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Katerina Pramatari
Athens Universty of Economics and Business, k.pramatari@aueb.gr

Aristeidis Theotokis
Athens University of Economics and Business (AUEB), a.theotokis@aueb.gr

Georgios Doukidis
Athens University of Economics and Business (AUEB), gjd@aueb.gr

CONSUMER ACCEPTANCE OF TECHNOLOGY CONTACT: EXTENDING WEB-BASED E-COMMERCE TO TECHNOLOGY-BASED SERVICES

Completed Research Paper

Katerina Pramatari
ELTRUN, Department of Management Science and Technology, Athens University of Economics and Business
Evelpidon 47, 11362 Athens, Greece e-mail
k.pramatari@aueb.gr

Aristeidis Theotokis
ELTRUN, Department of Management Science and Technology, Athens University of Economics and Business
Evelpidon 47, 11362 Athens, Greece e-mail
a.theotokis@aueb.gr

Georgios Doukidis
ELTRUN, Department of Management Science and Technology, Athens University of Economics and Business
Evelpidon 47, 11362 Athens, Greece e-mail
gjd@aueb.gr

Abstract

This paper theoretically defines the concept of technology contact, as a specific service characteristic, that is referred to the level of customer-technology interaction the service requires. Moreover, it defines technology contact of a service as a construct with three dimensions: time of interaction with technology, medium sophistication and task complexity.

Then, we develop a conceptual model for consumer acceptance of technology-based services that includes the notion of service technology contact. It is hypothesized that technology contact, as a unique service characteristic, affects performance expectancy, ease of use and behavioral intentions, but these relationships are moderated by individual's anxiety with technology and the type of shopping trip. The scenario of technology-based dynamic product information service in supermarket stores is used in order to empirically test our model. The technology contact of the service is manipulated at three levels using service scenarios with different supporting technologies (electronic shelf labels, electronic kiosk and PDA) that are presented to 575 grocery store shoppers.

Results confirm the hypotheses and the paper concludes that the level of technology contact is an important service characteristic that should be taken into account when designing and evaluating technology-based services.

Keywords: Technology-based Services, E-commerce Pervasive/Ubiquitous IS, Technology Contact, Retailing, Consumer Behavior, Service Science

Introduction

The appearance of new technologies, such as Radio Frequency Identification (RFID), mobile computing, GPS tracking and smart cards provides retail companies with a great opportunity to offer innovative in-store consumer services that goes beyond the traditional notion of e-commerce (Burke 2002; Günther and Spiekermann 2005; Rai and Sambamurthy 2006) . Touch screens in department stores and information kiosks at hotels, automated teller machines (ATMs), self-scanning at grocery stores and libraries and self-check-in systems at airports are only some examples (Dabholkar and Bagozzi 2002) . Several researchers have spotlighted the benefits of these services both for companies and consumers (Bitner et al. 2000; Rust and Lemon 2001). Similarly to online services provided by B2C e-commerce, the potential benefits of in-store technology-based services can be materialized only if consumers adopt them (Pavlou and Fygenson 2006). Marketing researchers have labeled this kind of services as Self-Service Technologies (SSTs) or Technology-Based Self-Services (TBSS) and they have studied consumer adoption of them (Bobbitt and Dabholkar 2001; Dabholkar and Bagozzi 2002; Meuter et al. 2005; Simon and Usunier 2007). However, most researchers approach consumer attitude towards different technology-based services homogeneously and ignore the service design characteristics that distinguish technology-based services (Curran et al. 2003; Im et al. 2007; Theotokis et al. 2008).

Information Systems (IS) researchers have also studied extensively the adoption of technology in consumer settings under the e-commerce umbrella (Gefen et al. 2003; Koufaris 2002; Pavlou and Fygenson 2006). However, the majority of these studies regard only the internet technology. However, Rust and Kannan (2003 p.38) extend the notion of *e-service* by defining it as *"the provision of service over electronic networks",* and specifying that: "*the notion of electronic networks includes the Internet and wireless networks as well as electronic environments such as ATMs, smart card networks, kiosks, among others"*. In parallel, more and more scholars and practitioners call IS researchers to investigate consumer acceptance of technology infusion in services systems (Chesbrough and Spohrer 2006; Lusch et al. 2008; Maglio and Spohrer 2008; Paulson 2006). Under the similar logic, Rai and Sambamurthy (2006 p.330) note: "*The growth of self-service and multichannel environments raises questions about how service interfaces should be designed to manage the total customer experience"*.

A previous study in consumer acceptance of technology-based services suggests the concept of *technology contact (TC),* as a specific service characteristic that differentiate technology-based services according to the level of customer-technology interaction that they require (Theotokis et al. 2008). By analyzing in-store technological applications as service systems, the same authors define the concept of *technology contact (TC), a*s the level of interaction with technology that a service requires from the customer in order to be produced. Moreover, they show that technology contact, as a service design characteristic, moderate the effect that individual characteristic has on consumer attitude.

Drawing on this previous study, the purpose of this paper is to theoretically develop and empirically test a conceptual model for consumer acceptance of technology-based services by including their design features. For this reason, we investigate whether and how technology contact as a characteristic of a service system affects consumer acceptance of technology-based services. Firstly, we describe in-detail the concept of service technology contact and theoretically define it as a function of three dimensions: time of interaction with technology, task complexity and medium sophistication. Then, based on the unified theory of acceptance and use of technology (Venkatesh et al. 2003) and on several other IS theories, this paper hypothesizes that what shapes intentions to use an in-store technology-based service is dependent on the service technology contact it requires. Thus, we develop a conceptual model for consumer acceptance of technology-based services that include the notion of technology contact. It is hypothesized that technology contact, as a unique service design characteristic, affects behavioral intentions through performance expectancy and perceived ease of use. Moreover, it is proposed that technology contact effect on ease of use and performance expectancy is contingent upon individual's anxiety with technology and the type of shopping trip respectively. In order to empirically test our model we exploit an experimental design. Scenarios of the same service (in-store dynamic product information) differing in the levels of technology contact (no, low and high) are presented to 402 supermarket shoppers. Findings confirm our hypotheses and provide evidence that the concept of service technology contact, as a design characteristic of technology-based service, plays an important role in consumer acceptance.

In summary the proposed approach of this paper provides contribution in technology adoption literature in the following issues:

1. It extends the notion of e-commerce from web-based information systems to the most general concept of technology-based services.
2. It conceptualizes and studies technology adoption at the service system level, consistently with increasing call for including the service concept in the IS field.
3. It proposes the concept of service technology contact as a variable that classifies technology-based services according to their design and it is based on traditional services classification
4. It introduces the construct of technology contact, as service design characteristic that is refer to the level of customer technology interaction, in the study of consumer adoption of technology.

The paper first presents the research background, describes the concept of service technology contact and discusses its dimensionality. Following, hypotheses regarding the effect of technology contact on consumer perceptions are built. Next the methodology as well as the results of the empirical study are presented. Discussion of the findings and a discussion of areas for further research conclude the paper.

Background and Theory Development

Technology – Based Consumer Services

Retail consumer service is defined by Levy & Weitz (1998 p.350) as *the set of activities and programs undertaken by retailers to make the shopping experience more rewarding for the customers*. Retailers today provide a wide range of services in order to increase shopping convenience and speed of shopping, to provide rich information, and to better promote their products or even create enjoying experiences for shoppers (Kalyanam et al. 2006). Technology is a major enabler for these innovative retail services. Handheld devices, touch screen kiosks, electronic signage and shelf labels, virtual reality displays, body scanning, smart cards, and robotics or the rapidly forthcoming RFID technologies promise to enhance shopping experience (Burke 2002; Günther and Spiekermann 2005). Therefore, *Technology-Based Consumer Services can be defined as the set of retail service that exploit any kind of technology in order to be provided.* Although web-based services can be included in the definition of technology-based services, existing literature on Marketing and Information Systems is usually referred to online retail services as e-commerce activities or e-services distinguishing them from the in-store technology-based services (Rust and Kannan 2003) .

Service marketing researchers have studied several factors that affect consumer adoption of technology-based services. In a nutshell, individual traits and personality characteristics (Curran et al. 2003; Dabholkar and Bagozzi 2002; Meuter et al. 2005; Parasuraman 2000; Simon and Usunier 2007), perceived risk, complexity and control (Bobbitt and Dabholkar 2001; Meuter et al. 2005; Simon and Usunier 2007) and situational factors (Dabholkar and Bagozzi 2002; Simon and Usunier 2007) have been proposed as antecedent factors that affect customer perceptions about technology-based service delivery. However, most researchers explore consumer attitude towards different technology-based services homogeneously (Theotokis et al. 2008). Nevertheless, technology-based services differ in terms of the level of customer-technology interaction they require (Bobbitt and Dabholkar 2001). For example, a form of technology-based service (TBS) is an LCD display that informs customers about promotions in a supermarket store and it requires from the customer to interact with technology by just watching the display. On the other hand, another example of TBS - from the same industry- is the self-checkout service which requires from the customer to use a barcode reader technology and –possibly a touch screen for paying. Consequently, technology-based services differ in terms of consumer-technology interaction they require and may be misleading to study customer perceptions about these services as a single type of services (Theotokis et al. 2008). Furthermore, some researchers have demonstrated that consumers can have distinguishable attitudes towards different technology-based services (Curran and Meuter 2005; Im et al. 2007).

Therefore, it is important to study technology adoption in service delivery by focusing not only on consumer behavior literature but also on the specific IT artifacts that used to support services and the specific service characteristics that are defined by their design. In order to do this it is important to build a typology of technology-based services that would classify services based on their design characteristics. Based on this need, Theotokis et al. 2008 exploits the traditional services classification according to the level of consumer-employee interaction they require and propose a construct that classifies technology-based services according to the level of consumer-technology interaction they require. This concept is service technology contact and classifies technology-based services to low and high technology contact services.

The Concept of Service Technology Contact (STC):

In response to the increasing importance of the services industry in the developed world, researchers have made quite a few efforts to classify services according to their unique characteristics (for a review see Verma and Young 2000). A significant contribution to the classification and analysis of service systems-from an operations viewpoint- has been provided by Chase (1978; 1981). In 1978, Chase introduced the phrase "customer contact," and in 1981 (p. 700) suggested its theoretical basis and gave its first operational definition as *"the time in the system relative to the total time of service creation"*. According to this theory, the classification of services is based on the amount of contact the customer has with the service system. More specifically, the extent of contact is defined as the percentage of time the customer interacts with the service system in relation to the service completion time. However, the service system in the traditional service encounters is represented by the service employee. Thus, Kellogg and Chase (1995, p. 1734) tried to derive an empirically-based measure of customer contact. Thus, they propose that: *"the degree or level of contact can be measured at the service episode level"*. Using multidimensional modeling techniques, they suggested that the customer contact with the service provider can be empirically measured by three dimensions: *communication time*, *the information richness*, and the *level of intimacy*.

Drawing on the contact theory, Theotokis et al. (2008) theoretically define a concept that is referred to the "*degree or the level of consumer contact with the technology in a service system",* namely the concept of *Service Technology Contact* (STC). Conceptually, the theory of customer contact investigates the level of customer interaction with the human service provider. In parallel to this theory, they have proposed a concept that represents the level of customer-technology interaction in a service delivery system and they propose a classification of low and high technology contact services. Service technology contact is applicable in all service modes where the customer interacts directly with the technology in order to produce the service. Technology contact is a specific service characteristic and is referred to the customer-technology interaction level during the service process. Technology contact has been shown to moderate the effect of technology readiness – a personality characteristic – on consumer attitude towards technology-based services (Theotokis et al. 2008). However, the effect of technology contact as a service design characteristic, on consumer acceptance of technology-based services has not been investigated yet.

Dimensionality of Customer-Technology Contact

Kellogg and Chase (1995) suggested that the customer contact with the service provider can be empirically measured by three dimensions: *communication time*, *the information richness*, and the *level of intimacy*. Consistently with this conceptualization from the consumer-employee service contact theory, technology contact can be described as a function of three dimensions: *the time of interaction with technology*, *the task complexity* and the *medium sophistication*. In this section we describe the three dimensions of technology contact and provide their theoretical relevance with the corresponding dimensions from the traditional services contact theory. Table 1 presents the dimensions of the proposed construct, the corresponding dimensions from the traditional customer contact theory as well as the supporting theories used to make the adaptation.

Table 1*. Service technology contact dimensions and supporting theories

Technology Contact Dimension	Definition	Customer Contact Dimension	Supporting Theory
Time of Interaction with Technology	The time (or the number of distinct steps) during which a consumer interacts with the technology during the service process	Time of Contact	Contact Theory (Chase 1981)
Task Complexity	The characteristics (density, dissimilarity, uncertainty) and the relationships of information cues that the consumer must process during the service process	Information Richness	Media Richness (Daft and Lengel 1986) ;Task Complexity (Wood 1986)
Medium Sophistication	The level of technological and interface complexity of the medium used during the service process	Level of intimacy	Contact Theory (Chase 1981); Technological Sophistication (Prez 1984)

*Adapted from Theotokis et al. 2008

Time of Interaction with technology

In 1978, Chase introduced the phrase "customer contact," and in 1981 suggested its theoretical basis and gave its first operational definition as "the time in the system relative to the total time of service creation" (i.e., Contact = f (time of interaction with service/total service creation time). Time is frequently seen as a factor when dimensionalizing customer contact. Mills (1985) used time as one dimension involved in the interface between the client and the service organization.

In case of technology-based services, the time of user interaction with technology may vary from some seconds – by just looking a display – to several minutes, by using different input devices and multiple interfaces. Thus, the dimension of time is defined in the context of customer-technology contact as either the absolute value of time or the number of distinct steps that a user must interact with the technology during the service creation time.

Task Complexity

Information exchange is considered to be an important dimension of contact. In 1984, Daft and Lengel introduced the concept of information richness. Moreover, Wood (1986) connects directly information cues (pieces of information about the stimulus that individuals must process in performing a task) as central to understanding perceived complexity. Traditional service contact theory postulates that the richness of information exchange and the direction of information flow are important factors for dimensionalizing customer contact with service provider (Kellogg & Chase 1995).The same authors conceptualizing information richness as a combination of information density and directionality.

Although information richness is medium dependent and some researchers refer to it as media richness, Nadkarni & Gupta (2007), based on Wood's framework, provide a definition of website complexity and consider, information cues (e.g., text, animation, hypertext structure, and navigation tools) presented at a website as central to online users' perceptions of task complexity, although the only medium that users interact with is the web. Following this conceptualization, we define information richness as the characteristics (density and directionality) and the relationships of information cues that the consumer must process during the service process and consider it as a dimension of customer technology contact, independently of the medium used. In parallel, we refer to medium characteristics as the third dimension of our concept.

Medium Sophistication

The degree to which the service episode can be described as being intimate is considered by Kellogg and Chase (1995) as another dimension of service contact. Intimacy was conceptualized as trust and mutual confiding. Therefore the third dimension of service contact is strongly relevant to the service employee personal characteristics and behavior.

In the case of technology-based services technology plays the role of human. The dimension of intimacy for the concept customer-technology contact should be strongly relevant to technology characteristics. We, therefore, define as the third technology contact dimension the level of technological medium sophistication. Researchers have used the term of technological sophistication for a company, in order to describe mainly the quantity and the complexity of technologies used in a company's processes (Ghorab 1997; Pırez 1984; Weil and Rosen 1995). Correspondingly, medium sophistication can be defined as the level of technological and interface complexity of the medium used during the service process. In parallel with traditional service contact theory, trust and intimacy towards technology can be captured by the level of medium sophistication. Consumers are more intimate and trust more technologies that already has used extensively, like telephone, than more sophisticated technologies like smart phones or PDAs.

Hypotheses and the Research model

In this study we investigate the effect of technology contact as a service characteristic on consumer acceptance. In order to do this we exploit as dependent variables three constructs included in the unified theory of acceptance and usage of technology (UTAUT) proposed by Venkatesh et al. (2003), the effort expectancy, the performance expectancy and intention to use the service. Moreover, we consider an individual psychographic factor capturing consumers' attitude towards the technology in general , namely technology anxiety (Meuter et al. 2003) and a shopping goal-related factor namely the shopping orientation (Noble et al. 2005). In what follows we use theories

from IT adoption in order to build the conceptual model that connects these constructs with the notion of the customer-technology contact.

Technology Contact, Ease of Use and Technology Anxiety

Effort expectancy is defined as the degree of ease associated with the use of the system (Venkatesh et al. 2003). Three constructs from the existing models capture the concept of effort expectancy: perceived ease of use, complexity, and ease of use. In this study, we use the term *ease of use* to denote all the above concepts. The concept of ease of use occupies a central position in technology adoption research and for this reason we select to investigate it as our first dependent variable. We posit that users' familiarity with technology – as captured by the construct of technology anxiety- will play a significant role in determining the relationship between the perceived ease of use and technology contact of a service.

Technology Anxiety (TA) is a construct proposed by Meuter et al. (2003) and express the ability and willingness of customers to use technologies. TA focuses on a user's state of mind about general technology tools. Technology anxiety is a broad extension of the narrower construct of *computer anxiety*, which defined as ''the fear, apprehension and hope people feel when considering use or actually using computer technology'' (Cambre and Cook, 1985; Scott and Rockwell, 1997). This anxiety is characterized by ''excessive timidity in using computers, negative comments against computers and information science, attempts to reduce the amount of time spent using computers, and even the avoidance of computers in the place where they are located'' (Doronina, 1995).

The task complexity literature suggests that the relationship between objective complexity and perceived complexity is a function of the individual's familiarity with the task stimulus and/or task domain (Campbell 1988; Earley 1985; Huber 1985; Jacoby et al. 1971; Keisler and Sproull 1982; Taylor 1981). Familiarity increases individuals' tolerance of complexity by (1) allowing them to better understand interrelationships between elements of the task stimulus and (2) helping them to distinguish relevant from irrelevant information in the task stimulus.

Therefore, consumers who are more familiar with the technology –i.e. with low technology anxiety- do not anticipate high cognitive effort from their part in order to understand high technology contact service offerings and use them. Moreover, high technology contact services make users more effective in their task accomplishment and the interaction with the technology during the service process offers them a challenging experience (Wolfinbarger and Gilly 2001).Thus, consumer with low technology anxiety will perceive services that require higher levels of technology contact as easier to use.

In contrast, consumers less familiar with technology- with higher levels of technology anxiety- will need more cognitive effort to use and understand high technology contact services and therefore they perceive them as more difficult to use. However, the same group of consumers will recognize that the usage of services with medium levels of technology-contact will require from them reasonable levels of effort in order to complete the service process. In addition, compared to low technology contact services, service with medium levels of technology contact will enable consumers to complete the service process quicker and easier. Therefore, for consumers with high technology anxiety, ease of use and technology contact will have a positive relationship from low to medium levels of technology contact and a negative relationship for medium to high technology contact services.

Based on the above argumentation we formulate the hypotheses:

H1: Technology Anxiety will moderate the relationship between Technology Contact and Ease of Use

H1a: There will be a positive relationship between technology contact and ease of use for low technology anxious consumers

H1b: There will be an inverted-U relationship for high technology anxious consumers

Technology Contact, Performance Expectancy and Shopping Orientation

Performance expectancy is defined as the degree to which an individual believes that using the system will help him or her attain gains in job performance (Venkatesh et al. 2003). The five constructs from the different technology acceptance models that pertain to performance expectancy are perceived usefulness, extrinsic motivation job-fit, relative advantage, and outcome expectations. We posit that the effect of technology contact of a service on perceived performance expectancy will be moderated by the underlying consumer's shopping motives. Shopping research has proposed several types of shopping motives which have been widely accepted as a theoretical

foundation to understand consumer outcomes (e.g., Childers et al. 2001; Dawson et al. 1990; Eastlick and Feinberg 1999; Sheth 1983). Commonly explored shopping motives include convenience, information attainment, price attainment (either lowest price or price comparison), assortment and uniqueness, as well as social interaction and browsing.

In this study, we consider two motivational orientations that are relevant to the context of the study. The first motivational orientation involves consumers spending time in order to gain information related to the products. We refer to this orientation as the information attainment orientation. Information attainment is usually considered an important motivational orientation among consumer shopping goals and it is usually operationalized in contrast with convenience or time seeking orientation (Dickerson and Gentry 1983; Noble et al. 2006). For this reason, the other orientation we explore in the current study describes consumers engaging in shopping out of necessity to obtain the needed products at the least time with limited or no need to obtain information for the products. We refer to this orientation as the convenience seeking orientation.

Task-Technology fit theory postulates that the features of the technology used must fit the task needs (Goodhue & Thompson, 1995). In addition, information richness theory suggests that performance will improve if the richness of the medium is matched to the communication requirements of the task. For example, media perceived high in information richness would be more appropriate for socio-emotional communication and equivocal tasks (e.g. influence attempts, conflict resolution, social or personal communications). Media perceived low in information richness would be more appropriate for less socio-emotional and analyzable tasks (e.g. information exchange and asking questions).

H2: Shopping Orientation will moderate the relationship between Technology Contact and Performance Expectancy

H2a: There will be a negative relationship between technology contact and performance expectancy for time seeking-oriented consumers

H2b: There will be an inverted-U relationship for information-seeking oriented consumers

Ease of Use, Performance expectancy and Behavioral Intentions

To further understand the effect of customer-technology contact on consumer behavior, it is important to include in our model behavioral intentions. The technology acceptance model as well as the unified theory of technology acceptance suggest that the most important determinants of intentions to adopt technology is ease of use (or effort expectancy) and usefulness (or performance expectancy). Furthermore, several empirical researches have confirmed that these two constructs have a positive effect on consumers' intentions to use technology. Based on these well established theories and extending empirical findings on the context of offline technology-based services we propose that performance expectancy and effort expectancy will have a positive effect on consumer intention to use technology-based services.

H3: Effort expectancy will have a positive effect on intention to use technology-based services

H4: Performance expectancy will have a positive effect on intention to use technology-based services

Moreover, we expect an intervening role of ease of use and performance expectancy in the linkage between technology contact and behavioral intentions. There are several rationales behind this choice.

Firstly, technology acceptance literature place ease of use and usefulness as critical components in application design and evaluation (Davis and Venkatesh 2004). Secondly, a lot of studies provide evidence that usefulness and ease of use act as mediators between specific technology characteristics and users attitudes (Venkatesh 2000). Thirdly, technology contact of a service, as described in this article, can be considered as a part of the service design and thus defining service at a lower level than its perceived performance expectancy and its perceived ease of use. In parallel with the SOR framework that postulates that consumers' perceptions follow the route of stimulus-organization- response, it is expected that consumers will formulate their perceptions about technology-based services by following the route service design – system perceptions - attitude & behavioral intentions.

Based on the above argumentation we formulate the next hypothesis:

H5: Performance expectancy and ease of use will mediate, at least partially, the effect of technology contact on behavioral intentions

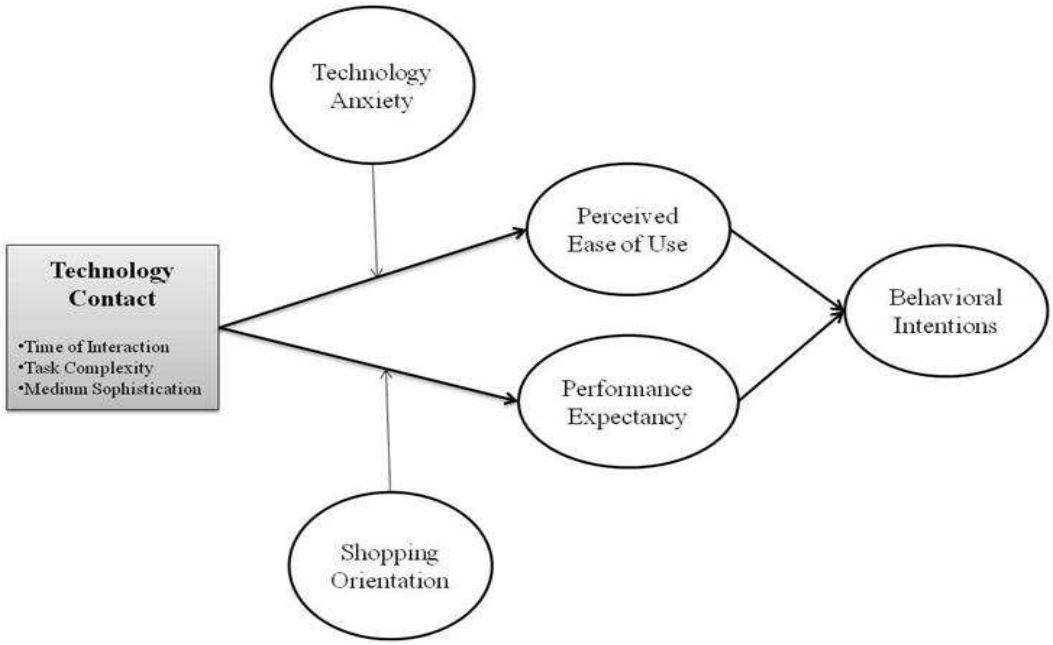

Figure 1. The research model

Research Methods

The hypotheses proposed in the present study were tested through an experiment with the customer technology contact as a manipulated variable. The empirical context for the research was grocery retailing stores. The retail service application investigated was the "dynamic pricing information service". The practice of dynamically pricing perishable products (dairy, meat and poultry and vegetables) based on their current expiration date is a practice already used in grocery stores (Theotokis et al. 2008; Tsiros and Heilman 2005). However the consumers' need for accurate and rich product information drive retail companies to exploit technology in order to provide information services to their consumers. A dynamic product information service is a technological application that gives the opportunity to consumers to get informed about the price and other unique characteristics (expiration date, production date etc) of any product in-store.

We used this service as an exemplar of technology-based services and retail store as the research context for several reasons. Firstly, it is an information service (instead of transactional or operational services) as it is the majority of technology-based services used today. Second, grocery stores are frequented by a more representative sample of the general population than are airports, catalog stores, movie theaters, or sports events (Dabholkar 1996). Moreover, the design and application of in-store consumer information services is a challenging task for managers because several alternatives of supporting technologies (Barcode, 2d Barcode, EPC, RFID,) and interfaces (touch screens, large displays, electronic shelf tags, Mobile Phones, PDAs) can be used. Finally because of the availability of different technologies, depending on the selected design, service applications can require different levels of technology contact from the consumer. Thus, the grocery retailing setting is a good choice for initial theory development and for suggesting relevant implications for practitioners. Research implications could extend to other on-site service encounters which offer similar technology-based self-service options.

It was decided to use a scenario approach over a field study for several reasons. In testing a new and as of yet widely unavailable technology-based self-service option, a study of potential customers and their expectations was thought to be appropriate. In addition, using the scenario approach allowed manipulation of the focal construct of our research: the customer-technology contact, something not easily achieved in field experiments (Dabholkar 1996). In the next sections we present the experimental design as well as data collection and measurement issues.

Experimental Design

In order to examine the effect of the technology contact on important adoption variables, we manipulated it at three levels. Three different application scenarios were used each describing the same service but applied with different

level of technology contact. A scenario and survey methodology (Dabholkar & Bagozzi, 2002) was used in order to capture consumer perceptions about the three different scenarios. Table 2 presents the three different service concepts and summarizes their classification using the dimensions of technology contact. Ratings of the level of each dimension are considered at the service episode level, i.e. similar to the theory of customer contact (Kellogg and Chase 1995) .

Table 2. Experimental Design

Scenario	Service Concept Description	Interface Technology	Time of Contact	Medium Sophistication	Information Richness/ Directionality
Low technology contact	Consumer gets the price information using the electronic shelf labels	Electronic Shelf Labels	Very Low	Low	1-way
Medium technology contact	Consumer uses the stand/kiosk, near to the shelf, equipped with an LCD screen, in order to "read" the product barcode and get the price information	LCD Screen	Low	Medium	1-ways
High technology contact	Consumer uses a PDA in order to read the product barcode. Then using the touch screen selects the kind of information he wants to see (price, nutritional, cooking tips)	Smartphone / PDA	High	High	2-ways

The low technology contact scenario uses the electronic shelf labels in order to provide consumers with the basic price information. The medium technology contact scenario is a service application based on a kiosk near to the shelf equipped with a barcode reader and an LCD Screen. In this case consumer uses the kiosk in order to read the price information of the selected product. For this scenario there is no input of information from the user apart from the scanning of product. Finally, the third scenario, the high technology contact, requires from consumer to use a PDA or an advanced mobile phone in order to "read" product information. In this case user inputs information to the system by selecting the kind of information he would like to see. The available information in this scenario is richer than in the other two. The three visualized scenarios that used in the study are included in the appendix.

Data collection and Sampling

Researchers were occupied in data collection in supermarket stores in Ireland for two weeks. The researchers "intercepted" respondents in supermarket stores, employing a face-to-face personal interviewing method. Each respondent was assigned randomly to one of the three service scenarios. Respondents, firstly, were reading carefully the service scenario and could ask interviewers any clarification questions regarding it. Then they completed a questionnaire comprising all research items.

The population of the study was consumers of retail stores. The sampling frame included the stores of a major super market retail chain in Ireland. Because the characteristics of respondents may vary by day of the week and time of the day (Bush and Hair 1985), researchers were present different days of the week and at different times in order to avoid this problem (Bush and Hair 1985). Researchers collected data in low, medium, and high-peak shopping days. A total of 402 completed questionnaires were collected. Overall in terms of gender, age, and marital status, the sample was representative of country's supermarket shoppers, as indicated from retail managers of 5 supermarket chains from Ireland.

Measures

We have adapted the measures employed in the present study from the extant literature. Behavioral intentions, performance expectancy and ease of use were measured with three-item scales adapted to the retailing context from

the UTAUT Venkatesh et al. (2003). Technology anxiety was measured with a four-item scale based on Meuter et al. (2003). Finally, for shopping motivational orientation, information attainment seeking was conceptualized as the motive of seeking out information related to product related attributes and measured via a single-item scale adapted from Noble et al.(2006). Responses were made on a 7-point Likert-type scale, with the endpoints being strongly disagree and strongly agree.

Manipulation Checks and Pilot Phase

To ensure the validity of our experimental design a pilot phase was also included in our study. During this phase technology contact measures were developed and manipulation checks were performed to verify that respondents perceived manipulations as intended. The pilot phase conducted in Greece and 173 consumers from Greek supermarket stores participated. Because we drew from different research streams in order to define the concept of technology contact and this concept is focal in our study, manipulation checks was applied both to the pilot sample (Greece) and the test sample (Ireland) so as to ensure that the manipulations is not country-dependent or culture-dependent. Four items were used in order to measure the perceived technology contact of each service scenario. The first three items are measuring each separate dimension of the technology contact and the last one provides an overall assessment of the level of technology contact of the service. Using the ANOVA framework we tested the manipulation checks. Table 3 presents the average responses on manipulation check items for the two countries. In both countries, subjects allocated in the low technology contact scenario perceive that the service technology contact was significantly lower than subjects in the medium technology contact scenario perceptions of which is in turn lower than those of subjects in high technology contact. The same is true for each separate dimension of technology contact. Therefore, all manipulation checks are successful.

Table 3. Means for Technology-Contact Manipulation Check Items

	Dimension	**Time of Contact**	**Task/Information Complexity**	**Medium Sophistication**	**Overall Technology Contact**
	Item	*When using this service I interact with the technology for a lot of time*	*I input a lot of information to the system during this service*	*I have to use an advanced technological medium for using this service*	*When using this service I have contact with the technology*
Greece	Low	2.65	2.31	3.06	3.48
	Medium	3.65	3.22	4.38	5.04
	High	5.41	4.57	6.08	6.39
Ireland	Low	2.06	2.10	2.18	2.99
	Medium	2.76	2.54	2.77	3.75
	High	3.58	3.04	3.22	4.13

Note: 5-point scales used for Ireland and 7-point scales used for Greece

Data Analyses

We used partial least squares to analyze the data (Chin 1998; Venkatesh and Morris 2000). The categorical measures of customer technology contact and the interaction variables in our model violate the multivariate normality required by maximum likelihood estimation. PLS is particularly useful for our study because it is robust to non-normal data distribution (Chin 1998).

We used the measurement variables to generate factor scores (behavioral intentions, performance expectancy, ease of use, technology anxiety and shopping orientation). Before estimating the structural models, we created all necessary latent interaction and quadratic variables. First, to reduce inflation in path coefficients, we standardized and centered

the indicators of each construct (Chin 1998). Then, in line with the work of Chin et al. (2003), we represented latent interaction variables by creating all possible products from the two set of indicators and latent quadratic variables by multiplying all construct indicators by themselves.

Results

Measurement Model Assessment

We tested our measurements for internal consistency, convergent and discriminant validity employing the testing system recommended by Fornell and Larcker (1981). Internal consistency of our constructs is acceptable since all the reliabilities - as measured by composite reliability indicator- exceed the 0.70 guideline that Nunnally (1978) recommends. According to Gefen and Straub (2005) convergent validity is shown when each of the measurement items loads with a significant t-value on its latent construct. Typically, the p-value of this t-value should be significant at least at the 0.05 alpha protection level. Finally, discriminant validity is shown when the PLS indicators (a) load much higher on their hypothesized factor than on other factors (own-loadings are higher than cross loadings), and (b) when the square root of each factor's Average Variance Extracted (AVE) is larger than its correlations with other factors (Gefen and Straub 2005).

Table 4. Composite Reliability, Correlation Matrix and Average Variance Extracted

	CR	1	2	3	4	5	6
1. Technology Contact	.94	N/A					
2. Performance Expectancy	.95	-.19	.75				
3. Ease of use	.94	.08	.13	.77			
4. Attitude	.70	.03	.61	.19	.94		
5. Technology Anxiety	.76	-.01	-.06	-.42	-.08	.65	
6. Shopping Orientation	.91	-.01	.45	-.01	.40	-.04	N/A

Note: The diagonal elements represent the AVE and the off-diagonal the correlation between latent variables, CR = Composite Reliability

We investigated these tests using the PLS confirmatory factor analysis procedure. All items loaded well on their respective factors, which are much higher than all cross-loadings. Second, as shown in Table 4, the square root of all AVE's is much larger than all other cross-correlations. These results support their discriminant validity according to the test of Fornell and Larcker (1981).

Structural Models Assessment

Hypotheses of the study are tested using a series of five models. Table 5 presents the PLS results for the effects of technology contact on performance expectancy and ease of use. In the first model (A1) we test only the direct effects of technology contact on the two dependent variables without including any moderating variables. In the second model (A2) we include also the hypothesized moderating effects of technology anxiety and shopping orientation. Results from the comparison of the two models indicate that the inclusion of the interaction terms increases significantly the total variance explained both for ease of use (ΔR^2 =.045) and performance expectancy (ΔR^2 =.017). Therefore the existence of moderating effect of technology anxiety and shopping orientation can be confirmed. Results from the A2 model show that the square term of technology contact has a significant negative relationship with ease of use and performance expectancy. This confirms the existence of an inverted U-relationship for both. Moreover, the significance of the term (technology anxiety × technology contact) on ease of use suggests that technology anxiety moderates this inverted-U relationship and supports H1. Similarly, the moderating role of shopping orientation on the effect of technology contact on performance expectancy is confirmed by the significance of the term (shopping orientation× technology contact). Therefore, H2 is also supported. The two moderating effects are depicted graphically

Table 5. PLS Results – Technology Contact, Ease of Use, and Performance Expectancy		
Model A1. Only Direct Effects		
	Parameter Estimate	
	Ease of Use (R^2 =0.189)	Performance Expectancy (R^2 = 0.270)
Technology Contact (TC)	0.082*	-0.184***
Technology Contact Squared ($TC^{2)}$	-0.095**	-0.0174***
Technology Anxiety (TA)	-0.407***	
Shopping Orientation (ShOr)		0.449***
Model A2. Moderating Effects		
	Parameter Estimate	
	Ease of Use (R^2 = 0.234)	Performance Expectancy (R^2 = 0.287)
Technology Contact (TC)	0.098*	-0.184**
Technology Contact Squared ($TC^{2)}$	-0.088*	-0.0174**
Technology Anxiety (TA)	-0.400***	
Shopping Orientation (ShOr)		0.444***
TC × TA	0.200**	
TC × ShOr		0.054*
TC^2 × TA	0.058	
TC^2 × ShOr		0.115**

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

Table 6 presents the results of the model that includes the direct effect of technology contact on behavioral intentions.The first model (B1) does not include the moderating effects of technology anxiety and shopping orientation. The difference of R^2 (ΔR^2 =.032) between the two models shows that the inclusion of moderating effect provides better model fit. However, the direct effect of technology contact on behavioral intention is insignificant, while the quadratic effect significantly negative, in both models. This indicates that, in general, an inverted-U relationship exists between technology contact and behavioral intentions. But , the relatively low price of R^2 even in the second model (B2) leads to the conclusion that we have to test the full model by including the mediating effects of ease of use and performance expectancy.

Table 6. PLS Results – Technology Contact and Behavioral Intentions	
Model B1. Only Direct Effects	
	Parameter Estimate (t-value)
	Behavioral Intentions (R2 = 0.178)
Technology Contact (TC)	0.030
Technology Contact Squared (TC2)	-0.083*
Technology Anxiety (TA)	0.099
Shopping Orientation (ShOr)	0.386***

Model B2. Moderating Effects	
	Parameter Estimate (t-value)
	Behavioral Intentions (R2 = 0.210)
Technology Contact (TC)	0.025
Technology Contact Squared (TC2)	-0.087*
Technology Anxiety (TA)	0.094
Shopping Style (ShOr)	0.389***
TC x TA	0.061
TC x ShOr	-0.137**
TC2 x TA	-0.060
TC2 x ShOr	-0.072*

Finally, we test the full model (C) of technology contact, ease of use, performance expectancy and behavioral intentions which is shown in Table 7. The significant relationships between performance expectancy and behavioral intention confirm H3 and the significant relationship between ease of use and behavioral intention confirm H4. Furthermore, the results show that once the performance expectancy and ease of use variables are entered in the model the direct effect of technology contact on attitude is decreased, but remains significant, which indicates a partial mediation of ease of use and performance expectancy on the effect of technology contact on behavioral intentions. This confirms H5.

Table 7. PLS Results – Technology Contact, Ease of Use, Performance Expectancy and Behavioral Intentions

Model C. Full Model			
	Parameter Estimate (t-value)		
	Ease of Use (R2 = 0.234)	Performance Expectancy (R2 =0.285)	BI (R2 =0.401)
Technology Contact (TC)	0.097*	-0.185***	0.142***
Technology Contact Squared (TC2)	-0.088*	-0.0172**	0.029
Technology Anxiety (TA)	-0.400***		
Shopping Orientation (ShOr)		0.443***	
Ease of Use			0.095*
Performance expectancy			0.627***
TC x TA	-0.202***		
TC x ShOr		0.053	
TC2 x TA	0.057		
TC2 x ShOr		-0.115**	

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

Conclusion

The advent of new technologies in retailing and the rapid development of onsite technology-based services was the main motivation of this research. Several research efforts from different disciplines propose factors that affect customer attitude towards technology-based services, but most researchers treat this type of service delivery as a homogeneous group. However, the need for classifying technology-based services according to the level of customer-technology interaction has been noted by recent researches. Technology contact is a service characteristic that has been proposed by previous research and it refers to the level of customer-technology interaction that a technology-based service requires. Technology contact has been initially shown to have a moderating role in the relationship between technology readiness and attitude towards technology. This research was motivated by an interest in examining whether, how and when the level of technology contact, as a service design characteristic, has a direct effect on consumer acceptance of technology-based services. To this end, we developed and tested a model comprising the constructs of technology contact, performance expectancy, ease of use and behavioral intentions. Moreover, we included in our model as moderators a situational characteristic, the shopping motivational orientation, and an individual trait, the technology anxiety. We examined whether technology contact affect behavioral intentions. We investigated how this relationship is mediated by the intervening variables of ease of use and performance expectancy. Finally, we examine when technology contact has an effect on behavioral outcomes by testing the moderating effects of technology anxiety and motivational orientation.Exploiting the dynamic product information service, as an exemplar application, this study shows that the level of customer technology contact is related with consumer perceptions about the service. Our results provide two important insights into the role of technology contact to consumer acceptance of technology-based services. Firstly, it has been shown that technology contact effect on perceived ease of use is contingent upon consumer's technology anxiety. Specifically, for low technology anxiety user's, medium levels of technology contact drives to greatest levels of perceived ease of use. In contrast, for high technology anxiety consumers technology contact has a negative effect on perceived ease of use. Secondly, the results have shown that the effect of technology contact on performance expectancy is moderate by the shopping motivational orientation. Users engaging in shopping with primary motivation the information seeking activities found most useful services with medium levels of technology contact. On the other hand, consumer with time-seeking as shopping goal found services with low technology contact as most useful. Finally, performance expectancy and perceived ease of use function as intervening variables into the effect of technology contact on behavioral intentions

Implications for Research

Most research studies in technology acceptance focus either on employee's usage of technology or consumer behavior regarding web-based e-commerce. However, technology is infused also in traditional in-store service encounters. These issues call for a more holistic approach for studying technology acceptance. The Service Science Management an Engineering (SSME) initiative proposes the inclusion of concepts form different disciplines in order to study technology acceptance at the service system level. Our study approaches technology acceptance at the service system level by defining a classification characteristic of technology-based services. By approaching technology acceptance in this way researchers can include notions and concepts from different discipline so as to study different forms of technology infusion.

Secondly, by studying consumer acceptance of in-store technology-based service we extend the notion of e-commerce and e-service to a broader discipline that is not only related with internet based services but also with every kind of technology used to support consumer services. Moreover, by proposing the concept of technology contact as a variable classifying technology-based services and showing its effect on consumer acceptance we propose a design characteristic that defines technology at the service system level.

Finally, this study proposes a comprehensive yet parsimonious model of technology acceptance from consumers that is not only applicable on on-stie technology based services but also on offsite internet based services which belong to the "traditional" e-commerce research stream.

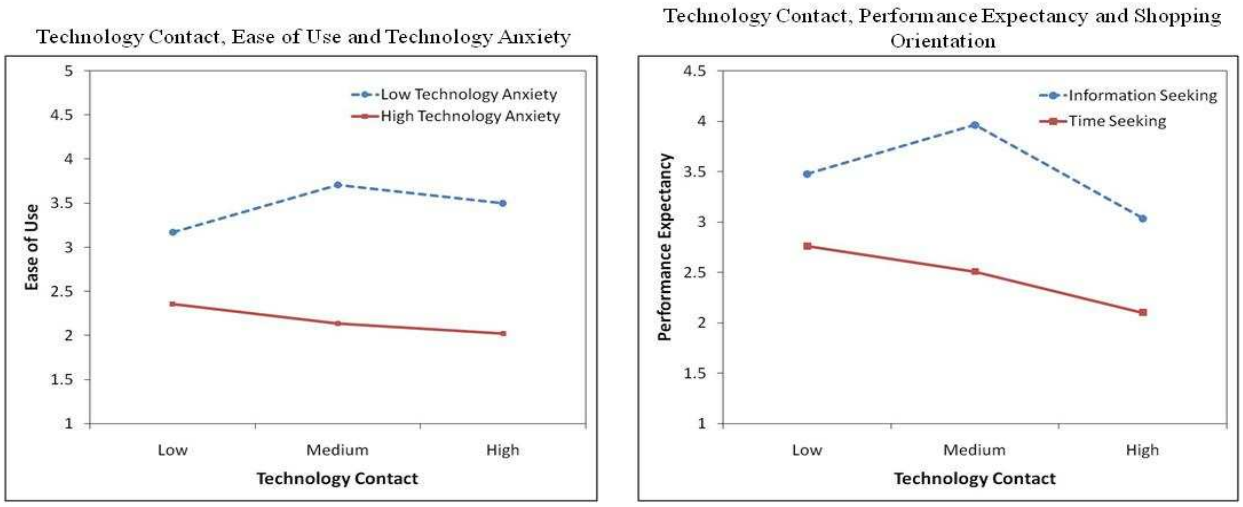

Figure 2
Moderating effects of Technology Anxiety and Shopping Orientation

Practical Implications

This study proposes a construct that classifies IT applications by approaching them at the service system level. Technology based services can require different levels of customer technology interaction. This level of interaction affects customer perceptions about services. It is therefore important for a manager to be aware of this and make the right choices regarding the use of technology when designing a new service system. Managers, through appropriate design could manipulate this specific service characteristic and improve customer attitude and adoption. For instance, the usage of different technology for providing to customer the same service could change the technology contact of it. Take for example the self-checkout service, if RFID technology is used, the technology contact that is required from the customer will be much less than if UPC scanners are used. In the first case, customer would just pass-through his trolley and automatically all products would be scanned, while in the second case customer has to scan each product separately. Therefore, the time and the level that customer interacts with technology in these two cases is quite different and therefore the level of technology contact. Of course, financial and other managerial aspects when designing a service system should be considered for ensuring its success.

Limitations and Further Research

The concept of technology contact can be extended in any technology-based service. Web services and electronic commerce applications for example can be also categorized by their technology contact. Although the medium with which user interacts is the same the other two dimensions, task/ information complexity and time of service contact may vary from service to service. Therefore, researchers in technology acceptance can include the notion of technology contact in studies of consumer acceptance of websites and internet services. The role of each dimension of the technology contact construct can be examined separately. This can be done through an experiment which will use a manipulation of each of the three dimensions of technology contact.

Customer-technology contact could be operationalized as a latent (non-observable) variable that would measure customer perceptions about the level of interaction with technology that a service requires, namely *perceived customer technology contact*. However, before constructing an empirically derived measure for a concept, it is necessary to theoretically define it and provide an empirical proof of its value, which was the purpose of this paper. Scale development is a demanding procedure that requires diverse methodologies and data collection stages. Therefore, before researchers proceed to such a task, the operational definition, the theoretical support as well the empirical proof of its importance for the concept of technology contact are necessary and these are the aims of the current study.

In addition, a field experiment with different real-world applications of services would provide us with more valid results concerning consumer perceptions about service.

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