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## Acceptance by the public of the virtual delivery of public services

Hoefnagel, R.; Oerlemans, L.A.G.; Goedee, J.

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# Acceptance by the Public of the Virtual Delivery of Public Services: The Effect of Affect

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Ruud Hoefnagel<sup>1</sup>, Leon Oerlemans<sup>1,2</sup>, and John Goedee<sup>1</sup>

## Abstract

Little is known about the determinants of acceptance by the general public of virtual delivery of governmental services. The authors conduct an empirical study of the factors that influence the willingness of individuals to consent to a para-authentic virtual experience with a public sector employee as part of the delivery of a public service. This study is based on the theory of social presence and on the unified theory of acceptance and use of technology (UTAUT). The authors test these hypotheses using 224 questionnaires completed by persons who have filed a police report using synchronous video-mediated communication (VMC). This multiple regression analysis shows that four variables are likely to predict willingness to use virtual interaction as a part of the delivery of a public service: performance expectations, social presence, social influence, and anxiety. Two findings were especially interesting. First, affective predictors, as opposed to cognitive predictors, were found to be of increasing importance for the acceptance by the public of virtual service delivery. Second, social presence emerged as the strongest affective predictor. This study's empirical findings support the a priori assumption that affective predictors, as opposed to cognitive predictors, are relatively more important in predicting the intention to use virtual technologies, when contrasted with conventional technologies.

## Keywords

public service provision, video-mediated communication, crime reporting, virtual, social presence, unified theory of acceptance of technology

## Introduction

The use of virtual technology in the provision of public services is a relatively new phenomenon. While teleconferencing is a common practice in business and academia and telemedicine has been widely used for decades (Cyr, Hassanein, Head, & Ivanov, 2007; Schrijver, 2008), few public service agencies interact to any meaningful extent with clients using virtual technology, and in many cases those that do are still experimenting with its parameters.<sup>1</sup> Technology acceptance models

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<sup>1</sup>Tilburg University, Tilburg, EG, Netherlands

<sup>2</sup>University of Pretoria, Pretoria, South Africa

## Corresponding Author:

Ruud Hoefnagel, Tilburg University, Wilhelminapark 114-4, Tilburg, 5041 EG, Netherlands  
Email: Ruud.Hoefnagel@gmail.com

applied to a wide spectrum of nonservice contexts have yielded valuable insights, and the technology acceptance literature has added to our understanding of how the general public responds to technology (Davis, Bagozzi, & Warshaw, 1989; Venkatesh, Michael, Gordon, & Fred, 2003), but we contend that acceptance by the public of virtual interaction in the provision of public services is somewhat different. Moreover, there have been few empirical studies of the acceptance, or non-acceptance, of the use of virtual technology on the part of the general public. We intend to address these gaps.

According to social presence theory (SPT; Short, Williams, & Christie, 1976), acceptance of virtual technology depends on affective predictors as well as the cognitive predictors of conventional acceptance models. One would expect affective factors to be especially important when technological media are used by agencies responsible for meeting basic human needs such as welfare, health, and safety (Hasenfeld & Abbott, 1992). Our goal in conducting this study is to determine what factors influence user acceptance of mediated communication in the delivery of public services. We do this by collecting empirical evidence of the relative importance of affective and cognitive predictors in explaining the acceptance of real-time video communication in the provision of a public service.

While much has been written on computer-mediated communication (CMC), relatively few empirical studies have considered the delivery of services using video-mediated communication (VMC), and fewer still have attempted to determine what factors are likely to affect acceptance by the public of the use of such technology in the provision of public services. The remainder of this article is structured as follows. In the next section, we define virtuality, explain the context in which this study takes place, and evaluate synchronous VMC from the user's point of view. In the following section, we briefly summarize different technology acceptance models and virtuality theories that we combine in building a theoretical model with which to empirically study acceptance of virtual technologies. We then outline our methodology, report our results, and present our conclusions. Finally, we address the implications of our findings for both researchers and practitioners.

## Virtuality, Research Context, and Technology

Participating in a teleconference, watching television, even using a hearing aid are virtual experiences. According to Lee (2004, p. 37): "Virtual experience is the sensory or nonsensory experience of virtual objects." He sees virtual experience as being in its own realm between real experience, that is, sensory experience of an actual object, on one hand, and hallucination, nonsensory experience of an imaginary object, on the other hand (Lee, 2004). The core construct in studies on virtuality, the present one included, is the concept of presence, basically, which the technology gives the user a sense of "being there" (Biocca & Harms, 2003; Lee, 2004). Considering the broad spectrum of technologies available today that can mentally transport us, make us feel like we are "there," it is not surprising that there are also many ways to conceptualize presence. To deal with these divergent views, Lee (2004, p. 41) developed a typology of virtual experience. Our study can be positioned in the para-authentic/social dimension of that typology as graphically shown in Table 1, the domain in which the concept of social presence explains the perceived or actual quality of virtual mediating technology.

The concept of social presence was first proposed by Short, Williams, and Christie (1976) in their seminal book on the social psychology of telecommunications. According to their theory of social presence (TSP), social presence is the perceived quality of the communication medium, "the degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short et al., 1976, p. 65). Sallnäs, Kassmus-Gröhn, and Sjöström (2000) would later write that the degree of social presence can be equated to the degree of awareness of the other party in a mediated communication. In other words, social presence has to do with a communicator's sense of awareness of the presence of another person, a partner with whom one can interact through a

**Table 1.** Adapted From Lee (2004, p. 41)

Domains of Virtual Experience	Characteristics of Virtuality	
	Para-Authentic	Artificial
Physical	Experience of para-authentic objects Examples: Directing telesurgery and watching television news	Experience of artificial objects Example: Enjoying a historical battlefield within a computer game and reading nonfiction
Social	Experience of para-authentic social actors Example: Videoconferencing and chatting over the Internet	Experience of artificial social actors Example: Responding to a telephone answering system
Self	Experience with para-authentic self Example: Seeing oneself in a videoconference	Experience with artificial self(selves): adopting an identity in a role-playing game, identifying with a character in a movie

medium. That awareness is important in determining the way a communicator comes to think of the interlocutor, his or her characteristics, qualities, and inner state (Short et al., 1976).<sup>2</sup> In Table 2, we consider the origins of some of the most influential definitions of social presence and ways in which it has been measured.

The definitions of Biocca (1997) and Lee (2004) have added breadth to our understanding of social presence, but for our purposes the earlier definition of Short, Williams, and Christie (1976) is most applicable as it suggests a validated measure and best describes the para-authentic/social dimension of the presence construct (Biocca & Harms, 2003; Gefen & Straub, 2004; Heerink, Krose, Evers, & Wielenga, 2008; Lee, 2004; Rice, 1992; Sallnäs, Kassmus-Gröhn, & Sjöström, 2000; Short et al., 1976; Steinfeld, 1986; Welmers, 2005). In sum, the quality of the virtual medium, and therefore the willingness to use the technology, is closely related to human communication constructs such as intimacy, humanness, warmth, and sociability. In the following sections, we consider further the relationship between the perceived quality of the virtual medium and its acceptance. First, however, we focus on the context in which we explored virtuality.

### *Research Context: The Reporting of a Crime*

The taking of a report by the police is an example of a public service provided by a governmental agency. Tucker (1992, p. 47) describes the provision of services of this kind as “a nonmarket form of organizing with indeterminate or ambiguous technology, which is mainly concerned with changing, constraining, and/or supporting human behavior.” Hasenfeld (1992), writing on human service organizations (HSO), points out that their clients expect them to embody values of caring, commitment, human welfare, trust, and responsiveness to human needs. Despite the positive expectations that recipients of assistance from an HSO or from a public service agency may have, given the situation in which clients find themselves, it comes as no surprise that they may be fearful or feel victimized (Hasenfeld, 1992). The characteristics described by Hasenfeld (1992) are often seen during the process of filing a police report and thus can serve, as we will see, as a theoretical starting point for our research.

In the following section, we describe further emotions that are often displayed by persons filing a police report and describe the physical settings in which the police take reports. We also give the motivations for adopting the use of VMC in policing.

*Conventional crime reporting.* In most countries, a person who wants to report a crime goes to the police station closest to where the incident occurred. The way in which a report is taken in the

**Table 2.** Definitions of Social Presence

Definition	Source	Measures and Origins
“The degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships”	Short, Williams, and Christie (1976)	Differential scale: cold–warm, sociable–unsociable, sensitive–insensitive, and personal–impersonal Also operationalized as Likert-type scale (De Greef & Ijsselsteijn, 2000) Definition is inspired by interpersonal communication literature involvement, intimacy (Argyle & Dean, 1965), and immediacy (Wiener & Mehrabian, 1968)
“The ability to make one’s self-known under conditions of low-media richness”	Savicki and Kelley (2000)	Naturalistic assessment of communication style, think of: self-disclosure, opinion, fact, apology, question, call to action, challenge, reference to other group members, use of “we” language, argumentativeness, use of coarse language, attempts at conflict resolution, and indications of status
“The minimum level of social presence occurs when users feel that a form, behaviour, or sensory experience indicates the presence of another intelligence. The amount of social presence is the degree to which a user feels access to the intelligence, intentions, and sensory impressions of another”	Biocca (1997)	Nowak (2000) operationalizes this definition by involving interpersonal communication literature constructs: involvement, intimacy (Argyle & Dean, 1965), and immediacy (Wiener & Mehrabian, 1968)
“A psychological state in which virtual (para-authentic or artificial) social actors are experienced as actual social actors in either sensory or nonsensory way”	Lee (2004)	Based on Biocca & Harms (2003) and informed by own literature review and taxonomy

Netherlands is very similar to how it is done in most of Europe. In the greater metropolitan area of Rotterdam in the Netherlands, traditionally, most police reports have been taken by a police officer who meets the person filing a report privately. While the filer and the officer are separated from one another by a desk, they are nonetheless face-to-face in close proximity to one another. The officer uses a text-based information system to create and store a document in which all of the pertinent information given by the filer is entered. In a study of public perceptions of the police in the Netherlands, researchers found that it is not uncommon for persons reporting a crime to express or show signs of anxiety or anger. Often they seem to be eager to share what they have experienced and want the officer to whom they are relating the incident to be friendly and a sympathetic listener who shows concern about what has happened (MinIKR, 2005).

*Virtual crime reporting.* The way of taking police reports described above is costly. Each locale where a police report may be filed needs to be staffed with officers trained in handling the task and backup personnel, including armed police officers. Time devoted to the taking of police reports is not available for other functions, including crime prevention and investigation. It is not surprising

that budgetary constraints have prompted consideration of alternative means of taking police reports. We look now at technology that allows the police to meet the needs of the public in a more cost-effective way.

Advances in information and communication technology (ICT), including improved holographic display and other audiovisual infrastructure, can make it possible to reduce the number of employees staffing police stations. One of the main advantages of virtual presence technology is that it can mean significant savings in labor costs without appreciably reducing the intensity and quality of human contact. Persons filing reports still have contact with a police officer, but in a virtual way. The officer's three dimensionality (3D) image is projected on a screen with sufficient clarity to allow for making eye contact with the filer. This technology makes it possible for there to be 1 central facility at which crimes may be reported rather than at 24 different locales. The attendant considerable reduction in personnel, and to a lesser extent in facilities, has resulted in an annual savings of Euro 4.5 million. The one-time investment was Euro 3 million and the annual cost estimated at Euro 0.4 million, mostly for ICT (Politie, 2010). In the next section, we take a closer look at the technology used.

### *Enabling Virtual Crime Reporting: VMC*

VMC refers to technologies that enable humans to communicate mediated by a video signal (Finn, Sellen, & Wilbur, 1997). VMC has been a topic of interest in both business and academia since its introduction in the 1960s. Although it has proven to be invaluable in a wide range of applications such as remote task collaboration, teleconferencing, and long-distance learning (Finn et al., 1997), VMC technology has met with some resistance when face-to-face or copresent interaction is called for because a sense of real human contact has been lacking (see Egido, 1990, for a review of the possibilities and limitations of VMC). The influence of VMC technology has been studied from a communication process perspective (Cook & Lalljee, 1972; Doherty-Sneddon et al., 1997) and more recently from the perspective of users (Heerink et al., 2008; Schrijver, 2008; Welmers, 2005). We focus in this study on users, specifically on their acceptance of VMC technology in the delivery of public services.

It is apparent that VMC systems vary in terms of their ability to transmit audio and video in full-duplex so as to make eye contact and same direction of gaze possible (Doherty-Sneddon et al., 1997; O'Connaill, Whittaker, & Wilbur, 1993). O'Connaill, Whittaker, and Wilbur (1993) found that broadband communication delivers a richer, more face-to-face-like experience than small-band VMC. Broadband technology provides high-quality video and does away with time lag problems, the result being a more natural communication. Technological improvements have increased the use of VMC and broadened the array of applications. It is now possible to study VMC outside of high-tech and laboratory environments and to look at real-life situations in which VMC is in use, such as in the taking of a police report.

The system has two features not found on conventional webcam and teleconferencing systems. First, it allows for better eye contact, and second, it captures, to some extent, 3D. Argyle and Dean (1965) have confirmed that eye contact is an important part of gathering information from communication partners and thus an important feature in human interaction and communication. Most conventional videoconferencing systems and webcam solutions are not able to fulfill the need for eye contact and same direction of gaze because the video-capturing device is placed on top of the monitor or screen of the operator. The VMC studied enhances eye contact with a mirroring effect produced by a sloping glass panel placed in front of the screen that picks up light and reflects it similar to the mirrors of a periscope. The mirrors transport the objective of the video lens to the right behind the eyes of the police officer's virtual image, projected on the sloping glass that is positioned in front of the citizen. This way of transporting the objective enables eye contact, while the video camera itself is placed under the table at which the citizen is seated.

A number of features are used to create a 3D perception. The police officer is seated before a blue background. The blue emulsion layer of film has the finest crystals and blue is more complementary to most human skin tones, which is why a blue background is used in television studios. Real-time video enhancement makes it possible to separate the image of the police officer from the blue background. The video stream is captured in a video codec, the data are transmitted through a data network to a dedicated place, the video codec is encoded and the video stream is projected onto the sloping glass panel in real time.

## **Acceptance of Virtual Technologies: Developing a Theoretical Framework**

We present in this section our theoretical framework. Building on previous research on virtuality and on presence, we propose that acceptance of virtual technology in general, and of the use of such technology in the provision of public services in particular, relies more on affective than on cognitive predictors as may be the case with conventional technologies. We build our theoretical model in the following way: First, we provide an overview of conventional technology acceptance models and the present affective/cognitive predictor's ratio in those models is explicated as a baseline. We combine a technology acceptance model with SPT into a theoretical framework to study the central role that affective predictors play in the acceptance of virtual delivery of public services.

### *Conventional Technology Acceptance Models*

The efforts of scholars to determine how and why individuals adopt new technologies have resulted in a number of technology acceptance models. Drawing in part on Venkatesh, Michael, Gordon, and Fred's (2003) review of models of technology acceptance, we summarize eight of them, giving for each its author/authors, fundamental premise/premises, and core constructs. The theories that have most influenced these models are those of reasoned action (TRA; Fishbein & Ajzen, 1975), planned behavior (TPB; Ajzen, 1985, 1991), and innovation diffusion (IDT; Rogers, 1983). None of these models alone can predict the acceptance of virtual technologies specifically. According to SPT, the quality of a virtual technology depends on how well it evokes and/or carries affective responses in the user, that is, how well the technology transmit feelings, makes it possible to establish human contact (Short et al., 1976). This implies that to predict the acceptance of virtual technology, we must consider additional affective predictors as well as cognitive ones.

All of the models included in Table 3 share three main characteristics. First, they attempt to predict acceptance and use of a technology. Second, they see intention as a key predictor of these behaviors. Third, they stress cognitive and conative/intentional variables in predicting acceptance and use, consequently considerably fewer predictors, just 5 of the 30, are affective in nature (Ajzen, 2005). The last of these observations requires some clarification. Whether an individual has a favorable or unfavorable attitude toward a given technology is determined by that individual's cognitive, affective, and conative responses. Cognitive responses hinge on personal perceptions and beliefs, affective responses reflect emotions and feelings, and conative responses have to do with willingness, that is, expectations about one's own actions in the future (Ajzen, 2005; Short et al., 1976). Using definitions provided by Ajzen (2005) and Fishbein and Ajzen (1975), we indicate in Table 3 whether a given predictor is affective (A) or cognitive (C). This allows us to indicate the relative importance of affective predictors in the most influential models of technology acceptance, providing us with a baseline against which to measure if, and to what extent, the distribution between cognitive and affective predictors changes when predicting acceptance of virtual technologies, as opposed to conventional technologies.



**Table 3.** Overview of Acceptance Models

Theory/Model (Major Contributor)	Fundamental Premise	Core Constructs
Theory of reasoned action (TRA; Fishbein & Ajzen, 1975)	Individual behavior is driven by behavioral intentions which comprise of attitude and social norm	Attitude toward behavior: "an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein & Ajzen, 1975, p. 216) (A) Subjective norm: the person's perception that most people who are important to him think he or she should or should not perform the target behavior in question (Fishbein & Ajzen, 1975, p. 302) (C)
Theory of planned behavior (TPB; Ajzen, 1985, 1991)	Extension of TRA; perceived behavioral control is added to TRA as a predictor for individual behavior	Perceived behavioral control: "the perceived ease of difficulty of performing the behavior" (Ajzen, 1991, p. 188) in IS research; "perceptions of internal and external constraints on behavior" (Taylor & Todd 1995) (C)
Innovation diffusion theory (DT; Rogers, 1983, 1995; Moore & Benbasat, 1991)	Individuals possess different degrees of willingness to adopt innovations	Relative advantage: "the degree to which an innovation is perceived as being better than its precursor" (Moore & Benbasat, 1991, p. 195) (C) Easy of use: "the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991, p. 195) (C) Image: "the degree to which one can see others using the system in the organization" (Moore & Benbasat, 1991:195) (C) Compatibility: "the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adapters" (Moore & Benbasat, 1991:195) (C)
		Results demonstrability: "the tangibility of the results of using the innovation, including their observability and communicability (Moore & Benbasat, 1991, p. 203) (C) Voluntariness of use: "the degree to which use of the innovation is perceived as being voluntary or of free will (Moore & Benbasat, 1991, p. 195) (C)

(continued)

**Table 3 (continued)**

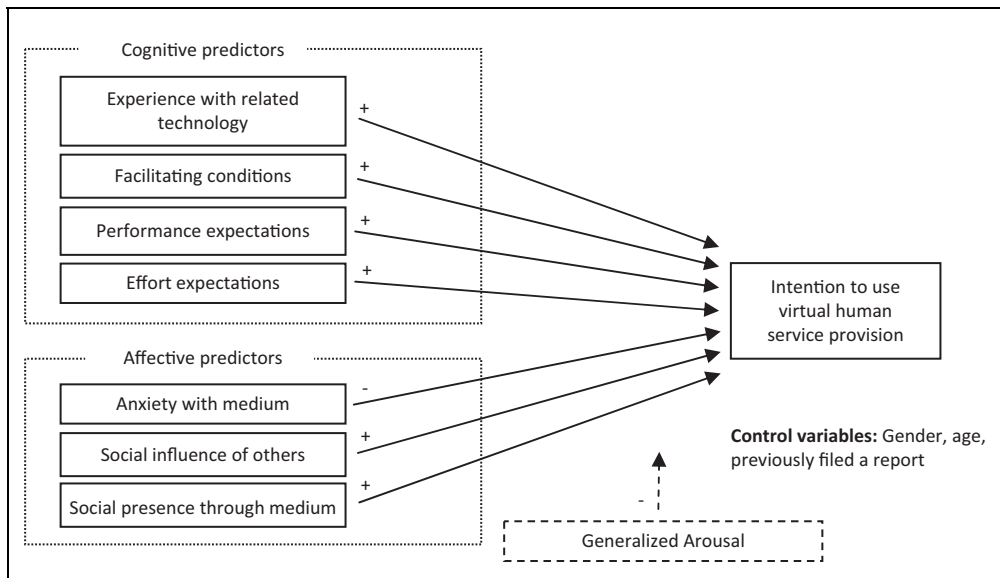
Theory/Model (Major Contributor)	Fundamental Premise	Core Constructs
Technology acceptance model [TAM/TAM2] (Bagozzi et al., 1992; Davis, Bagozzi, & Warshaw, 1989)	When users are confronted with a new technology, a number of factors influence their decision about how and when they will use	Perceived usefulness: "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis et al., 1989, p. 320) (C) Perceived ease of use: "the degree to which a person believes that using a particular system would be free of effort" (Davis et al., 1989, p. 320) (C)
Motivational model (MM; Davis et al., 1992; Taylor & Todd, 1995; Vallerand, 1997)	Behavior can be motivated intrinsically or extrinsically	Subjective norm: As in TRA (C) Extrinsic motivation: "the perception that user will perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions" (Davis et al., 1992, p. 112) (C) Intrinsic motivation: the perception that users will want to perform an activity for no apparent reinforcement other than the process of performing the activity per se (Davis et al., 1992, p. 111) (C)
Model of PC utilization (MPCU; Triandis, 1977; Thompson, Higgins, & Howell, 1991)	Derived from Triandis' theory of human behavior (Triandis, 1977); Thompson, Higgins, and Howell (1991) argues that utilization is affected by social factors, affect, perceived consequences, and facilitating conditions	Job-fit: "the extent to which an individual believes that using (a technology can enhance the performance of his or her job" (Thompson et al., 1991, p. 129) (C) Complexity: "the degree to which an innovation is perceived as relatively difficult to understand and use" (Thompson et al., 1991, p. 128) (C) Long-term consequences: "outcomes that have a pay-off in the future" (Thompson et al., 1991, p. 129) (C) Affect toward use: feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act (Thompson et al., 1991, p. 127) (A) Social factors: "the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific situations" (Thompson et al., 1991, p. 126) (C) Facilitating conditions: "objective factors in the environment that observers agree make an act easy to accomplish" (Thompson et al., 1991, p. 129) (C)

(continued)

**Table 3 (continued)**

Theory/Model (Major Contributor)	Fundamental Premise	Core Constructs
Social cognitive theory (SCT; Bandura, 1986; Compeau & Higgins, 1995)	Human behavior is seen as an interaction of personal factors, behavior, and the environment	Outcome expectations performance: "the performance-related consequences of the behavior" (Compeau & Higgins, 1995) (C) Outcome expectations personal: "the personal consequences of the behavior" (Compeau & Higgins, 1995) (C) Self-efficacy: "judgment's of one's ability to use a technology to accomplish a particular job or task" (C) Affect: "an individual's liking for a particular behavior" (A) Anxiety: "evoking anxious or emotional reactions when it comes to performing a behavior" (A)
Unified theory of acceptance and use of technology (UTAUT; Venkatesh, Michael, Gordon, & Fred, 2003)	Based on theories above, use behavior is determined by personal evaluations, personal attributes, social influence, and facilitating conditions	Performance expectancy: "the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003, p. 447) Effort expectancy: "the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450) Attitude toward using technology: "individual's overall affective reaction to using a system" (Venkatesh et al., 2003, p. 455) (A) Behavioral intention to use the system: "not defined" Facilitating conditions, anxiety, self efficacy & social influence: similar to MPCU

Note. A = affective predictor; C = cognitive predictor.



**Figure 1.** Empirical model for acceptance of the provision of public services virtually.

The unified theory of acceptance and use of technology (UTAUT) best meets the requirements of this study as it emphasizes the extent we want the importance of affective predictors in addition to other acceptance factors, and out of all the acceptance models, has the most predictive power (Venkatesh et al., 2003). The UTAUT has received considerable attention<sup>3</sup> and has been empirically validated several times (Oshlyansky, Cairns, & Thimblebly, 2007; Pu Li & Kishore, 2006). Studies applying the UTAUT have considered far-ranging applications, from the use of video-telephony in caring for Amyotrophic lateral sclerosis (ALS) patients and that of robots in providing companionship for older persons suffering from dementia, to Internet radio quality (Heerink et al., 2008; Schrijver, 2008; Welmers, 2005).

The UTAUT combines a number of influential theories of the acceptance and use of technology (Venkatesh et al., 2003), building especially on planned behavior and on technology acceptance models. These models maintain that attitudinal beliefs influence the intention to perform a certain act, which in turn influences actual behavior. According to the UTAUT, it is the attitudinal beliefs of users and would-be users about performance and effort, as well as the influence of other social actors and facilitating conditions, that impact the intention to use a certain technology, and so actual use. In the original UTAUT model, these relationships are moderated by age, gender, voluntariness, and experience.

### Explaining the Acceptance of Virtual Technologies

In this section, we present our empirical model and define our variables. The model is shown in Figure 1, and the variables are summarized in Table 4. We also summarize the UTAUT hypotheses in Table 5. We modify the original UTAUT model to meet our needs, deleting two variables and introducing an extension.

We extend the UTAUT model using elements of SPT. The public expects police officers to show concern and care about what has happened (MinIKR, 2005). The UTAUT does not take this expectation into consideration. However, it is very important in our study as virtual technology can undermine the transmission of empathy, and hence the quality of the medium and its acceptance (Short et al., 1976; Venkatesh et al., 2003). The two UTAUT variables that we do not use are *voluntariness*

**Table 4.** Definitions of Variables in UTAUT

Variable	Definition
Performance expectancy	"The degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh, Michael, Gordon, & Fred, 2003, p. 447)
Effort expectancy	"The degree of ease associated with the use of the system." (Venkatesh et al., 2003, p. 450)
Facilitating conditions	"Objective factors in the environment that observers agree make an act easy to accomplish" (Thompson, Higgins, & Howell, 1991, p. 129)
Social influence	"The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific situations." (Thompson et al., 1991, p. 126) "the degree to which an individual perceives that important others believe he or she should use the new system"
Anxiety	Evoking anxiousness or emotional reactions when it comes to performing a task (Compeau & Higgins, 1995)
Social presence	"The degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships" (Short, Williams, & Christie, 1976, p. 65)
Generalized arousal	The generalized feelings and emotions associated with the crime, and the perceived seriousness of the crime. (Greenberg & Beach, 2004)

*of use*, that is, the degree to which use of the innovation is perceived as being voluntary (Moore & Benbasat, 1991, p. 195), and *use behavior*. Neither of these variables applies to our context as non-use of the technology is not an option. Consequently, there would be no variation in these variables (Seddon, 1997).

### **Additional Affective Hypothesis**

We argue in this study, as does SPT, that affective responses are increasingly important in explaining attitudes about virtual technology and so subsequent use behavior. According to SPT, communication is more effective if the social presence qualities of the virtual system are appropriate in terms of the level of interpersonal involvement required for a task. We referred earlier to an empirical study of crime reporting in the Netherlands, which found that affective qualifiers, like police officers being seen as friendly, are important to persons filing a police report. SPT measures warmth, sociability, sensitivity, and personableness. According to SPT, communications media vary in the degree to which users perceive social presence, and these variations are important in determining the medium individuals wish to use to interact with others (Short et al., 1976, p. 65). The wish to interact can be seen as the SPT operationalization of the UTAUT's central conative concept, *intention to use*. SPT and the UTAUT share the same conation intention, the former stating it more specifically than the latter. This reasoning leads us to assume that when individuals perceive their interlocutor through VMC as warm and caring, that is, having a high social presence level, they are more likely to intend to use services delivered virtually in the future. We hypothesize then that:

*Hypothesis 1:* The greater the perceived social presence of the communication medium, the greater the acceptance of virtual delivery of public services.

It is reasonable to assume that individuals who are under significant emotional stress will require more reassurance than they might normally. Therefore, we can assume that the level of stress that

**Table 5.** UTAUT Hypothesis Predicting the Dependent Variable: Intention to Use Technology in Virtual Public Service Provision

Independent Variable	Direction	Theoretical Mechanism
Effort expectations	+	The degree to which a technology is easy to get used to, positively relates to acceptance of that technology. Similar to the ease of use construct in technology acceptance model (Davis, Bagozzi, & Warshaw, 1989)
Performance expectations	+	The degree to which a technology is perceived as useful positively relates to the acceptance of that technology. Similar to the usefulness construct in the technology acceptance model (Davis et al., 1989)
Social influence	+	Social influence has an impact on (intention to) use through three mechanisms: Compliance, internalization, and identification (Venkatesh & Davis, 2000; Warshaw, 1980). The latter two relate to altering an individual's belief structure and/or causing an individual to respond to potential social status gains, the compliance mechanism causes an individual to comply with the social influence. Individuals are more likely to comply with others' expectations when those others have the ability to reward desired behavior and punish undesirable behavior (French & Raven, 1959; Warshaw, 1980)
Experience with related technology	+	More experienced users of technology accept new technologies easier than less experienced users of technology (Davis et al., 1989)
Facilitating conditions	+	Facilitating conditions includes aspects of the technological and/or organizational environment that are designed to remove (that is positively influence) barriers to use, such as the facilitating conditions in the model for PC utilization and compatibility in innovation diffusion theory (Rogers, 1983)
Anxiety with medium	-	Having fears about technology use, such as a fear of making mistakes or loss of data, results in low intention to use and eventually even to avoidance of use (Gilroy & Desai, 1986; Igbaria & Chakrabarti, 1990)

may accompany the filing of a police report will lead to a need for a greater degree of social presence. If the technology is not able to provide that, one would expect a lower level of acceptance (Short et al., 1976). This has been confirmed by recent studies (Gefen & Straub, 2004; Straub & Karahanna, 1998). This means that persons filing a police report may not accept the use of VMC. While this has not been studied, it seems reasonable to conclude that the relationship between social presence and intention to use virtual delivery of services, as proposed in Hypothesis 1, would be negatively moderated by the state of mind of the person filing a police report and that might well hinge on the type of incident being reported. According to Short et al. (1976), higher states of arousal may lead to avoiding use of the medium. This leads us to a second hypothesis:

*Hypothesis 2:* The relationship between perceived social presence and acceptance of technology is negatively moderated by high generalized arousal.

## Method

### *Design and Sampling*

We used a one shot, ex post survey to gather data for our study of factors that influence the willingness of individuals to consent to a para-authentic virtual experience with a public sector employee as part of the delivery of a public service (Bauer, Gaskell, & Allum, 2000). We conducted our study at a local police station located in a multiethnic multicultural area of the major European port city of Rotterdam in the Netherlands. The Rotterdam metropolitan area, referred to as the Rotterdam–Rijnmond area, has a population of 1.2 million made up of 173 different nationalities.

There are 150,000 crimes reported each year between the 24 Rotterdam–Rijnmond area police stations. We gathered data over a 2-month period, October and November 2009, during which time 224 persons completed questionnaires after filing a police report. Respondents were selected at random from a population of persons arriving at a police station to report a crime. Approximately, 95% of the crime reports filed during the time window of this study were taken using virtual communication technology. The crimes reported ranged from the loss of important documents, passports for example, to serious crimes including burglary, robbery, and assault. During that period, about 4% of reports were taken in person by a police officer with extensive training in handling crimes such as rape and domestic violence, and 1% of reports were taken where an incident took place.

As reports may be filed whenever a station is open to the public, our sample includes responses from persons who filed reports at various times of day. Once it was determined that a person arriving at the station intended to report a crime of the kind covered by our study, he or she was shown by a police officer to the door of a room in which the VMC system we described earlier had been installed. The person filing a report was told briefly about the way in which the report would be taken and then the door of the interview room was opened and the filer invited to enter. Inside the torso and head of the police officer who will be taking the report are projected, that is, those parts of the body normally seen above desktop level. The “virtual police officer” invited the filer to sit down, spoke briefly about the design of the virtual setting, and in general engaged in casual conversation with the person who wished to file a report in order to make him or her feel comfortable. This introductory phase usually took just a few minutes, then the process of taking the report commenced.

### *Data Collection and Analysis*

We collected our data using a questionnaire with validated scales (Greenberg & Beach, 2004; Short et al., 1976; Venkatesh et al., 2003). Each item was measured using a 7-point Likert-type scale (1 = *totally disagree* to 7 = *totally agree*) translated into Dutch. The questionnaire was peer-reviewed, both by Dutch academics and law enforcement officers. The social influence construct was slightly adapted to fit the research context. We introduced 2 items with which a police officer’s social influence on a filer’s perception of a virtual experience could be explored. We reasoned that the police officers guiding filers through the reporting procedure, both the officer who meets the filer face-to-face and the officer entering into an exchange with the filer virtually, might influence the filer’s perception of the experience. For instance, the officer who meets the filer face-to-face might influence the level of acceptance in either a positive or a negative way, that is, the officer may promote or sabotage the use of virtuality as part of the process, intentionally or not. Finally, the questionnaire was pretested on police officers at first and eventually on citizens. Before constructing scales from the individual items, we performed a principal component factor analysis for the generalized arousal scale to explore its multidimensional character. From the factor analysis (KMO = 0.76, Bartlett’s test of sphericity:  $\chi^2 = 581$ ,  $\sigma = 0.000$ ,  $R^2 = .69$ ), we found a two-factor solution, instead of the three predicted by theory. A two-factor solution seemed to fit the data best, as only two components had Eigenvalues higher than 1, and after two components the Cattell’s scree plot started to flatten.

Additionally, we used varimax rotation to find the optimal solution.<sup>4</sup> Both variables were entered into regression analysis along with other variables from our conceptual model. However, the new variables both caused high variance inflation factor ( $VIF > 5$ ) and low tolerance values ( $< 0.2$ ), indicating multicollinearity problems (O'Brien, 2007). To overcome this violation, we followed Tabachnick and Fidell (2007) and combined both components in one variable. We show the reliability of this now one-dimensional arousal scale, and of other scales, in Table 6. All scales were found to be sufficiently reliable. The hypotheses were tested using multiple regression analysis. We report our results in the following section.

## Results

### *Descriptive Statistics and Correlation Analysis*

The pool of 224 respondents included 135 males and 89 females between the ages 13 and 83. Both the mean age and the median age are 40 with a standard deviation of 16. More than half of the respondents, 142 of them, had at some time previously had the experience of reporting a crime. We give the descriptive statistics for other variables and their correlations in Table 7. Social presence and generalized arousal were both mean-centered (MC) to prevent potential multicollinearity problems.

Although the respondents on an average reported feeling somewhat nervous ( $M = 4.72$ ), their intention to use the technology again should the need arise, our dependent variable, *intention to use again*, was high (5.38 of a maximum 7). The variable *effort expectations* had the highest average (5.53). This is not surprising in retrospect as filers did not actually have to learn to operate the system, as they do in most other studies of technology acceptance. The scores for most of the other variables, including *performance expectations*, *social influence*, *facilitating conditions*, and *social presence*, were high. The only variable that had a relatively low score was *anxiety*, with a mean score of 2.73.

The correlations between performance expectations and effort expectations ( $r = .69$ ) and between performance expectations and intention to use ( $r = .75$ ) are high but not problematic; as both are lower than .85.

### *Regression Analysis*

We ran three models: (a) Model 1 includes only the control variables; (b) Model 2 adds the affective variables; (c) Model 3 adds to Model 2 the cognitive variables. The results of the regression analyses are presented in Table 8. Regression analysis assumptions (multicollinearity, singularity homoscedasticity, linearity, independence of residuals, normality, and outliers) are not violated. We conclude that multicollinearity is not a problem (Lewis-Beck, Bryman, & Liao, 2004; O'Brien, 2007).

Model 1, with only the control variables, is insignificant,  $F(\sigma) = 1.18(0.319)$ , indicating that these variables exert no influence on acceptance of the technology. Models 2 and 3 are significant. Model 3 provides 15% more explanatory power and hence is the preferred model because it has the highest explanatory power, while remaining sparse and parsimonious. Four significant predictors explain 69% of the variance in intention to use: *performance expectations* ( $\beta = .54$ ), *social presence* ( $\beta = .18$ ), *anxiety* ( $\beta = -.14$ ), and *social influence* ( $\beta = .11$ ). The coefficients of the interaction between *social presence* and *generalized arousal*, and those of the following cognitive predictors, *effort expectations*, *facilitating conditions*, and *experience with related technology*, are all statistically insignificant. The same is true for the coefficients of all the control variables, *gender*, *age*, and *previously filed a report*.



**Table 6.** Reliability Analysis for Scales

Scale/Variable	Reliability (Cronbach's $\alpha$ )	Items
Intention to use again	.914	I intend to report another crime in the same virtual way I predict that I will report another crime in the same way I plan to report another crime in the same way
Performance expectations	.625	I found this way of reporting a crime useful This way of crime reporting is quick
Effort expectations	.652	What was said through the virtual system was clear and understandable It was easy for me to use the virtual system I found the virtual system easy to use
Facilitating conditions	.664	Learning to operate the virtual system was easy for me The atmosphere created in the room where I reported a crime was excellent I felt that my privacy was guaranteed as I reported a crime The room temperature was comfortable in the room where I reported a crime
Social influence	.775	In general, the police officers were supportive as I filed a report While I was reporting a crime the police officers were supportive of me
Anxiety	.682	I felt apprehensive about using the virtual system I hesitated to use the virtual system for fear of making mistakes I could not correct The idea of using a virtual system is somewhat intimidating to me
Generalized arousal	.858	Feelings Looking back on the crime committed against me, I feel: Angry (GA11) Anxious (GA12) Surprised (GA13) Confused (GA14) Concerns: I have suffered a great injustice (GA21) I feel victimized again (GA22) Perceived seriousness of the crime: I perceive the crime committed against me as being serious (GA3)
Social presence	.839	I found the police officer taking the report through the virtual system to be Friendly Sympathetic Warm Responsive

## Conclusion

What factors determine user acceptance of virtual delivery of public services? Our results show that the factors that determine acceptance of the virtual delivery of public services, as demonstrated by the intention to again use VMC, are the cognitive variable *performance expectations*, and the affective variables *social presence*, *anxiety*, and *social influence*. Thus, our hypothesis that social

**Table 7.** Descriptive Statistics, Correlation Analysis

	M	SD	Intention to Use Again	Gender (0 = male; 1 = female)	Previously Filed a Report (0 = yes, 1 = no)	Social Influence	Performance Expectations	Effort Expectations	Social Presence MC	Facilitating Conditions	Experience With Related Technology	Generalized Arousal MC	Anxiety
Intention to use again	5.38	1.41	1.00	-0.05	0.09	0.42**	0.75**	0.66**	0.63**	0.59**	0.10	-0.06	-0.3**
Gender (0 = male; 1 = female)	-	-	1.00	1.00	0.13*	-0.01	0.05	-0.10	0.02	-0.00	-0.16	0.11	0.16*
Age	40.31	16.04	-	-	1.00	0.05	0.15	0.17*	0.19*	0.31**	-0.27	0.03	0.03
Previously filed a report (0 = yes, 1 = no)	-	-	-	-	1.00	-0.03	0.08	-0.01	0.02	0.06	-0.10	-0.03	-0.03
Social influence expectations	4.86	1.56	-	-	-	1.00	0.34**	0.31**	0.41**	0.31**	0.11	-0.05	0.03
Effort expectations	5.42	1.16	-	-	-	-	1.00	0.69**	0.62**	0.57**	0.13	0.06	-0.22**
Social presence MC	5.53	0.96	-	-	-	-	-	1.00	0.64**	0.57**	0.17	-0.04	-0.29**
Facilitating conditions	0.00	1.22	-	-	-	-	-	-	1.00	0.63**	0.09	-0.09	-0.20**
Experience with related technology	5.21	1.14	-	-	-	-	-	-	-	1.00	0.11	-0.04	-0.23**
Generalized arousal MC	4.24	2.10	-	-	-	-	-	-	-	-	1.00	0.01	-0.01
Anxiety	0.00	1	-	-	-	-	-	-	-	-	-	1.00	0.14
	2.73	1.35	-	-	-	-	-	-	-	-	-	-	1.00

Note. Collinearity diagnostics (Variance Inflation Factor [VIF]; Tolerance).

\* p < 0.05. \*\*p < 0.01.

**Table 8.** Determinants of the Intention to Use Virtual Technology

Independent Variables	Model 1: Control Variables (Tolerance/VIF)	Model 2: Model 1 + Affective Variables (Tolerance/VIF)	Model 3: Model 2 + Cognitive Variables (Tolerance/VIF)
Constant	5.02	4.98	1.2545
Gender (0 = male; 1 = female)	-0.187 (0.957/1.044)	-0.07 (0.898/1.114)	-0.139 (0.850/1.176)
Age	0.009 (0.958/1.044)	-0.04 (0.914/1.095)	-0.006 (0.783/1.278)
Previously filed a report (0 = yes, 1 = no)	0.219 (0.989/1.011)	0.09 (0.976/1.024)	-0.081 (0.953/1.050)
Social presence (A)		0.61*** (0.636/1.572)	0.22** (0.385/2.600)
Anxiety (A)		-0.25** (0.841/1.190)	-0.164** (0.732/1.365)
Social influence (A)		0.23** (0.799/1.252)	-0.112* (0.736/1.359)
Social presence* Generalized arousal (A)		0.006 (0.81/1.235)	0.025 (0.806/1.240)
Performance expectations (C)			0.71*** (0.357/2.800)
Effort expectations (C)			0.023 (0.308/3.251)
Facilitating conditions (C)			0.069 (0.492/2.033)
Experience with related technology (C)			-0.011 (.871/1.148)
N	224	224	224
F( $\sigma$ )	1.18 (0.319)	21.85 (0.000)	24.57 (0.000)
R <sup>2</sup>	0.018	0.54	0.69
F( $\sigma$ )	0.487(0.692)	33.81 (0.000)	16.21 (0.000)

Note. A = affective; C = cognitive.

\*  $p < 0.1$ . \*\* $p < 0.05$ . \*\*\* $p < 0.01$ .

presence has a positive effect on intention to use is confirmed, while our hypothesis that this relationship is moderated by perceived arousal, with regard to the crime being filed, is not confirmed.

Our results show a statistically insignificant impact of *effort expectations*, unlike in most empirical UTAUT studies where it is a strong predictor. This may be because the respondents in our study were not asked to learn the technology but simply sat down and “used” the system in the way they would had the officer taking the report been using a pen and paper to record the information they were giving.

Perceived experience with related technology showed considerable variation between respondents ( $SD = 2.04$ ), but it did not prove to be a predictor for intention to use. This is probably due to the fact that, similar to effort expectations, no related experience was needed to use the technology. Females and persons who are older are often assumed to be generally less technology literate. However, these effects are not found in this study probably due to the ease with which untrained users can use the system. Our explanation for this counterintuitive finding regarding technology acceptance by older persons is that they felt that they were in control of this specific technology. Older people often feel deficient or a bit clumsy when confronted with new technology. In this case, the technology is easy to use, indeed is used passively, and this facilitates acceptance. Finally, *facilitating conditions* was probably an insignificant predictor because there was so little variation in the responses, a large majority of respondents finding the conditions to be simply good. This may be because that facilitating conditions were not seen as a barrier to using the virtual system.

The moderating effect of *general arousal* could not be confirmed empirically. Although victims of crime may be very nervous, this does not seem to influence the strength or direction of the relationship between social presence and intention to use. This finding is contrary to our expectations. One explanation may be that although persons filing reports were on average moderately aroused, the medium itself seems to fulfill a certain minimum “social presence.” Persons who wanted to report a crime in which violence was a factor, such as rape, may have had much stronger emotions to report. Though including such cases in our sample may have led to different results, we were for ethical reasons not comfortable including persons who wanted to report certain kinds of crime, as stated in our third endnote. Moreover, the police authorities have concluded that using VMC technology in some cases is not desirable. Virtually taking reports of burglary, robbery, or pickpocketing, or of bicycle, motorcycle, or automobile theft is, on the other hand, an appropriate way to reduce costs, including labor costs, in delivering public services.

## Discussion

Our goal in conducting this study was to test the relative importance of affective predictors in acceptance by the public of public services delivered using virtual technologies. We used and extended with a social presence construct the UTAUT. Both the original UTAUT model and our extended version have significant predictive power. We found empirical support for our premise that, in the case of the virtual delivery of public services, affective variables are relatively more significant predictors of acceptance than cognitive variables than is the case with conventional technologies.

According to the literature on the acceptance of technology, and specifically the UTAUT, cognitive variables such as effort expectation, facilitating conditions, experience with the technology, and the control variables of age and gender, play an important role in predicting the conative intention to again use the technology. In the 8 conventional acceptance models reviewed in this study, only a minority of predictors (5 of the 30) can be characterized as affective. In this empirical study, we found that 3 of the 4 statistically significant predictors, that is, *social presence*, *anxiety*, and *social influence*, are affective variables. This finding leads to the conclusion that acceptance of virtual technologies in the delivery of public services depends on affective predictors. Extending the UTAUT model by including social presence proved beneficial in predicting acceptance of the virtual

technology considered in this study. Our results show social presence to be the second strongest predictor of acceptance of technology, thus there is reason to believe that social presence is of pivotal importance in explaining the acceptance of virtual technologies in the delivery of public services. We believe that replication of this study in different contexts would prove very interesting (Ajzen, 1985, 2005; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

Future research could replicate this study with other types of public services or other types of technologies used for virtual delivery of public services. Some exemplar studies have tested the UTAUT model in e-commerce, e-government, and telemedicine (Cyr et al., 2007; Schrijver, 2008). Another interesting avenue for research would be to test if users who are free to decide whether or not to use virtual technology are willing to do so. We were unable to test the effect of this variable, which is generally used in testing technology acceptance, as our users were not given the option to file a report in another way. Also the role ethnicity might have on acceptance of virtual technologies is an interesting direction for future research. Some research suggests that there are small but noticeable effects (Dupagne & Salwen, 2005; Kim, Jung, & Ball-Rokeach, 2007). Longitudinal studies of the acceptance of virtual technologies are another promising area for future research (Venkatesh et al., 2003). Such an approach was not possible in our context since too few persons return to report another crime. Other service contexts, the delivery of routine municipal services and health care for instance, would be better suited. Finally, in this study, the service provided was not delivered in a completely virtual way. Filers would see one or more officers face-to-face on arrival at the station, and they were guided by a police officer to the room in which reports were taken. This contact and guidance increased the level of social presence, and since social presence has a positive effect on intention to use, it would be interesting to investigate whether our model can also explain acceptance of a totally virtual delivery of public services. Another limitation of our study is that the technology requires no "use" in the sense of manipulation of any kind. The setup of the system and its hands-on use is not done by the filer but by the police. It would be interesting to test reactions of persons who have to take a more active role, for instance, if the information were to be provided online by someone who would like it to be entered into a police report.

For practitioners, we have a number of recommendations. First, considering the broad range of crimes reported using VMC, we think it is reasonable to suggest that VMC could successfully be used in delivering many other kinds of public services, as one reviewer of a previous version has suggested, VMC might be used by motorists disputing a parking ticket. Second, investing in a virtual technology for the provision of a public service is a strategic decision between what Treacy and Wiersema (1995) call "customer intimacy," that is excelling in customer service, and operational efficiency. The use of VMC in crime reporting is exceptional in that it provides both a high level of customer intimacy, through the high social presence of the medium, while at the same time also increasing operational efficiency by pooling all of the resources needed to take crime reports in one shared service center (Strikwerda, 2010). While the Dutch police authority is adopting the reporting of crime virtually, and some Dutch municipalities and health care providers are experimenting with other ways to deliver services virtually, the application of VMC in other contexts might not have the same kinds of outcomes. Our suggestion to organizations considering service delivery virtually is to first determine the extent to which customer intimacy and operational efficiency are required and to carefully consider ease of use and affective criteria, especially social presence. In this study, we found that the quality with which the technology mediates the communication process between actors during the process of delivering a public service is important. This study shows that affective predictors explain to a considerable extent acceptance and use of virtual technologies by persons receiving a public service. Hence, the technology itself has direct and substantial impact on the communication process between members of the public and the service provider, and so on the acceptance of a virtually delivered service. Second, the technology should be very easy to use. In this

study, the technology was so easy to use that experience with related technology, which is a common predictor in conventional technology acceptance models, lost its predictive value entirely.

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### Notes

1. Teleweide (<http://www.teleweide.nl>) and Welzijn Aa and Hunze (<http://www.welzijnaaenhunze.nl/marktwerk/virtuele-loketten.html>) are two other empirical examples of a municipal and health care project in the Netherlands in which virtual technology is used. In both examples, citizens living in rural areas are connected to municipal/health services through video mediation.
2. For a comprehensive discussion on presence and social presence see Biocca et al. (2003), Lee (2004).
3. UTAUT is extensively used and highly cited. According to Google Scholar (<http://www.google.com>), as of April 2011, the UTAUT citation count was 3,374.
4. Using Varimax rotation, we found that (factor loadings): GA22 (0.90), (0.76), GA3 (0.83), and GA11 (0.72) formed one component and GA12 (0.84), GA13 (0.49), and GA14 (0.91) formed the other. See Table 6 for an explanation of the abbreviations for the items used here.

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**Bios**

**Ruud Hoefnagel** studied business engineering at Fontys University in the Netherlands and earned a master's degree in organization studies at Tilburg University, Tilburg, the Netherlands. He is currently a PhD candidate at Tilburg University. He is also an information management consultant for a regional law enforcement agency in the Netherlands. Email: ruud.hoefnagel@rijnmond.politie.nl.

**Leon Oerlemans** is a professor of Organizational Dynamics and Fellow of the Center for Innovation Studies at Tilburg University, the Netherlands and an extraordinary professor of Economics of Innovation of the Graduate School of Technology Management at the University of Pretoria, Republic of South Africa. He earned a PhD at Eindhoven University of Technology (1996). His research focuses on the analysis of innovative behavior of organizations and users and can be characterized as theory-based empirical research. His current research topics include temporary organizations, interactive learning, and interorganizational relationships and networks. Email: l.a.g.oerlemans@uvt.nl.

**John Goedee** studied business administration at Erasmus University, Rotterdam, the Netherlands and earned a PhD at Tilburg University, Tilburg, the Netherlands. His doctoral thesis investigates the implementation of change. He is a member of the administrative boards of several firms has acted as a program management consultant in the banking sector and is currently a business unit manager for a consultancy firm. He is a lecturer and researcher at Tilburg University and at TiasNimbas Business School. Email: j.goedee@uvt.nl.