, on average, viewed most favorably by the general public. For example, the most favorable online appointment booking service should consist of 1–3 steps, provide user instructions, use password as a security measure and

require users to install some specific software only to extend the functionality of citizens' existing computer equipment (Table 3).

The existence of population segments having different preference structures poses challenges to the community-wide deployment of transactional e-government services. The foremost challenge would be to meet the expectations of different groups of citizens. For example, to develop a user-friendly transactional e-government service, software designers may incorporate more graphics and animations into the applications, resulting in users having to install specific software plug-ins (e.g., a Flash player) to view content. In this case, usability-focused citizens may like this service, while resource-conservative citizens may be deterred from using it. To deal with these tradeoffs, it would be better to let citizens choose their preferred mode of service. For instance, government Web sites could allow citizens to choose their preferred mode of browsing, i.e., text mode or interactive mode with vivid visual effects. One potential solution to this problem would be personalization that allows citizens to decide not only what information they will see and but also the system features they will use.

Another important finding of this study is that citizens' attribute preferences for transactional e-government services cannot be easily distinguished by their background variables as the demographic profiles of most segments appear to be identical. There are only significant differences in gender and education across some segments for the online appointment booking service, and in education and income across some segments for the online tax filing service (Table 4). This makes the formulation of strategies targeted at various population segments based on demographic characteristics difficult to achieve. One possible cause is the very high Internet penetration rate in Hong Kong where this study was conducted (Internet World Stats, 2009). As a result, the citizens' attribute preferences may be affected by their Internet experiences rather than determined by demographic and socioeconomic variables that may be applicable only to novice Internet users. Thus, in countries where citizens' attribute preferences cannot be easily determined by their background variables, a better way to understand citizens' preferences is to partner with citizen groups and non-profit organizations to get citizens involved in the design process (Magnusson et al., 2003).

6. Conclusions

This study examined key service attributes of transactional e-government services and citizens' preference structures for these attributes. We applied Grönroos (1987, 1998, 2000) conceptualization of services and drew from the services and IS literatures to identify four key service attributes—i.e., usability, computer resource requirement, technical support provision and security provision—of transactional e-government services. The survey results confirmed the importance of these attributes in influencing citizens' intentions to use, use and satisfaction with e-government services. Moreover, the results from a conjoint experiment suggested that usability and security provision were the two most important attributes, and citizens' preference structures were consistent across both transactional e-government services. Also, the results revealed four major population segments that were termed—i.e., balanced, usability-focused, risk-conscious and resource-conservative—based on the attributes valued by different groups. Interestingly, citizens' preferences were not associated with background variables. The results highlight the need to consider the tradeoffs among service attributes, and to understand the preferences and the characteristics of various population segments, in designing and promoting transactional e-government services.

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Appendix A. Items

A.1. Survey instrument

A.1.1. Usability (adapted from Curran and Meuter, 2005; Flavian et al., 2006)

USAB1: I would find it easy to use SmartID to access government services.

USAB2: Learning to use SmartID to access government services would be easy for me.

USAB3: It would be easy for me to become skillful at using SmartID to access government services.

A.1.2. Computer resource requirement (reverse coded; adapted from Wixom and Todd, 2005)

REQ1: Service points for using SmartID to access government services would be very accessible to me.

REQ2: Facilities for using SmartID to access government services would be highly accessible to me.

REQ3: I would be able to readily access devices for using SmartID to access government services.

A.1.3. Technical support provision (adapted from Karimi et al., 2004)

SUPP1: I expect to get the help I need in using SmartID to access government services.

SUPP2: It would be easy for me to get assistance when I am having trouble using SmartID to access government services.

SUPP3: I expect clear instructions for using SmartID to access government services to be available to me.

A.1.4. Security provision (adapted from Curran and Meuter, 2005)

SEC1: I expect my use of SmartID to access government services to be secure.

SEC2: It would be secure for me to use SmartID to access government services.

SEC3: SmartID would be a safe device for me to access government services.

A.1.5. Knowledge of government services (adapted from Wilson and Lankton, 2004)

KNOW1: I am very knowledgeable about government services in general.

KNOW2: I am very familiar with government services.

KNOW3: I know government services very well.

A.1.6. Intention (adapted from Venkatesh et al., 2003)

INT1: I intend to use SmartID to access government services in the next 4 months.

INT2: I predict I would use SmartID to access government services in the next 4 months.

A.1.7. Use (adapted from Curran and Meuter, 2005)

USE1: How often do you use SmartID to access government services in the past 4 months? (Low use. . . High use)

USE2: In the past 4 months, when you have to access government services, how often do you use SmartID to do so? (Low use. . . High use)

A.1.8. Satisfaction (adapted from Spreng et al., 1996)

I am _____ with my use of SmartID to access government services.

SAT1: Extremely displeased. . . Extremely pleased.

SAT2: Extremely frustrated. . . Extremely contented.

SAT3: Extremely dissatisfied. . . Extremely satisfied.

A.2. Service attributes of e-government services for the conjoint experiment

A.2.1. Usability (number of steps required to use an e-government service):

"1–3 steps"—Users have to go through 1–3 steps to use the service.

"4–6 steps"—Users have to go through 4–6 steps to use the service.

"7–9 steps"—Users have to go through 7–9 steps to use the service.

">9 steps"—Users have to go through more than 9 steps to use the service.

A.2.2. Security provision (type of security measures provided by an e-government service)

"Null"—No security check is required for using the service.

"Password"—Password is required for authentication before using the service.

"e-Cert"—Electronic certificate (based on PKI) is required for authentication before using the service.

A.2.3. Technical support provision (type of technical support provided by an e-government service):

3.1 "Null"—No support is provided to users.

3.2 "User instructions"—User instructions (e.g., Frequently Asked Questions—FAQs) are provided to users.

3.3 "Service demo"—Service demo is provided to users to show them how to use the service.

3.4 "Enquiry hotline"—Enquiry hotline is provided to users for calling for assistance.

A.2.4. Computer resource requirement (software/hardware required to use an e-government service)

"Null"—No specific software or hardware is required.

"Software"—Specific software (e.g., Java virtual machine) is required.

"Hardware"—Specific hardware (e.g., printer/scanner) is required.

"Software and hardware"—Specific software and hardware are required.

Appendix B. Confirmatory factor analysis

Item	Construct							
	USAB	REQ	SUPP	SEC	KNOW	INT	USE	SAT
USAB1	0.91	−0.51	0.51	0.52	0.38	0.44	0.20	0.22
USAB2	0.94	−0.47	0.50	0.46	0.33	0.44	0.19	0.22
USAB3	0.92	−0.48	0.49	0.44	0.35	0.39	0.13	0.21
REQ1	−0.46	0.94	−0.56	−0.57	−0.50	−0.32	−0.15	−0.28
REQ2	−0.48	0.95	−0.57	−0.56	−0.46	−0.31	−0.14	−0.24
REQ3	−0.54	0.92	−0.59	−0.60	−0.54	−0.32	−0.14	−0.23
SUPP1	0.50	−0.55	0.91	0.57	0.46	0.41	0.21	0.31
SUPP2	0.45	−0.55	0.87	0.55	0.53	0.27	0.13	0.25
SUPP3	0.49	−0.56	0.91	0.60	0.41	0.39	0.16	0.25
SEC1	0.44	−0.56	0.62	0.95	0.41	0.38	0.16	0.35
SEC2	0.47	−0.59	0.60	0.96	0.44	0.37	0.15	0.32
SEC3	0.54	−0.61	0.60	0.93	0.47	0.38	0.13	0.39
KNOW1	0.40	−0.51	0.48	0.45	0.94	0.22	0.13	0.24
KNOW2	0.32	−0.49	0.47	0.42	0.95	0.13	0.13	0.23
KNOW3	0.34	−0.50	0.49	0.44	0.93	0.14	0.13	0.21
INT1	0.44	−0.33	0.40	0.38	0.19	0.98	0.21	0.16
INT2	0.46	−0.34	0.40	0.39	0.17	0.98	0.21	0.16
USE1	0.15	−0.16	0.14	0.10	0.15	0.15	0.84	0.28
USE2	0.18	−0.12	0.19	0.17	0.10	0.22	0.91	0.36
SAT1	0.22	−0.25	0.28	0.36	0.21	0.17	0.35	0.94
SAT2	0.21	−0.25	0.26	0.32	0.23	0.11	0.32	0.95
SAT3	0.24	−0.26	0.31	0.37	0.25	0.18	0.38	0.96

Note: USAB: Usability; REQ: Computer resource requirement; SUPP: Technical support provision; SEC: Security Provision; KNOW: Knowledge of government services; INT: Intention. USE: Use; SAT: Satisfaction.

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