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TOWARDS A THEORY OF TRUST-BASED ACCEPTANCE OF AFFECTIVE TECHNOLOGY

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Research

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Abstract

Affective technology has received increasing attention since Rosalind Picard's ground-breaking book on "affective computing" in 1997. Although affective technology shows distinct characteristics in contrast to other types of technology and has great potential to have a substantial impact on the field of Information Systems (IS), there is little insight into the specific conditions of its acceptance. Due to the specific characteristics of affective technology, it can be assumed that trust is an essential construct of the acceptance of affective technology. This study explores the trust-based acceptance of affective technology by using a grounded theory approach. Based on a literature review on trust-based acceptance theories in the field of IS, we developed a semi-structured interview guideline and interviewed 43 persons about the idea of trust in affective technology. Emerged from our empirical findings, we introduce a construct new to the field of technology acceptance which we call "emotional self-reflexivity". The construct refers to the capability to reflect and to be aware of one's own emotions. We propose that emotional self-reflexivity supports the process of understanding the behavior of affective technology which then leads to trust-based acceptance towards the system. From this chain of effects, we derive implications for theory and design.

Keywords: Affective Technology, Trust, Trust-based Acceptance, Grounded Theory, Emotion, Self-Reflexivity

1 Introduction

Affective technology is an emerging technology and has received increasing attention since Picard's ground-breaking book on "affective computing" in 1997 (Picard, 1997). Since then, affective computing has established itself as a multidisciplinary research field (Picard, 2015). It deals with the interaction between humans and technology which intricately involve affect at their core (Picard, 2015). In accordance with the definition of affective computing, *affective technologies are systems which can sense and/or generate human emotions (e.g. happiness, anger, fear etc.)*. Emotion is an important topic in nearly every subfield of psychology, has great impact on human behavior (Reisenzein, 2015) and, therefore, shows enormous potential for various applications in the field of human-computer interaction (Zeng *et al.*, 2009; Elkins *et al.*, 2015). Affect-Aware Learning Technologies, for instance, can detect boredom, confusion or frustration of the learner based on conversational cues, body language and facial features and respond with empathetic, encouraging, and motivational dialogue to significantly increase the learning effect (D'Mello and Graesser, 2015). A further application scenario is given by Arkin and Moshkina (2015), in which affect is added into human-robot interaction. From this, human interacting with a robot ought to benefit by "using nonverbal methods to create a more effective and stronger relationship between artefact and person" (Arkin and Moshkina, 2015, p. 483).

Although affective technology shows distinct characteristics in contrast to other types of technology and has great potential to have a substantial impact on the field of Information Systems (IS), there is little insight into the specific conditions of its acceptance. So far, affective computing has focused on theoretical foundations, inter alia, from psychology (Reisenzein, 2015), neuroscience (Kemp *et al.*, 2015), or computing (Lisetti and Hudlicka, 2015); technical aspects and ways of implementation, for instance, how to detect (Cohn and La Torre, 2015) or generate (Ochs *et al.*, 2015) affect; specific use cases and application fields (D'Mello and Graesser, 2015; Arkin and Moshkina, 2015); or ethical issues which are particularly privacy or data protection concerns (Picard, 2003; Ward and Marsden, 2004; Cowie, 2015; Reynolds and Picard, 2004a; Stahl *et al.*, 2013). Even though research in affective computing is thriving, it remains unclear in how far people are actually willing to use affective technologies in everyday life.

Due to the specific characteristics of affective technology, it can be assumed that trust is an essential construct of the acceptance of affective technology. Affective technology applications are, until now, not part of everyday life, unknown to most people, and not only respond to human commands but mainly to hardly controllable human affects. Affective applications appear as a very complex piece of technology and operate with highly sensitive data. Each of these characteristics increases the feeling of uncertainty and dependence when it comes to using an affective technology application. As McKnight *et al.* (2011) state, "trust is crucial to almost any type of situation in which either uncertainty exists or undesirable outcomes are possible" (pp. 1-2). It is for this reason that Gefen *et al.* (2003) and Gefen (2000) use the construct of trust to explain use intentions in the field of e-commerce because of the uncertainty when a consumer interacts with an e-vendor. Each consumer takes a risk when trading with an e-vendor because of a potential opportunistic behavior by the vendor. In the context of affective technology, trust-based acceptance has only been scarcely explored. However, it can be assumed that the use of affective technology is also perceived as risky and uncertain by its user.

Because, so far, there has been little insight into the acceptance of affective technology, it can be assumed that trust is an essential construct of the acceptance of affective technology, and trust-based acceptance theories have not yet been studied in the context of affective technology, we come to the conclusion that there is a need for theorizing trust-based acceptance of affective technology. We identify a missing theory as a research gap. This study aims to make a contribution to close this gap. It is therefore guided by following research questions:

RQ1: What does trust-based acceptance mean in the context of affective technology?

RQ2: Which are the specific conditions for trust-based acceptance of affective technology against the background of trust-based acceptance theories?

Given its explorative nature, our study uses a grounded theory approach. In doing so, we use the literature on trust-based acceptance to get a first insight into the subject, develop a semi-structured interview guideline and match our empirical findings with the literature. Emerged from our empirical data, we introduce a construct new to the field of technology acceptance which we call "emotional self-reflexivity". The construct refers to the capability to reflect and to be aware of one's own emotions. We propose that emotional self-reflexivity supports the process of understanding and becoming familiar with an affective technology's behavior which in turn leads to trust-based acceptance towards the system. Hence, this study contributes to literature by 1) extending existing trust-based acceptance theories with the identified chain of effects, 2) describing the condition of emotional self-reflexivity, and 3) differentiating the multifaceted construct of trust into three different aspects.

This paper is organized as follows. In Section 2, we review the literature on trust-based acceptance in the IS field including a closer look on the construct of trust and its antecedents. In Section 3, we describe the methodology of this study. In Section 4, we present our empirical findings. In Section 5, we match our findings with the research questions and discuss implications for theory and design as well as limitations and outlook.

2 Related Work

Affective Technology: Although affective technology is an emerging technology, there is sparse research on the acceptance or trust-based acceptance of this type of technology. In accordance with the definition of affective computing (Picard, 2015), *affective technologies are systems which can sense and/or generate human emotions such as happiness, anger, or fear*. So far, research on the acceptance of affective technology is mainly connected with ethical issues. Since an affective technology has the ability to express and to recognize emotions (Picard, 1997; Reynolds and Picard, 2004b) and human emotions are ultimately personal and private, there is a risk that affective technology can provide sensitive information to others. According to Picard (2003), Reynolds and Picard (2004a), and Cowie (2015), one major criticism of affective computing (from a devil's advocate perspective) is that the detection, recognition, or manipulation of emotions is the "ultimate breach of ethics and will never be accepted by users" (Picard, 2003, p. 61). Without any data protection, an affective technology would be widely rejected and could lead to distrust towards computer systems in general (Picard, 2003). Cowie (2015) states that the relationship between ethics and emotional systems (i.e. affective technology) needs "characteristic imperatives: to increase net positive affect, to avoid deception, to respect autonomy, to ensure that system's competence is understood and to provide morally acceptable portraits of people" (p. 334).

Trust-based Acceptance: In the field of IS, trust-based acceptance theories have gained much attention, of which some of them are empirical studies. For instance, in the field of e-commerce, Gefen *et al.* (2003), Gefen (2000), and Davis *et al.* (1989) have investigated the interaction between e-vendors and consumers and McKnight *et al.* (2011) focus their work on the interaction between IT artefacts and users having trust as their key construct. The studies of Chen and Barnes (2007), Kim (2012), and Wu and Chen (2005) have examined the formation of initial trust of consumers in online shopping. Wu and Chen (2005) have extended the model of Gefen *et al.* (2003) and examined the initial adoption of on-line tax. Chen and Barnes (2007) have investigated the drivers for the development of initial trust. Kim (2012) has focused his work on the relationship between beliefs and intentions to purchase on the basis of initial trust. Hong and Cha (2013) have studied the mediating role of trust for purchase intention while trust is influenced by perceived risk. This is similar to the study of Roghanizad and Neufeld (2015) who have studied non-rational motivators of trust such as intuition and risk. Furthermore, Ponte *et al.* (2015) have examined online purchase intentions with the antecedents of trust, perceived value and the antecedents of perceived security and privacy.

Trust: Not only the relation between acceptance and trust has been studied but the construct of trust itself has gained attention in research (Gefen, 2000; Gefen *et al.*, 2003). Following Rousseau *et al.* (1998), they define trust as a "psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions or behavior of another" (p. 395). McKnight *et al.* (2011)

suggest that trust is not only relevant for interpersonal or person-to-firm relations, but argue that "trust in the information technology itself plays a role in shaping IT-related beliefs and behavior" (p. 1). Bringing both together, trust (or trusting beliefs of the trustee) depends on the characteristics or attributes of the other party, whereby the other party can be an individual or an object (McKnight *et al.*, 2011; Lewicki and Bunker, 1995). In other words, trust is the belief of an individual to another party. It is the belief that this party will behave in a dependable (Kumar *et al.*, 1995; Kumar, 1996), ethical (Hosmer, 1995), and socially appropriate way (Zucker, 1986). It becomes clear that trust is a complex, multidimensional (Butler, 1991; Zucker, 1986), and context-dependent (Rousseau *et al.*, 1998; Luhmann, 1979) phenomenon. In the context of e-commerce, for example, trust is an important construct because of the absence of proven guarantees that an e-vendor does not act opportunistic, such as "unfair pricing, providing inaccurate information, violations of privacy, unauthorized use of credit card information, and unauthorized tracking of transactions" (Gefen *et al.*, 2003, p. 55). The avoidance of these e-vendors would be a consequence of consumer's distrust (Jarvenpaa and Tractinsky, 1999; Reicheld and Schefter, 2000). Human beings, and here in particular consumers, try to identify and understand the social surroundings, that is what, when, why, and how others behave (Gefen *et al.*, 2003). The comprehension of the social environment is complicated and an all-day challenge, because people's behavior is not necessarily rational or predictable. As a result, people adopt a strategy to reduce social complexity by trust (Rousseau *et al.*, 1998; Luhmann, 1979) and, therefore, are willed to engage in activities where they are exposed to risk and have no control of the other party's behavior (Gefen, 2000). Consequently, trust is an essential precondition for a successful adoption of unpredictable, uncontrollable, "risky" and new technology (Fukuyama, 1995).

Trust antecedents: Several studies have identified and examined trust-based antecedents. The antecedents are based on knowledge (and familiarity), institution (particularly structural assurance and situational normality), calculation, cognition, and personality (Gefen *et al.*, 2003; Lewicki and Bunker, 1995). Cognition-based (i.e. categorization and illusions of control) and personality-based (i.e. the propensity to trust divided into trusting stance and faith in humanity) trust antecedents are relevant for initial trust formation (McKnight *et al.*, 1998). The calculative-based trust antecedent contains the idea of costs and benefits for the other party to cheat in the interaction (Lewicki and Bunker, 1995). Here, the relationship between the trustor and the trustee is based on economic principles, so that trust comes from a rational assessment and the belief that the other party would not benefit by behaving opportunistically (Gefen *et al.*, 2003). The institution-based trust antecedents "focus on the belief that success is likely because of supportive situations and structures tied to a specific context or a class of trustees" (McKnight *et al.*, 2011, p. 8). Situational normality refers to a setting which is well-ordered and not new to the individual, so that trust can be extended to a similar, but new situation (McKnight *et al.*, 2011). For example, situational normality is based on the belief that the use of a new technology feels normal and comfortable within a specific setting (McKnight and Chervany, 2001) and "people extend greater trust when the nature of interaction is in accordance with what they consider to be typical and, thus, anticipated" (Gefen *et al.*, 2003, p. 64). Additionally, institution-based structural assurance refers to the belief of safety through, for example, regulations, safeguards, guarantees etc. It is the individual's belief of support in a legal, contractual, or physical manner that ensures successful interaction behavior or use of IT (McKnight *et al.*, 2011).

Familiarity: Finally, the antecedent of knowledge-based trust corresponds to the idea that trust emerges from being familiar with the what, who, how, and when of what is happening (Gefen *et al.*, 2003; Gefen, 2000; Lewicki and Bunker, 1995). As mentioned above, trust reduces the social complexity of behavior between parties (people or objects). According to Lewicki and Bunker (1995) knowledge-based trust relies on the other's predictability and on the anticipation of their behavior. This type of trust is grounded in the information we have about the other. Hence, familiarity reduces uncertainty through comprehension of what is happening in the present (Gefen *et al.*, 2003; Luhmann, 1979). Familiarity is a "specific activity-based cognizance based on previous experience or learning of how to use the particular interface [here, an information technology]" (Gefen, 2000, p. 727). In other words, being familiar with an individual or a technology results from experience and knowledge of past activities (information) in which

the other party was not or did not behave opportunistically (Gefen *et al.*, 2003). It means that trust emerges from a prediction process based on the trustor's knowledge about the other party and the anticipation of their behavior (Doney *et al.*, 1998).

In summary, there is much research on trust-based acceptance and its constructs, particularly in the field of e-commerce, but only little research on the acceptance or trust-based acceptance of affective technology. Due to the specific characteristics of affective technology (such as dealing with highly sensitive information) and related ethical issues around it (such as personal, privacy, or data protection concerns), it can be assumed that trust is an important construct of acceptance of affective technology. In the IS field, trust-based acceptance, the construct of trust and trust antecedents have been subject of several research papers (e.g. Gefen *et al.*, 2003 or Gefen, 2000). Nevertheless, they have not been connected to the context of affective technology. We identify this missing connection as a gap which this study wants to address.

3 Methodology

This study follows an inductive grounded theory approach (Glaser and Strauss, 1967; Strauss and Corbin, 1990; Urquhart and Fernández, 2013; Urquhart *et al.*, 2010) to explore the specific conditions of trust-based acceptance of affective technology by building upon general trust-based acceptance theories. In particular, questions such as "which constructs are relevant for trust-based acceptance of affective technology?", "what are the antecedents of trust?", or "in how far can these constructs ne integrated into existing theories?" arise. The grounded theory approach is applied due to the explorative nature of this study. The explorative nature results from the fact that, so far, trust-based acceptance has not been investigated in the field of affective technology in any previous study.

To explore the trust-based acceptance of affective technology we conducted 43 interviews with potential users of affective technology. In a first step, we reviewed the literature on trust-based acceptance of technology and the construct of trust in technology in the field of IS to develop an initial conceptualization of the subject to explore. Building upon this initial insight, we developed a semi-structured interview guideline to make sure that we get an in-depth insight into trust-based acceptance in the specific context of affective technology. Here, we explicitly ask questions in regard to the idea of trust in affective technology, the relation between trust and acceptance as well as the conditions for trust in affective technology. Due to the enormous amount of potential affective technology applications (cf. Calvo *et al.*, 2015; Picard, 1997), almost everyone can be considered as a potential user of affective technology. Hence, we selected the respondents using a convenient sampling, but in consideration of demographic diversity (age, gender, background).

Average Age	**Gender**		**Average duration of all interviews**
35.8	Male 29	Female 14	23:44 min
Background of interviewees			
13 students, 4 unemployed, 3 office workers, 2 self-employed, 2 self-employed insurance salesmen, 2 engineers, 1 teacher, 1 mechanic, 1 car rental agent, 1 shop assistant, 1 controller, 1 pensioner, 1 civil servant, 1 executive, 1 supply chain manager, 1 self-employed driving instructor, 1 policeman, 1 lawyer, 1 hairdresser, 1 medical assistant, 1 fitness administrator, 1 cutting mechanic, 1 web programmer			

Table 1. Overview of Interviewees

One major challenge of the interviews results from the fact that affective technology is not yet part of everyday life and, therefore, largely unknown among non-experts. None of the interviewees had actual first-hand experience with affective technology. That is why before the interviews started, the interviewers took time to explain the nature of affective technology by giving different application examples. Depending on the background of the interviewee, the described examples were an affective car assistance system which reacts to the driver's emotional state, an affective communication manager at the workplace which controls the communication flow of an employee on the basis of their emotional state or an affective assistant system at a production workplace to increase the safety of the worker.

Following the grounded theory approach, we started the analysis by using open coding of the transcripts (Glaser and Strauss, 1967; Strauss and Corbin, 1990). This step was done iteratively by two researchers (the first two authors) including phases of independent coding and code-matching to come to a joint result. We then applied axial coding by building clusters of similar codes. The axial coding allowed us to identify different constructs relevant for our subject. In a third step we searched for relations between the constructs (selective coding). After we conducted 43 interviews, we finished collecting data because no new insights were found (theoretical saturation). Finally, to better understand the results and to derive theory implications, we reflected them by matching them with the literature (theoretical coding). For the following presentation of our findings, we chose quotations which were most suitable to represent the overall findings.

4 Findings

4.1 Trust in affective technology and conditions for trust-based acceptance of affective technology

Acceptance of affective technology depends on trust in affective technology. Almost all interviewees state or confirm that their acceptance of an affective technology relies on how far they can trust such a technology, because, for them, affective technology is complex, hardly controllable, captures sensitive data and is something completely new.

> *"This is a kind of system for which you need trust somehow. In the system architecture, you need to trust the developers, you have to trust the security of the data, and all sorts of things."* (Interviewee 37 (self-employed))

> *"Well, it is a technology which is very new and maybe that's why it acts as a deterrent. It is not yet part of my daily life. […] Maybe a good idea but it is something new. And of course, at the beginning you rather keep distance."* (Interviewee 5 (office worker))

The interviewees discuss what trust in affective technology actually means. In accordance with the common definition that trust is the individual's willingness to depend on another party (Rousseau *et al.*, 1998), trust in affective technology can be differentiated into three different aspects: 1) the willingness to depend on proper functioning of the technology, 2) the willingness to depend on proper technology behavior on the basis of a functioning emotion recognition, and 3) the willingness to depend on proper data handling and privacy protection.

Accepting an affective technology depends on how far you believe that the technology can capture your emotions correctly. Some interviewees doubt that technology is capable of recognizing human affects, since human affects are not only complex but difficult to identify from the outside.

> *"Trust means that I believe that the system can really find out that I'm angry, I'm sad. […] It should not mix up joy with anger or something like that."* (Interviewee 26 (student))

> *"I'm really not sure how well such a system would work, whether it really could understand my feelings based on my facial expression or my action."* (Interviewee 6 (student))

Provided that a technology can identify human affects correctly, a second aspect of trust in affective technology appears: trust in a proper technology behavior. Here the question arises what a technology actually does when it knows how its user feels. Equivalent to the fact that emotions are not easily controllable, the behavior of an affective technology is less predictable than for other information systems. Hence, the interviewees fear arbitrary behavior by the system.

> *"I must have faith that the system really always does the right thing […] and does nothing wrong with my emotions."* (Interviewee 22 (insurance salesman))

> *"I think that it is somehow a matter of trust in the technology, because when the technology reacts quicker than my mind then this would make me quite uncertain."* (Interviewee 5 (office worker)).

Many interviewees mention data security and privacy concerns as a major aspect of trust due to the fact that affective technology captures highly sensitive personal data. Already now, they appear to be sensitized towards data issues in consequence of the digitalization of their everyday life and related public debates. But emotion-related data go even beyond data which are already captured nowadays.

> *"Who gets the data? Who gets the data on my emotional state, after a car accident for example? When you were angry or you were not concentrated then there will be accusations and something like that."* (Interviewee 35 (student))
>
> *"I think there is a risk of data misuse. In the sense that the data is used to evaluate employees."* (Interviewee 3 (office worker))
>
> *"Such sensors go into very sensitive spheres of life. I mean emotions are one of the most sensitive things we have. It is definitely a highly risky technology and that's why trust is necessary so that you want to use the technology and you can rely on it; that nothing wrong happens with the data and nothing is transferred through the internet or a hacker can obtain such data and so on."* (Interviewee 20 (policeman))

Our findings show that trust is an important construct for the acceptance of affective technology because, as stated in section 2, trust is important for accepting new technology (McKnight *et al.*, 2011). This is especially true in an environment with high social complexity in which an individual act is hardly controllable (Butler, 1991; Zucker, 1986). In our case, the behavior of an affective technology might be hardly controllable. Here, an individual tries to anticipate future behavior of another party (i.e. the affective technology) as a strategy to reduce the complexity through trust (Rousseau *et al.*, 1998; Luhmann, 1979). Trust in a complex environment is based on the belief of an individual that the affective technology does not behave opportunistic or the designer of this technology has no opportunistic intentions (Reynolds and Picard, 2004a, 2004b). According to Gefen *et al.* (2003) and Gefen (2000), opportunistic behavior includes violations of privacy, unauthorized use of the user's data, or a manipulation of the data. If a technology would signal such an opportunistic behavior, the consequence would be consumer's distrust and rejection (Jarvenpaa and Tractinsky, 1999; Reicheld and Schefter, 2000).

Trust in affective technology depends on understanding affective technology. Questioned about what it needs to trust an affective technology, the most significant aspect mentioned is to understand, to know about, and to be familiar with the affective technology application. More specifically, this aspect is not about understanding how an affective technology works because the technical details are too complicated to be understood. Here, the ability to understand and to predict how an affective technology reacts after it has recognized a human affect is significantly important. If the behavior of an affective technology is comprehensible and predictable, the fear of arbitrary behavior by the system will decrease.

> *"If everything is processed in a black box and it doesn't give me any feedback, then I don't trust the thing. But if I have the feeling that I can control it, that the system is not just doing something but something what is defined and something that I can comprehend. I don't have to know the program code but at least the conclusions it makes and why it makes them."* (Interviewee 13 (pensioner))
>
> *"I would need to inform myself about the system and maybe make some tests before I really use it in my daily life."* (Interviewee 21 (lawyer))

The "black box" motive has been mentioned by several interviewees. It portrays the idea that an affective technology captures personal information and does something with it without letting the user know which information it actually has. In addition, an informational asymmetry emerges when the system knows more about or is more aware of the user's emotional state than the user themselves. This informational asymmetry leads to distrust or, from the other perspective, the removal of the asymmetry leads to trust.

> *"I would have a strange feeling if a system would know more about my state than I do."* (Interviewee 16 (executive))
>
> *"Somehow I would feel externally controlled. Maybe you would rely more on the device and not on what you think about yourself. I would feel insecure and then I would be very sceptical whether the device really knows what I feel."* (Interviewee 33 (cutting mechanic))

Besides the necessity to understand and predict the behavior of an affective technology, the understanding of what an affective technology does with personal data leads to trust in proper data handling and privacy protection.

> *"It is important to understand what happens with the data. One the one hand, which data is captured? And on the other hand, what is it doing with it? For instance, if I assume the data is collected through a camera, I won't have a clue what else can be measured through a camera."* (Interviewee 15 (teacher))
>
> *"Of course I won't be able to understand a system completely […] but at least I need insight into which data is collected from me and why this data is collected, for which aim and which purpose."* (Interviewee 30 (student))

Alongside the necessity to be able to understand an affective technology to trust it, 'system transparency' is needed to understand the technology. It means that information has to be provided about the purpose of the system and the information it collects about the user.

> *"It would be best if I am told in detail how it is used, how the system behind it looks like and what exactly you can measure with it. Maybe this will take the fear."* (Interviewee 17 (engineer))
>
> *"It just won't be trustworthy if it is not transparent. If I don't know when it is active and what it is doing. Camera is very problematic."* (Interviewee 14 (civil servant))

By matching our findings with the literature, we found that knowledge-based familiarity with a technology is based on the understanding of who, how, when, and what is happening while using the technology (Gefen *et al.*, 2003; Gefen, 2000; Lewicki and Bunker, 1995). According to Doney *et al.* (1998), familiarity is a prediction process. This prediction relies on information and the knowledge concerning the other party (Lewicki and Bunker, 1995), whereby this information and knowledge could be based on past experiences (Luhmann, 1979; Gefen *et al.*, 2003) or other sources.

Besides the important construct of familiarity, many interviewees mentioned the aspect of institution-based structural assurances or structural safeguards as an important condition for trust in affective technology. In order to get a better feeling when using a highly complex technology which is hardly controllable, individuals tend to rely on third party structures such as the manufacturer's reputation, friends, family, contracts, certificates, studies, regulations, laws or statement of guarantees.

> *"Some third party authority should assure that the detected and depicted emotions are correct. I want to be sure here. There should be a "structure of trust" such as society, friends, family or some other third party authorities [government] which assure the functioning and right reactions of such a technology."* (Interviewee 31 (student))

Our data shows that trust arises through institutional structures. Here, trust relies on the belief of safety in a legal, contractual, or physical manner (McKnight *et al.*, 2011) such as guarantees, regulations, legal recourse, or other structures (Zucker, 1986; McKnight and Chervany, 2000).

Understanding affective technology depends on the capability to reflect and to be aware of one's own emotions. Going deeper into the subject of understanding affective technology, our interviews indicate that system transparency is not sufficient. To understand and to get familiar with an affective technology application means to be able to constantly compare the behavior of an affective technology with one's perception of the own emotions. Only by comparing the technology's behavior with their own perception, a user can develop an understanding of how and why an affective technology behaves in a certain way. Otherwise, it would hardly be possible for a user to recognize a behavioral pattern of the technology and to predict the behavior.

> *"Trust means that the system corresponds to my own judgement. For instance, when I'm driving a car and I know I'm not that concentrated because I'm angry and the [affective] assistance system tells me I'm not concentrating, then it helps me to develop trust."* (Interviewee 4 (teacher))

> *"It is a condition, of course, that you are aware of how others perceive you and how you feel yourself. And if the system shows the right thing, then yes. Then you can trust the system to some extent."* (Interviewee 29 (fitness administrator))

As a consequence, the capability of a person to reflect and to be aware of their own emotions is a condition to understand the behavior of affective technology. Persons do not only have different levels of capability to reflect but have different levels of awareness depending on the situation. We call this condition "emotional self-reflexivity".

> *"That would be very important because, as I just said, I'm not sure when certain functions are doing something and what the outcome is. And, in this moment, my emotion is the trigger for a certain function and in order to foresee the function I certainly must know in which state I am."* (Interviewee 41 (unemployed))

> *"Surely, I'm not permanently aware of my emotions and that's why you don't know what the effect will be. It's difficult to imagine what would happen. Because, if it captures my emotions and I feel very normal but the camera tells me 'hey, you are sad!', then I don't know how it will react and what it will do. Maybe, I don't want that."* (Interviewee 7 (unemployed))

> *"It depends on the situation. Surely there are emotions which you suppress and you don't want to know too exactly. But there are also situations in which it would be better do be capable of evaluating yourself."* (Interviewee 4 (teacher))

4.2 "Emotional self-reflexivity" in the literature

After the construct of "emotional self-reflexivity" has emerged from our empirical data, we searched the literature to get a deeper understanding of the construct. In the (psychological) literature the construct of emotional self-reflexivity can be found in different publications. In the context of emotional intelligence, Dulewicz and Higgs (2000) define emotional intelligence as (i) knowing your own feelings and being able to handle those feelings, (ii) being able to motivate yourself and to perform at your peak, and (iii) being able to sense what others feel and to handle relationships. (i) comes closest to the definition of emotional self-reflexivity from our findings. Steiner (1997) describes emotional self-reflexivity as self-awareness, i.e. the ability to understand one's own emotions. However, our empirical findings show

that emotional self-reflexivity is more than just understanding or dealing with your own emotions. Further findings in the literature support our data by the construct of emotional competence (Boyatzis *et al.*, 2000; Bar-On and Parker, 2000; Ciarrochi and Deane, 2001). Goleman (1998), for example, states that emotional competence comprises self-awareness, the knowledge of one's own abilities, and the comprehension of factors that cause emotions in oneself and others. In accordance with Goleman (1998), Goleman,Ç, Berking and Znoj (2008) classified emotional competence in sub-constructs and tested them in a quantitative study. The sub-constructs "comprehension" (understanding), "clarity" (detect/realize), and "awareness" (perceive/sense) of emotions highly overlap with the construct of emotional self-reflexivity from our findings.

5 Discussion

While many studies have investigated theoretical foundations, technical aspects, specific use cases, or ethical issues in the thriving research field of affective computing, little attention has been given to the specific conditions of the acceptance of affective technology. It is important to explore the willingness of people to use affective technology applications in everyday life, since such technologies are expected to have a substantial impact on the IS field. Trust-based acceptance theories and their application context provide a suitable basis for this necessary exploration because the construct of trust is important for the acceptance of affective technology due to its specific characteristics. Our study makes a contribution by answering the following research questions:

RQ1: What does trust-based acceptance mean in the context of affective technology?

Trust in affective technology is threefold: Firstly, it means the individual's willingness to depend on proper functioning of an affective technology. It is the belief that the technology can capture your emotions correctly. Secondly, it means the individual's willingness to depend on a proper behavior of an affective technology. Provided that a technology can identify human affects correctly, still the question remains what a technology actually does when it knows how its user feels. Thirdly, it means the individual's willingness to depend on proper data handling and privacy protection of an affective technology. This is important due to the fact that affective technology captures highly sensitive personal data.

RQ2: Which are the specific conditions for trust-based acceptance of affective technology against the background of trust-based acceptance theories?

Our findings indicate that the ability to understand and predict the behavior of an affective technology is essential for trusting affective technology. The reason for this is the fear of arbitrary behavior by the system because of the potential informational asymmetry between the system and its user. The informational asymmetry emerges when the system knows more about the emotional state of the user than the users themselves or it is just unclear what the system actually knows. Additionally, the understanding of what an affective technology does with personal data leads to trust in proper data handling and privacy protection. Against the background of trust-based acceptance theories, the "ability to understand and predict" corresponds to the construct of "knowledge-based familiarity". Compared to the application fields in which the trust-based acceptance theories have been studied, it can be assumed that knowledge-based familiarity is of significant importance in the field of affective technology.

Furthermore, our findings show that to understand (or being familiar) and to predict the behavior of an affective technology means to be able to constantly compare the behavior of an affective technology with one's perception of the own emotions. As a consequence, the capability of a person to reflect and to be aware of their own emotions is a condition to understand the behavior of affective technology. Hence, emotional self-reflexivity is a condition for the ability to understand and predict the behavior of an affective technology. So far, trust-based acceptance theories in the IS field do not cover this condition by any construct.

Figure 1 illustrates the chain of effects we have identified in this study:

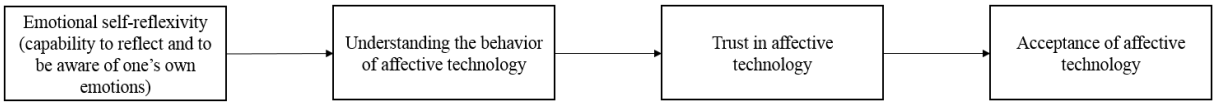

Figure 1. Chain of effects identified in this study

Implications for theory

This study contributes to literature and proposes three implications for theory: Firstly, the contextualization of trust-based acceptance theories for affective technology needs to integrate the chain of effects described above (emotional self-reflexivity leads to understanding and predicting an affective technology's behavior (familiarity) leads to trust in affective technology leads to acceptance of affective technology) and to extend existing trust-based acceptance theories. The construct of knowledge-based familiarity offers a suitable link. Secondly, a trust-based acceptance theory of affective technology needs to contain the condition of emotional self-reflexivity. In psychology, research on, for instance, emotional competence or emotional self-awareness deals with the capability of an individual to self-reflect and to be aware of their own emotions. Such research in psychology appears to be a suitable starting point for the development of a self-reflexivity construct for acceptance theories. Thirdly, trust in affective technology is a multifaceted construct. In the context of affective technology, it can be differentiated into three aspects: willingness to depend on proper functioning, proper behavior, as well as proper data handling and privacy concerns.

Implications for design of affective technology

This study offers insights for developers of affective technology into how to design affective applications to increase its acceptance. It suggests that "system transparency" is needed to increase trust-based acceptance for two reasons: Firstly, the system should constantly make visible to the user on which basis – that is which emotional state of the user the system has detected – the affective technology reacts. This supports the comprehensibility and predictability of the system and aims at removing the potential informational asymmetry between the technology and the user. Otherwise, users would have the fear of arbitrary behavior by the system. Secondly, information on the data or the data itself, which is captured by the system about its user, should be easily accessible to the user (and only to this user to protect their privacy). Since affective technology captures and collects highly sensitive data and concerns about the affective technology being a "black box" were expressed, it can be assumed that data transparency towards the person, from whom the data is captured, will support the trustworthiness of the technology.

Furthermore, trust in data handling and privacy protection is of significant importance. That is why highly effective data security should be part of an affective technology. Emotion-related data must not be easily transferrable to somewhere outside the system, e.g. to the system's designer or to other applications. Data minimization could help to increase the belief that personal data will not be misused for other purposes than the intended one.

In general, besides system transparency and proper data handling, developers of affective technology should think of how affective technology can incorporate trust and which design options help to increase the comprehensibility and predictability of the technology.

Limitations and Outlook

This study has several limitations. First, this purely qualitative study is based on interviews with 43 participants with diverse backgrounds following a convenient sampling strategy and was conducted in central Europe. It does not cover how other cultures, certain professions, or organizational backgrounds deal with topics such as human affects, affective technology, or trust. Second, all of the participants were unfamiliar and inexperienced with affective technology. Although we took time to explain affective technology with the aid of different application scenarios, the findings may be limited by their

imagination. Third, a stronger focus on acceptance in affective technology in general could broaden our findings. As stated in the methodology chapter, the semi-structured interview guideline focused on questions about trust in affective technology, the relation between trust and acceptance, and the conditions of trust in affective technology, which can be considered as limitation of the study.

As a consequence, this study offers potential for further research. It can be used to develop a general theory of trust-based acceptance of affective technology which in turn can be validated by a broad-based quantitative approach. In addition, the chain of effects proposed in this study can be validated by an experimental approach. Experiments have the advantage that the participants are directly confronted with a specific application and, thus, the results are not dependent on the participant's imagination. Furthermore, the study could be extended to other cultures to get a broader perspective and deeper insights into the trust-based acceptance of affective technology.

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