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USER EXPECTATIONS, USE EXPERIENCES AND CONTINUED ADOPTION OF A MOBILE SECURE COMMUNICATION APPLICATION

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Track: Security and Privacy

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Abstract

The importance of secure communication between employees in enterprises and governmental organizations as well as technologies to support that has increased tremendously over the past years. This study examines the user expectations before and the use experiences during the implementation phase of a mobile secure communication application together with expectation–confirmation and its influence on continued adoption. The study is explorative in nature and empirically based on thematic analysis of qualitative data collected from pilot users of a mobile secure communication application who work in a governmental organization in Finland. The theoretical basis of the study draws from two well-established theories: the expectation–confirmation theory (ECT) and the unified theory of acceptance and use of technology (UTAUT). The findings reveal the user expectations before and the use experiences during the implementation phase that are important for users in terms of continued adoption of a mobile secure communication application. The findings are also reflected on the UTAUT.

Keywords: Security and privacy, user expectations, use experience, IS security, adoption, implementation, secure communication, mobile application, ECT, UTAUT.

1 Introduction

The popularity and importance of different ubiquitous communication devices has exploded. This is the case in corporate, governmental, military, and personal use. Moreover, many things that need to be communicated contain information that is confidential or otherwise meant for certain eyes and ears only, for example, information that contains trade secrets, state secrets, or is otherwise sensitive or confidential. Naturally, this information can also be of interest to certain outsiders, like industry competitors, foreign governments, or criminals. It is well known that the attempts and attacks to capture confidential data and information from others are common and increasing. More and more of these attempts and attacks are also targeting mobile devices (Trend Micro, 2017). Therefore, there is a growing need, especially in enterprises and governmental organizations, to ensure that the critical communication is safe and secure and the confidential information is not breached. To decrease the risk posed by the prevalent security and privacy threats, different solutions have emerged to safeguard the confidentiality of communication. Some of the solutions have been around for a long time, but there are also solutions that are more novel, for example mobile applications meant for secure communication.

Security management in mobile communication has been studied at least since (Chan et al., 1993). Despite the many aspects of IS research (see e.g., Cram et al., 2017; Guo, 2013; Siponen and Oinas-Kukkonen, 2007; Soomro et al, 2016), the number of studies on the user-centric aspects of mobile security and privacy is limited. Studying these issues can have important implications for the development and diffusion of the used technologies as well as for implementing them into use.

The purpose of our study is to qualitatively explore the expectations users have towards mobile secure communication applications before the implementation phase and how the (dis)confirmation of the user expectations through use experiences during the implementation phase influences the continued adoption or discontinuance of the applications. The idea that the (dis)confirmation of expectations influences behavioral intention (or in this case continued adoption or discontinuance) draws from the expectation–confirmation theory (ECT) by Oliver (1977; 1980). In addition, to specify which expectations are the most relevant determinants of behavioral intention in the specific case of mobile secure communication applications, or more generally in IS, we draw from the unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003). Further, we also use the UTAUT to reflect our findings. Note that our aim in this study is not to confirmatory test either of these theories but rather to use them as a theoretical lens in our qualitative exploratory research. Our study contributes to IS research by answering the following two research questions: 1. What kinds of expectations users have towards mobile secure communication applications before the implementation phase? 2. How do the use experiences during the implementation phase (dis)confirm the user expectations and influence the users' continued adoption or discontinuance of the mobile secure communication applications?

The study focuses on an organizational setting. The implementation phase is set to cover the first 12 weeks of use, as the study precisely focuses on the experiences and continued adoption during the implementation phase, not on a longer-term time scale. 12 weeks was seen as a sufficient time period in which most users were able to (dis)confirm their expectations based on their use experiences. Our study follows a qualitative approach and is based on a thematic analysis of the data collected from the pilot users of a mobile secure communication application in a governmental organization in Finland.

In technology adoption, when looking for suitable solutions and perhaps testing different alternatives to meet the prevailing needs, the implementation phase is crucial: Does the new technology bring enough added value or not? (Rogers, 2003). Rogers (2003, p. 475) defines the *implementation phase* in the innovation diffusion theory as a stage of the innovation-decision process where the individual implements the innovation into use and determines its usefulness. Following the initial adoption decision and the implementation phase, the individual then makes the final adoption confirmation and decides whether to continue using the innovation (continued adoption) or to reject the innovation (discontinuance). Thus, the implementation phase is highly important to study when examining the adoption of an innovation and the use experiences that influence its continued adoption or discontinuance.

2 Theoretical Background

Theoretically, the study draws its idea from two well-established theories: the expectation–confirmation theory (ECT) by Oliver (1977; 1980) and the unified theory of acceptance and use of technology (UTAUT) by Venkatesh et al. (2003). The ECT (illustrated in Figure 1) posits that expectations, coupled with perceived performance, affect use satisfaction. This effect is mediated through positive or negative disconfirmation between expectations and performance. If a product's perceived performance is greater than the expectation (positive disconfirmation) it will result in satisfaction. If a product's perceived performance is less than the expectation (negative disconfirmation) it will likely result in dissatisfaction. In addition, the theory posits that perceived performance directly affects satisfaction (Oliver, 1980). Finally, satisfaction influences (behavioral) intention. In the ECT, expectations refer to the features that an individual expects will be related with a product and its use (for example, the expected benefits of IS use) before using it. Perceived performance refers to an individual's perceptions of the actual performance of a product, which are formed based on use experiences. (Dis)confirmation of the expectations refers to the evaluations that an individual makes regarding a product. Satisfaction refers to the degree to which an individual is satisfied with a product after having direct use experiences with it. In other words, according to the ECT, the expectations towards a product and how the use of the product meets these expectations influence use satisfaction, which in turn influences (behavioral) intention in terms of continuance or discontinuance.

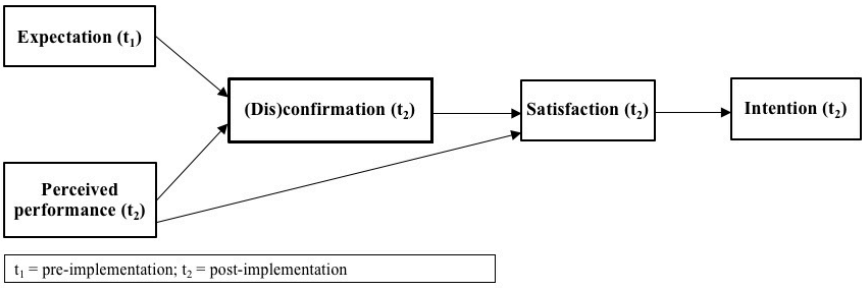

Figure 1. Illustration of the Expectation–Confirmation Theory.

The ECT has been applied in IS research, for example, in the expectation-confirmation model (Bhattacherjee, 2001) and the expanded two-stage model of IS continuance (Venkatesh et al., 2011). These theories hold the same idea that the (dis)confirmation of expectations (among determinants and mediators) influences behavioral intention. However, regarding the expectations, the ECT does not specify these expectations. Therefore, to specify the expectations in our exploratory study, we draw from the UTAUT, which posits that in IS context, expectations regarding performance expectancy, effort expectancy, social influence, and facilitating conditions are the main determinants of intention.

We consider the UTAUT to be suitable regarding the focus of our study as the UTAUT precisely focuses on technology acceptance in an organizational context (Venkatesh et al., 2003). Overall, the UTAUT has been widely applied in IS research (e.g., Venkatesh et al., 2016; Williams et al., 2015). The authors of the original UTAUT paper presented their results quantitatively to empirically validate the theory, but during the years, researchers have used the theory also qualitatively to gain a more in-depth understanding of the acceptance and use of technology (e.g., Kiwanuka, 2015; Williams et al., 2012). In this study, we also follow a qualitative approach as we draw from the UTAUT in building our investigation and, further, reflect our findings on the UTAUT in a qualitative manner.

The UTAUT has four core determinants of behavioral intention and use behavior that affect the acceptance and use of technology: performance expectancy, effort expectancy, social influence, and facilitating conditions. The UTAUT also presents four moderators of those key relationships: gender, age, experience, and voluntariness of use (Venkatesh et al., 2003). Venkatesh et al. (2012) extended the UTAUT and introduced the UTAUT2 to cover the context of individual consumers. The UTAUT2 introduced three new determinants: hedonic motivation, price value, and habit, while the voluntariness

of use was dropped from the model because consumer behaviors are typically voluntary (Venkatesh et al., 2012). For detailed descriptions of these determinants, see Venkatesh et al. (2003; 2012)

As mentioned, in our study, we draw from the UTAUT in specifying the expectations to aid our exploratory investigation. In addition to drawing from the determinants of the original UTAUT, we also draw from habit introduced in the UTAUT2. A similar approach (i.e., extending the original UTAUT with habit) has been used, for example, by Pahnila et al. (2011). From the UTAUT2, we did not include hedonic motivation as the purpose of using the application is primarily utilitarian. Also, we did not include price value as the use setting was organizational and the use was free for individual users. Of the moderators, age, gender, and experience (as defined in the UTAUT) were not investigated in the study. Regarding voluntariness, for some of the participants using the application and joining the pilot was a voluntary choice, whereas for some the use was part of specified work duties.

3 Methodology

To conduct our study, we chose a qualitative approach. Qualitative research aims to understand people, their sayings and doings as well as the social and cultural context in which they act. The goal is to understand real life and find new knowledge (Myers, 2013).

The study was conducted in cooperation with the provider of the mobile secure communication application and the governmental organization, where 50 employees implemented the application into use for a pilot period of 12 weeks (implementation phase). The application was installed to their work phones and all 50 pilot participants started using the application at the same time. Most of them took part in the pilot voluntarily, while for some it was part of specified work tasks. In both cases, the idea towards initial adoption came from the organization. The pilot was launched in September 2017.

The used application is described by its provider as a comprehensive solution for secure communication. It is designed for actors who need to ensure the security and privacy of their communications, and its purpose is to protect the privacy of calls and messages. Key features include, for example, strong voice and message encryption, strong authentication, multiple encryption, controlled life cycle for the messages, and a high-availability background system that is scalable, organization specific, and can be geographically decentralized. The application works on modern mobile devices (with Android or iOS). Due to these properties, we find it as an excellent case application for this particular study.

To gather the data, we utilized different data collection methods. We conducted two surveys with mainly open-ended questions to the participants – one before the start of the pilot and one right after the pilot had ended. The first survey (pre-implementation) focused on the user expectations towards the application, whereas the second survey (post-implementation) focused on the use experiences with the application and the intention of continued adoption. As the setting was organizational, the intention of continued adoption was enquired as the willingness to continue the use after the pilot.

The surveys acted as our primary data source. In addition, as a secondary data source, we also conducted interviews at the end of the pilot to deepen the data regarding use experiences from the second survey and explain the use experiences more fully. The themes of the surveys and interviews were developed from the research questions, previous literature, and the theoretical background (the ECT and UTAUT). The surveys focused on gathering qualitative data with the open-ended questions. Descriptions of the themes of the surveys and interviews with key questions are available from the authors by request. The surveys were created by using the LimeSurvey 2.05+ software. Before the launch of the surveys, their questionnaires were checked together with IS experts and the application provider.

For the interview, we chose a semi-structured qualitative interview as we wanted to deepen the data regarding use experiences from the second survey. To gain maximal benefit from a semi-structured interview and to avoid the potential pitfalls, we followed relevant guidelines for semi-structured interviews in planning and conducting the interviews (Guest et al., 2006; Myers and Newman, 2007). For the interviews, we prepared an interview script. Following Myers and Newman (2007), the script included an opening, an introduction, key questions related to certain themes, and a closing.

All 50 of the pilot participants were invited to respond the surveys. Unfortunately, not everyone responded, but we were still able to gather a reasonable amount of data. In addition to the survey data, we interviewed five pilot participants. The interviews were held face-to-face together with one of the authors and a representative of the application provider. On average, the interviews lasted 70 minutes. The interviews were recorded and notes taken during them in order to provide data for the analysis.

We used thematic analysis as the method of data analysis for all our data. In analysis, we applied the guidelines by Braun and Clarke (2006) and Patton (2002). As suggested (Braun and Clarke, 2006; Patton, 2002), we applied these guidelines flexibly to fit the research question and the data, and the analysis process was not a linear phase-to-phase process but a recursive one. The data from the first survey was used for investigating the user expectations, whereas the data from the second survey and the interviews were used to investigate the use experiences. The analysis began by first familiarizing ourselves with the data and marking all the interesting features in it. We then continued with a search for recurring themes, which were then reviewed in relation to the data. To aid this, we used the Microsoft Excel software. The primary data collected with the surveys was analyzed first and complemented by the analysis of the secondary data (interviews) to deepen our findings. Finally, a report was produced.

4 Findings

The surveys yielded a total of 27 responses from the 50 pilot participants. The respondents consisted of 23 males and 4 females with a mean age of 46.4 years (standard deviation 8.3 years). The significantly greater share of males among the respondents was due to the greater share of males among the pilot participants and could not be adjusted for this research. As for age, we had no information on the mean age or the age distribution of all the employees in the targeted governmental organization. However, we assume that the respondents' age distribution is quite representative of a typical governmental organization. A more detailed description of the survey respondents can be found in Table 1. The interviewees consisted of three male and two female participants between 31 and 60 years of age.

Regarding the innovativeness of the respondents and the interviewees in general, almost all of them perceived themselves to be rather interested in new technological solutions and capable of adopting and using new technologies and applications. Around three out of four also had previous experiences from using similar kinds of solutions in the past. Out of these, around half believed that those experiences would influence positively the implementation of the application used in the pilot.

	N	%
Age		
31–40	8	29.6
41–50	9	33.3
51–60	9	33.3
61–	1	3.7
Gender		
Male	23	85.2
Female	4	14.8
Voluntariness		
Voluntary	14	51.9
Non-voluntary	9	33.3
N/A	4	14.8

Table 1. Description of the survey respondents.

Out of the survey respondents, slightly less than two thirds would have opted for continued adoption of the application as they stated to be willing to continue using it also after the pilot. A bit more than one third would have opted for discontinuance as they stated to be willing to discontinue using the application after the pilot or had already ended the use during the pilot. We do not have the information

whether the organization decided to continue the use of the application after the pilot or whether they perhaps decided to continue the use only with those employees who were willing to do so.

4.1 User expectations and use experiences affecting continuance

The continued adoption of the application was influenced by various types of use experiences during the implementation phase. In line with the ECT, the positive or negative (dis)confirmation of the user expectations together with perceived performance were important in regards to satisfaction and subsequent continuance intention.

The central expectations that the users had towards the use of the application before the implementation phase concerned ease of use, effortless use and adoption, trustworthiness and reliability of the application, strong authentication, and ubiquitousness. The ease and effortlessness of use were highlighted. The application was also expected to manage their communication needs as efficiently as comparable solutions for personal use (e.g., WhatsApp) in changing environments. The use experiences that (dis)confirmed these user expectations were the most influential regarding satisfaction and subsequent continuance intention. In addition to these, perceived performance in terms of flawless functioning and good performance of the application increased satisfaction and had an important role in the continued adoption of the application. Contrary experiences, on the other hand, promoted discontinuance.

In practice, if the user perceived the application to be adequately easy to use, trustworthy and reliable, and exceeding the expectations, it positively influenced the use experiences of the application. Supporting prior research (Rogers, 2003), continued adoption was influenced by the perceived advantage of using the application. The sole possibility to conduct secure communication with a mobile application seemed to be insufficient in maintaining the interest towards the continued adoption of the application if the user was not aware and able to recognize the advantages over optional means of secure communication. The user expects and needs experiences that concretely exhibit that the use has been beneficial for oneself. Interestingly, the personal benefit was stressed over the organizational benefit.

Still, the findings also stressed the importance of secure and reliable communication. It was important for the users that the application provided strong authentication, security of the communication, and reliable message delivery. If the users had faced experiences that woke perceptions against this, it was likely to prevent satisfaction and promote discontinuance. Also, if the user was just a part of the pilot and did not have clear goals for the use of the application before implementing it, the perceived benefit was likely to be smaller, which promoted discontinuance already during the implementation phase.

4.2 User expectations and use experiences reflected on the UTAUT

As the theoretical background of this study partly draws and the survey and interview themes were build partly based on the determinants of the UTAUT, the findings are also reflected on this theory. The pre-implementation survey focused on the user expectations towards the application, while the post-implementation survey and the interviews focused on the use experiences and how these experiences (dis)confirmed the expectations as well as influenced continued adoption or discontinuance.

4.2.1 User expectations reflected on the UTAUT

Reflecting the expectations on the UTAUT, *performance expectancy* was based on the expectations that using the application would increase the security and privacy of confidential communication. Easy and fast use together with trustworthiness and reliability were especially important performance expectations. Additionally, the application was expected to be truly mobile, i.e., to work in different locations, countries, and networks. Moreover, previous experience on similar solutions influenced the performance expectancy towards the implemented application: previous experience had formed an image about such applications and use, which influenced the performance expectancy. *Effort expectancy* was mainly based on the expectations of the application being easy and effortless to use and easy to learn. In addition, easy implementation and no need for reading a usage manual were expected.

Facilitating conditions were largely based on how well the organizational and technical infrastructure were expected to support the ease and effortlessness of use. Strong authentication was also linked to facilitating conditions. These were perceived crucial and should these expectations regarding effort expectancy and facilitating conditions be confirmed, they were naturally expected to promote the formation of *habit* towards using the application. *Social influence* was largely based on other pilot users and how much they used the application. The users expected to be able to test the application with others and receive usage help if necessary. Voluntariness of taking part in the pilot had no influence on the user expectations as the responses of voluntary and non-voluntary pilot users were very similar.

4.2.2 Use experiences reflected on the UTAUT

Reflecting the use experiences on the UTAUT, *performance expectancy* was positively influenced particularly by those use experiences with the application that increased the perception of the application being useful and reliable. Likewise, the use experiences regarding the functionality of the application were important: especially how well the communication worked overall, for example, how quickly were the messages delivered, the sound quality of calls, and the possible call cut offs. *Effort expectancy* was positively influenced by the use experiences with the application regarding ease of use and easiness to learn the use from the beginning, experiencing the feeling that the use of the application was familiar from earlier experiences with similar applications, and the fit to own needs.

Facilitating conditions were positively influenced by experiences regarding fluency in the application environment – partly including same aspect as performance expectancy, strong authentication, and reliable technology. Facilitating conditions were negatively influenced by the use experiences of the application environment not working properly, technical issues, and perceived lack of organizational level support towards the use. *Social influence* was mostly based on the amount and activity of other pilot participants. Also, certain usage tests with given tasks, which the participants undertook during the pilot increased the perception that the application should be used. The formation of *habit* was advanced by the use experiences regarding ease of use and relative advantage. Furthermore, the ubiquitousness of the application – whether it was perceived to work in changing environments – was essential regarding habit. If the use did not provide satisfactory ease of use or enough relative advantage, it hampered the habit formation, similar to the user not having a clear goal for the use.

The above mentioned positive use experiences influenced the continued adoption positively. In contrast, the negative use experiences influenced negatively and promoted discontinuance. The voluntariness of use didn't seem to play a role as the responses between those using the application either voluntary or non-voluntary were very alike. Supporting the ECT, the use experiences that either positively or negatively (dis)confirmed the user expectations were highly important to continuance intention.

5 Discussion and Conclusions

The purpose of this study was to explore what kinds of expectations users have towards mobile secure communication applications before the implementation phase and how the (dis)confirmation of the user expectations through use experiences during the implementation phase influences the continued adoption or discontinuance of the applications. The main research questions that our study aimed to answer were: 1. What kinds of expectations users have towards mobile secure communication applications before the implementation phase? and 2. How do the use experiences during the implementation phase (dis)confirm the user expectations and influence the users' continued adoption or discontinuance of the mobile secure communication applications? Further, we reflected our findings on the UTAUT.

The main theoretical contribution follows from answering these two questions and reflecting the findings on the UTAUT. We found that the continued adoption of the application was influenced by various types of user expectations and use experiences. One of the central findings is that even in an organizational setting, the use experiences of an individual user play an important role in the continued adoption or discontinuance intention even with such important tools as mobile secure communication

applications – at least if the decision is not forced by the organization. Additionally, the user expectations that rise from previous experience with similar products are important in terms of how the use is expected to be and subsequently influence the perception of use experience. As posited by the ECT, the positive or negative (dis)confirmation of user expectations resulting from use experiences is important in regards to satisfaction and subsequent (behavioral) intention in the form of continued adoption or discontinuance. We presented the findings regarding user expectations and use experiences through UTAUT determinants, thus promoting their comparability with those of prior IS studies.

The central expectations the users had towards the use of the application concerned ease of use, effortless use and adoption, trustworthiness and reliability, strong authentication, and ubiquitousness, with the ease and effortlessness of use especially stressed. Use experiences that positively (dis)confirmed these user expectations were most influential regarding satisfaction and subsequent continuance intention. Additionally, the use feeling familiar with previous experiences promoted continued adoption. Moreover, perceived performance in terms of flawless functioning and good performance of the application increased satisfaction and had an important role in the continued adoption of the application. In practice, if the user perceived the application to be sufficiently easy to use and useful, secure, to work well in changing environments, and exceeding the expectations, it promoted continued adoption. Discontinuance was promoted by contrary perceptions, for example, difficulty in using the application, bad functionality, errors during the use, and falling short of the expectations.

We also found that if the use of the application was not sufficiently goal-oriented, the perceived benefit of using it was likely to be smaller, which promoted discontinuance already during the implementation phase. A mere possibility to conduct mobile secure communication is not sufficient to maintain the interest towards the continued adoption of the application. The user must be able to recognize the benefits of using the mobile secure communication application. Of course, this might be of less importance if the organization has already decided to take the application to long-term use and provides clear reasoning for this. Yet, it is still something important for the organizations to realize and implies that they should provide their employees with clear goals and meaning for using such applications.

Further, the organizations should present their employees the benefits of the use, not only from an organizational perspective, but also from a personal perspective. In addition, as effortlessness and ease of use were highly emphasized in our findings, the use needs to be easy and effortless – also in the important context of secure communication. Thus, the providers and designers of these solutions should, in addition to good functionality and reliable security, focus on making the solutions as easy to use and implement as possible. The providers would also benefit if their solutions would give a familiar feeling to the users. For example, in the case of mobile secure communication applications, solutions would probably be better welcomed if they had close resemblance to the most popular and widely used instant messaging and communication applications, such as WhatsApp, Telegram, or Slack.

Further practical implications to promoting the diffusion of secure communication solutions are that their providers should not just market the resulting benefits and provide the solutions but also assist their client organizations in implementing the solutions into use. The providers could offer their clients practical guides for the implementation, including also means to highlight the individual end-user benefits. The client organizations could then market these individual benefits to their employees in order to make them convinced of the relative advantage of using the new solutions. Through the increase in individual acceptance, the client organizations would also increase the organizational level of acceptance and the use of the solutions among their employees, thus strengthening their IS security.

To conclude, this study increases the understanding of user expectations and use experiences with mobile secure communication applications. Our findings and implications can help the industry to develop better solutions and mobile applications for secure communication that are better welcomed by the users and gain success in the market, hence advancing their adoption and diffusion. Our findings can also help organizations in implementing secure communication solutions into their daily practices and providing them to employees, thus improving the security and privacy of communication.

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