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A LONGITUDINAL PERSPECTIVE ON TRUST IN IT ARTEFACTS

Research

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Abstract

The importance of trust for IT adoption and diffusion has been shown in numerous studies throughout the IS discipline. Even though researchers agree that trust is not only relevant for one-time interactions, but develops gradually during an interaction and needs to be maintained, most studies rely on research designs that only capture a particular snapshot of this development. We aim to close this gap in IS trust literature, by conducting a five-wave longitudinal field study at a German university to investigate how trust in a new IT artefact – a new student information system – is established. Our results indicate that trust in a new IT artefact develops in three phases. First, the users seem to confirm whether their level of initial trust was correct and adapt their level of trust accordingly. Next – in our case after about 3 weeks – the users start to build trust, resembled by a linear growth in trust. Last – in our case after about another 6 weeks –trust stops to increase, and remains stable. Furthermore, this development does not vary comparing new and experienced users. Based on our results, we extend the trust lifecycle we derived from literature by a sixth phase called confirmation of initial trust.

Keywords: Trust, Trust in IT Artefacts, Latent Growth Modelling, Five-wave Longitudinal Field Study, Piece-wise Growth, Trust Lifecycle, Confirmation of Initial Trust.

1 Introduction

The importance of trust for IT adoption and diffusion has been shown in numerous studies throughout the IS discipline (e.g., Gefen, Karahanna and Straub, 2003; Pavlou and Gefen, 2004; Wang and Benbasat, 2005). The reason for this importance can be found in the value of trust as a mechanism to reduce social and technical complexity (Gefen, 2000; Lee and See, 2004; Luhmann, 1979). The Information Systems (IS) community started with investigating IT-mediated trust relationships, e.g., in the context of eCommerce (see, e.g., Gefen, Karahanna and Straub, 2003; Pavlou and Gefen, 2004) or virtual communities (see, e.g., Leimeister, Ebner and Krcmar, 2005). More recently, researchers also pointed out that instead of mediating trust relationships, IT can also become part of the trust relationship itself due to the steadily increasing complexity of IT, e.g., due to system automations (Söllner, Pavlou and Leimeister, 2013). Consequently, IS researchers started to investigate users' trust in IT artefacts, such as recommendation agents (Söllner *et al.*, 2012; Wang and Benbasat, 2005) or Excel (McKnight *et al.*, 2011). As a result, IS trust research generated a vast amount on insights on factors that build trust, and also on how IT artefacts should be designed.

Despite the plethora of IS research on trust, there are still gaps in the literature that need to be closed. Gefen, Benbasat and Pavlou (2008), e.g., point out that researchers agree that trust is not only relevant for one-time interactions, but develops gradually during an interaction and needs to be maintained (Hosmer, 1995). However, most IS studies rely on research designs that only capture a particular snap-

shot of this development. Studies that try to capture the changing nature of trust instead, are scarce. Three examples are Jarvenpaa, Shaw and Staples (2004), who investigate differences between initial trustworthiness and early trust in virtual teams, Zahedi and Song (2008), who use a longitudinal laboratory experiment to demonstrate chances of trust over time, and Kanawattanachai and Yoo (2002), who study the development of trust in different virtual team settings. However, also these studies can only provide little generalizable insights on how trust emerges or develops over time, since they only measure trust twice or three times, and all of them focus on trust in virtual teams.

As a result, we aim to close this gap in IS trust literature, by applying a longitudinal research design to investigate how trust in an IT artefact emerges when a new IT artefact is introduced. In particular, we aim at answering the following research questions:

RQ 1: How does trust in a new IT artefact develop over time?

RQ 2: How stable is this development regarding differences in prior experience?

To answer these questions, we accompanied the introduction of a new student information system at a German university over the course of one semester. We conducted a five-wave longitudinal field study and repeatedly measured the constructs important for our study. In total, we gathered data from 284 students that completed all five surveys throughout the semester. For data analysis, we relied on latent growth modeling (Serva, Kher and Laurenceau, 2011; Zheng, Pavlou and Gu, 2014) using the Mplus 7.31 software.

Our results indicate that trust in a new IT artefact develops in three phases. First, the users seem to confirm whether their level of initial trust was correct and adapt their level of trust accordingly. Next – in our case after about 3 weeks – the users start to build trust, resembled by a gradual increase as suggested by Gefen, Benbasat and Pavlou (2008). Last – in our case after about another 6 weeks – we observed that trust stops to increase, and remains constant. This indicates that trust has reached the phase of stability, as introduced by Rousseau *et al.* (1998). We further observed that this development remains stable comparing students that have experience with the provider and prior system, and students that started their studies in this particular semester, and consequently had no experience. Regarding the development of trust, our results indicate that the five stages of the trust lifecycle we derived from literature need to be extended. In fact our results show that after the first interaction with a new system, the users are not immediately starting to build trust based on their experiences with the IT artefact. Instead, the users try to assess whether their initial level of trustworthiness was correct before they start to build new trust based on their experiences. Consequently, a sixth stage called *confirmation of initial trust* should be added into the trust lifecycle in between the stages of *initial trust building* and *trust building*. Our results also allow conclusions on the time it takes until the confirmation of initial trust is complete – in our case about 3 weeks – and afterwards, how long it takes to build trust based on the experiences with the new IT artefact until stability is reached – in our case about 6 weeks.

The remainder of this paper is structured as follows. First, we present theoretical background on trust and details on our theory development. Afterwards, we provide insights into our methodology, before we report the results of our study and discuss its implications and limitations. The paper closes with a conclusion.

2 Theoretical Background

2.1 Trust in IT Artefacts

The importance of trust for IS research has resulted in a plethora of studies investigating the role of trust in different contexts (for an overview of the empirical IS trust literature please see Söllner and Leimeister, 2013). The popularity of trust in many disciplines, such as IS, management and marketing has led to a multitude of conceptualizations and definitions of trust. However, Rousseau *et al.* (1998)

highlight that all understandings have a common core, based upon positive expectations and vulnerability. We build on Mayer, Davis and Schoorman's (1995, p. 712) widely accepted definition of trust and define trust as the *willingness of a trustor to be vulnerable to the actions of a trustee based on the expectation that the trustee will perform a particular action important to the trustor, irrespective of the ability to monitor or control the trustee.*

In the beginning, IS trust researchers mainly focused on trust relationships between people that are mediated by IT. However, due to developments such as increasing automation (Lee and See, 2004), IS trust research started to investigate trust relationships between users and IT artefacts (Lankton, McKnight and Tripp, 2015; Söllner *et al.*, 2012; Wang and Benbasat, 2005). Whereas Wang and Benbasat (2005) argue that interpersonal trust theory – especially the dimensions ability, benevolence and integrity (Mayer, Davis and Schoorman, 1995) – can be used to study trust relationships between users and IT artefacts, IS trust researchers agree nowadays that another theoretical foundation should be used (Lankton, McKnight and Tripp, 2015; McKnight *et al.*, 2011; Söllner *et al.*, 2012). One key reason is that concepts such as benevolence cannot be transferred to IT, since IT artefacts cannot make decisions comparable to human decision making (Söllner, Pavlou and Leimeister, 2013). Consequently, IS trust researchers used different dimensions to grasp trust in IT artefacts. Söllner, Pavlou and Leimeister (2013) build on the approaches of Söllner *et al.* (2012) and McKnight *et al.* (2011), and propose three dimensions of trust in IT artefacts: *performance, helpfulness* and *predictability*. *Performance* – related to ability – refers to the user's perception of the IT artefact's competence as demonstrated by its ability to help the user to achieve his goals. *Helpfulness* – related to benevolence – refers to the user's perception that he can get support if necessary. *Predictability* – related to integrity – refers to the user's perception that he can predict the behavior of the IT artefact to a certain degree. We follow this approach, and consequently rely on these three dimensions to assess trust in IT artefacts.

2.2 Longitudinal Research on Trust

Before we present the theoretical background on longitudinal research on trust, we first need to clarify our understanding of the term *longitudinal*. We follow the understanding of Ployhart and Vandenberg (2010) that the use of *at least three waves of data for the exact same construct* is a defining attribute of longitudinal research. Their argument is quite plausible, since they argue that two waves of data will always result in a linear relationship. Since we are interested in the real development over time – also called natural oscillation (Kehr and Kowatsch, 2015) – we need at least three waves of data to account for non-linear developments. However, we need to mention that we do not recommend to always use longitudinal research design that rely on three waves of data. In general, researchers should try to gather enough data necessary to grasp the natural oscillation of their concept of interest (for further details, please see Kehr and Kowatsch, 2015).

Since, Kehr and Kowatsch (2015) already highlighted that only 10 articles that have been published in the journals of the AIS Senior Scholars' Basket of Journals between 2004 and October 2014, it is not very surprising that we were only able to identify two papers in these journals that applied a quantitative longitudinal research approach for studying trust. Kanawattanachai and Yoo (2002) and Kanawattanachai and Yoo (2007) study trust in virtual teams. Furthermore, we found related IS paper also focusing on virtual teams, e.g., Robert Jr, Dennis and Hung (2009) investigate swift trust in virtual teams, but only measured trust twice. Another study also focusing on trust in teams but not virtual teams was conducted by van der Werff and Buckley (2014). They apply a four-wave longitudinal research design to investigate the development of trust behaviours – in their case reliance and disclosure –over time when new employees join an organization. However, all these studies address trust in (virtual) teams, and thus trust relationships between people that are mediated by IT. Consequently, in the next section, we will rely on conceptual insight to develop an initial understanding of the development of trust for our study.

3 Theory Development

3.1 A Lifecycle Perspective on Trust

In general, trust researchers agree that trust is a dynamic concept that needs to be built and maintained (see, e.g., Gefen, Benbasat and Pavlou, 2008; Mayer, Davis and Schoorman, 1995; Rousseau *et al.*, 1998), suggesting that there is something such as a trust lifecycle. However, little empirical insights on the development of trust over time can be found. Nevertheless, different articles, either directly address different phases of the development of trust over time (e.g., Rousseau *et al.*, 1998) or indirectly address them by focusing on particular phases (e.g., Gillespie and Dietz, 2009; McKnight, Choudhury and Kacmar, 2002; Wang and Benbasat, 2005).

The fragments found in the literature allow us to derive a trust lifecycle, consisting of five phases: *initial trust building*, *trust building*, *trust stability*, *trust dissolution* and *trust repair*.

The core of our theory-based trust lifecycle is provided by Rousseau *et al.* (1998), who explicitly mention three phases in their 1998 editorial to the Academy of Management Review's special topic forum on trust: *building*, *stability* and *dissolution*. In the *trust building* phase, trust is either built or rebuilt. In the *trust stability* phase, trust has been built or rebuilt, and remains stable over time. In the *trust dissolution* phase, trust diminishes, e.g., due to the occurrence of an expected negative experience or because the two parties did not interact for a longer period of time (Rousseau *et al.*, 1998).

Taking further research on trust into account, we observe that quite a number of papers explicitly focus on repairing trust (see, e.g., Gillespie and Dietz, 2009; Tomlinson and Mayer, 2009), indicating that trust researchers differentiate between situation in which trust needs to be built for the first time and where trust needs to be rebuilt after it started to dissolve. Thus, based on this stream of research, we refer to *trust building* when trust is built for the first time, and to *trust repair* when trust needs to be rebuilt after it started to dissolve.

Finally, the plethora of research available on how trust can be built allows us to take a deeper look into the trust building phase. Here, a significant part of the literature focuses on *initial trust*. McKnight, Cummings and Chervany (1998, p. 473) define initial as *"when parties first meet or interact"*. They further highlight the importance of studying *initial trust building*, since different theoretical lenses (e.g., calculative-based trust versus knowledge-based trust, McKnight, Cummings and Chervany, 1998) lead to inconclusive results. Initial trust, has also received attention for IS researchers focusing on human trust in IT artefacts, e.g., by Wang and Benbasat (2005), who focused on initial trust building in recommendation agents. As a result, we split the trust building phase into two distinct phases – *initial trust building* (prior to and during the first interaction) and *trust building* (after the first interaction has taken place). Consequently, initial trust could, e.g., by built by word-of-mouth or advertisements, whereas afterwards, experiences are supposed to influence trust.

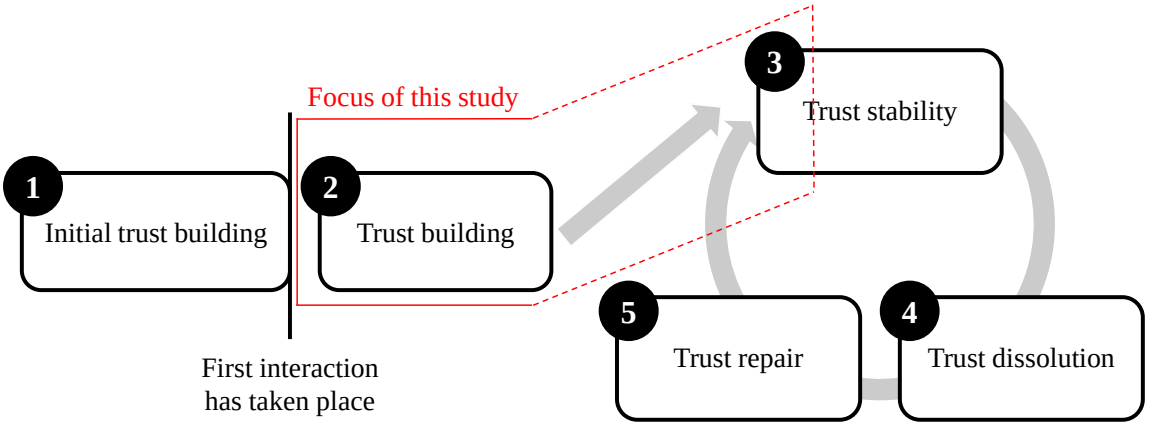

Figure 1. Theory-based trust lifecycle including the focus of our study.

With regard to our study, we accompany the introduction of a new system, and our data collection begins when the users are starting to use the new system. Consequently, we expect to capture their level of initial trust, since at t1 they had just started interacting with the system (thus the initial trust building phase ❶ ends), and thus are about to gather their own experiences. In the course of our study, we expect to capture the trust building phase ❷, and – depending on how long this phase lasts – might also be able to gather some insights on the phase of trust stability ❸ (see highlighted part of the theory-based trust lifecycle in Figure 1).

3.2 The Impact of Experience on the Development of Trust

Prior research has highlighted the impact of familiarity or experience on trust. Gefen (2000), e.g., showed that familiarity impacts trust in an Internet vendor, and Pavlou and Dimoka (2006), e.g., showed that past experience in the context of e-marketplaces impact a buyer's trust in a seller on that marketplace. Furthermore, Cyr (2008) showed that trust in a vendor's website is not only determined by characteristics of the website, but also depends on the people or organization running the website.

Building on this research, we aim to explore the impact of experience on the development of trust in a new IT artefact. In fact, when organizations introduce a new IT artefact, e.g., a new system, two different kinds of experience are prevalent for employees. First, in many cases a new system – at least to some extent – substitutes an existing system. Thus, the employees typically have experiences with prior systems. Second, the systems are typically provided by an internal IT service provider. Consequently, the employees will also have experience with the provider. From marketing literature – e.g., research on brand trust – we know that customer trust in a product or service is related to the willingness to buy other products or services from the same brand (see, e.g, Chaudhuri and Holbrook, 2001).

Even though it is hard to determine how experience will impact the development of trust, since this depends on different factors, e.g., whether the provider is perceived as doing a good job or not, we expect experience to have an impact on the development of trust. We, e.g., expect that experienced users will know what to expect from a certain provider, leading to a less steep growth in the trust building stage. Consequently, we expect that the way trust in a new IT artefact develops differs between users without experience with prior system or the provider, and experienced users.

4 Research Method

4.1 Setting of our Longitudinal Field Study

To answer our research questions, we conducted a five-wave longitudinal field study accompanying the introduction of a new student information system at a German university. The purpose of the system was to consolidate all the information and the functionalities the students needed, which were previously scattered across multiple systems, such as accessing Moodle, applying for specific courses, and registering for exam, but also accessing the menu of the cafeteria. The new system was introduced parallel to the existing solutions, so the use of the new system was – and still is – voluntary.

The roll-out of the system started in late October, and on November 3rd, the IT service provider of the university sent out an email to all students announcing the new system. The day after, the first author of the paper sent out another email to all students introducing our study and calling for participation. Participants that signed up for the study were asked to provide demographics (such as gender, age, semester), and data on time-invariant constructs (e.g., disposition to trust). On November 13th, the registration for the study closed with a total of 1087 participants. Five days later, on November 18th, we distributed the first survey to the 1087 enrolled participants, and sent a maximum of three reminders to people who had not yet completed the survey. In this (and the 4 subsequent surveys), all indicators for constructs that were expected to vary over time and necessary for our study were included. Thereafter, the process remained pretty much the same for all five measurement periods. Roughly every three

weeks, a new measurement period started with an initial mail to all of the 1087 enrolled participants (see Figure 2 for a detailed timeline of our project).

Even though the n went down from 1087 in t0 to 335 in t5 (~30% of participants remained), a total of 284 participants provided data in every measurement period (~26% of the enrolled participants). The results presented in section 5 are based on the data provided by these 284 participants.

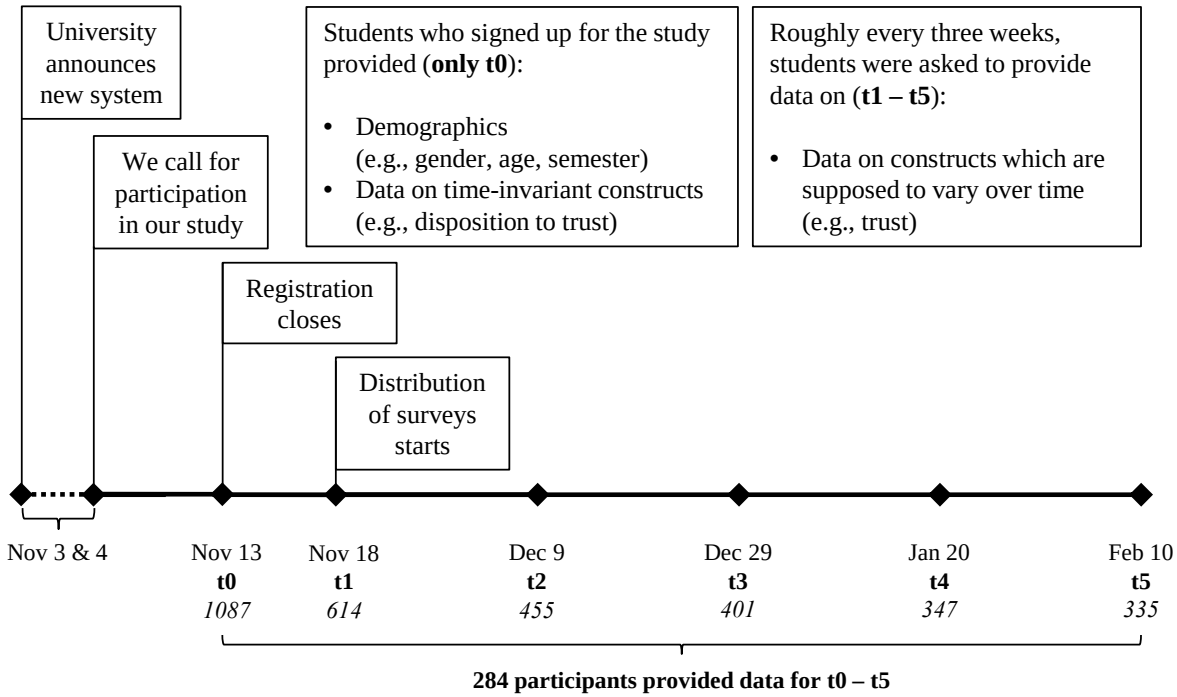

Figure 2. Timeline of our study.

4.2 Data collection and analysis techniques

To avoid problems in our data analysis, we whenever possible relied on indicators that have been published in top tier journals or were recommended by other researchers (e.g., by Petter, Straub and Rai, 2007). All responses were recorded on a bipolar 7-point Likert response format. A complete list of the indicators used in the study can be found in Appendix A.

For analysing our longitudinal data, we mainly relied on latent growth modelling (Serva, Kher and Laurenceau, 2011; Zheng, Pavlou and Gu, 2014). Even though numerous other methods can be used for analysing longitudinal data (for an overview see, Zheng, Pavlou and Gu, 2014), the core strength of latent growth modelling is that it captures changes over time on an individual level. This allows a more detailed analysis of differences on change over time (Duncan and Duncan, 2009; Serva, Kher and Laurenceau, 2011).

To conduct our analysis, we relied on Mplus 7.31 (Muthén and Muthén, 1998-2012) and SmartPLS 3 (Ringle, Wende and Becker, 2015). Since Mplus does hardly support the use of formative measurement models – in fact it is only possible by mixing measurement and structural model – we had to calculate the factor scores of our reflective-formative hierarchical construct (Becker, Klein and Wetzels, 2012) trust in IT artefacts. Therefore, we followed a two-step approach. First, like in every latent growth modelling study, we needed to assess the quality of our measurement models, especially establishing measurement invariance over time for our reflective measurement models, since they serve as the basis for the calculation of the factor scores. If measurement invariance over time is present, the measurement models for the different constructs do not differ over time. Thus, changes over time are

then not caused by changes in the measurement of a construct, allowing researchers to find alternative explanation for changes over time. The results on the respective tests are presented in the beginning of the results section. Second, after evaluating the quality of the measurement models, we relied on the approach provided by Becker, Klein and Wetzels (2012) to compute the respective factor scores. In particular, we used five repeated indicator models mode B which best reflects our reflective-formative hierarchical model, in the SmartPLS 3 software to compute our factor scores.

The factor scores were afterwards used in our latent growth modelling analysis in Mplus.

5 Results

Following the study by van der Werff and Buckley (2014), we first focus on evaluating our measurement models before we continue with investigating the development of trust over time. For assessing model fit, we also follow van der Werff and Buckley (2014), and rely on the following four goodness-of-fit indices: 1) chi-square (chi²) test (Bentler and Bonett, 1980), 2) the comparative fit index (CFI, Bentler, 1990), 3) the Tucker Lewis index (TLI, Bentler and Bonett, 1980), and 4) the root mean square of error of approximation (RMSEA, Steiger, 1990). Regarding the values that indicate of good model fit, Kline (2010) recommends that the chi²/degrees of freedom (df) ratio should be below 3, and the CFI and TLI should be higher than 0.9 (better above 0.95). Furthermore, the RMSEA should be below 0.08, and values below 0.06 indicate great model fit.

5.1 Evaluation of Measurement Models

As already lined out in the research methods section, we modelled trust in IT artefacts as a reflective-formative hierarchical construct and computed the factor scores using SmartPLS 3. Consequently, we start with evaluating the quality of our three reflective measurement models for performance, helpfulness and predictability. We therefore assess the composite reliability, the average variance extracted (AVE), as well as the cross-loadings for the single indicators of the reflective measurement models and the Fornell-Larker criterion. Regarding the cross-loadings, each indicator has the highest loading on its desired construct (lowest indicator loading is 0.816 for Perf4 in t1). Furthermore, the square root of the AVE is always higher than every correlation between two constructs. Since all values for the composite reliability (lowest value is 0.877 for predictability in t1), and the AVE (lowest value is 0.703 for predictability in t1) exceed the thresholds of 0.707 (composite reliability) and .05 (AVE), the reflective measurement models fulfill all quality criteria (Chin, 1998; Hair *et al.*, 2013).

In addition to these quality criteria, we furthermore need to assess measurement invariance over time for our reflective constructs (Ployhart and Vandenberg, 2010). This is important, since without establishing measurement invariance, we cannot be sure that we measure the same construct at each point in time. Consequently, changes over time might simple be created by the fact that we measure different constructs (Chan, 1998). Researchers distinguish between four degrees of measurement invariance (Meredith, 1993; Widaman and Reise, 1997): configural, weak factorial, strong factorial and strict factorial measurement invariance. For being able to interpret latent growth models (LGMs) in a meaningful way, researchers need to at least establish strong factorial measurement invariance (Geiser, 2013). In this case, the following requirements need to be fulfilled a) the same set of indicators is used to measure the same constructs (configural invariance), additionally b) the respective indicators should have equal loading across all measurements (weak factorial invariance), and furthermore c) the mean values for the respective indicators remain equal over time (strong factorial invariance). Such a test can be conducted following a bottom-up approach by adding more and more constraints until strong factorial invariance, and then comparing the changes in model fit (see, e.g., Benlian, 2015). We rely on the alternative top-down approach, and immediately add all constraints necessary to establish strong factorial invariance. The Mplus results (see Table 1) indicate great a model fit for all three reflective constructs, showing that strong factorial invariance is prevalent.

Quality Criteria	Performance	Helpfulness	Predictability
chi² (df)	199.561* (148)	278.895* (148)	62.542n.s. (70)
CFI	0.986	0.962	1.000
TLI	0.982	0.951	1.006
RMSEA	0.035	0.056	0.000

* indicates a significant chi² value at the level of 0.05

Table 1. Fit indices for the models testing for strong factorial invariance.

Last, we need to evaluate whether the formative part of our measurement model fulfils the guidelines by Cenfetelli and Bassellier (2009). Since a) all values for the Variance Inflation Factor (VIF) are below 3.33, b) all weights are significant, and c) we do not observe any negative weights, the formative part of the measurement model fulfils the quality criteria (please see Appendix B for further details).

5.2 Evaluation of the Development of Trust in IT artefacts

Consistent with previous studies (see, e.g., Benlian, 2015) or papers with a methodological focus on latent growth modelling (see, e.g., Duncan and Duncan, 2009; Serva, Kher and Laurenceau, 2011), we first conduct a univariate, unconditional LGM analysis to identify the basic form of our LGM.

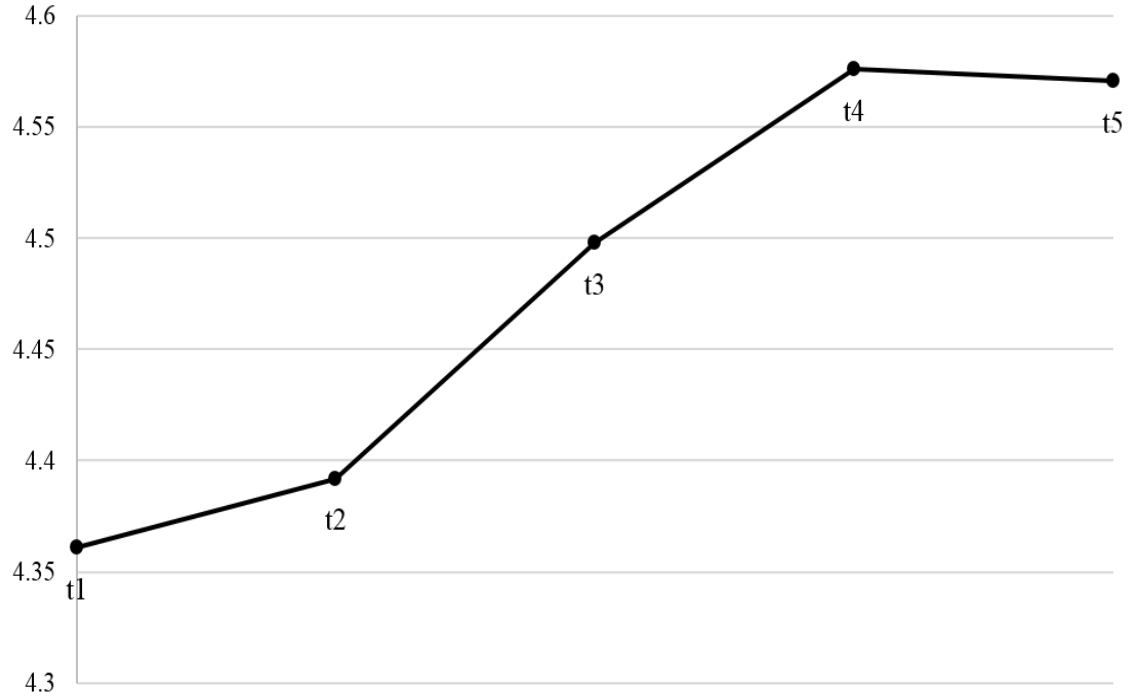

Figure 3. Trajectory of the mean of trust in IT artefacts over time[1].

[1] To avoid confusion, we want to highlight that the scale on the left of our trajectory figures does not reflect the whole scale (1 – 7). Please keep in mind that all trajectories we present are significant, thus growth is present. Thus, the rescaling is not supposed to deceive the reader, but to provide a closer look on the trajectories.

Since a plethora of different LGMs exists (Muthén and Muthén, 1998-2012), we investigate whether our data fits two established forms of LGMs: linear and free-form. Furthermore, like other researchers (see, e.g., Simons-Morton *et al.*, 2004), we take a look trajectory of our model (see Figure 3) that can, e.g., be accessed using Mplus, to see whether other non-linear growth models might also be suitable. The trajectory suggests that a piece-wise LGM might be prevalent, since we observe no – or only a very small – growth between t1 and t2 as well as no – or only a very small negative – growth between t4 and t5, and a linear growth between t2 and t4. Consequently, we compare a piece-wise growth model – assuming no growth between t1 and t2 as well as t4 and t5, and a linear growth between t2 and t4 – to the other two kinds of growth models (see Table 2).

Criterion	Linear model	Free-form model	Piece-wise model
chi² (df)	19.199* (10)	11.632ns (7)	13.462ns (10)
CFI	0.987	0.994	0.995
TLI	0.987	0.991	0.995
RMSEA	0.057	0.048	0.035
MLR scaling factor	1.0945	1.0851	1.1441

* indicates a significant chi² value at the level of 0.05

Table 2. Fit statistics for the different unconditional LGMs.

The results indicate that in general all three model show very good model fit, with the piece-wise model having the highest CFI and TLI values and the lowest value on RMSEA. Furthermore, we observed *significant slopes in all models*, indicating that growth is actually prevalent. Since this piece-wise model and the linear model have both 10 df, but the piece-wise model shows the better fit indices, and also has a lower chi² value, we can conclude that the piece-wise model should be preferred compared to the linear model. To determine whether the piece-wise model should also be preferred compared to the free-form model, we need to conduct a chi² difference test that accounts a) for the variance in df and b) for the MLR scaling factor, since we needed to choose the MLR estimator in Mplus that accounts for issues, such as missing values, kurtosis and skewness, in comparably small data sets, and our 284 observations are still considered quite small (Muthén and Muthén, 1998-2012). Consequently, we rely on the adjusted chi² test (Satorra, 2000; Satorra and Bentler, 2010) to compare the two growth models. The test shows an adjusted chi² difference of 2.196 in favour of the free-form model. However, for a given df difference of 3 (10 – 7), a chi² difference of at least 7.81 needs to be prevalent. To sum up, our results indicate that the basic LGM form is the piece-wise growth, assuming no growth between t1 and t2 as well as t4 and t5, and linear growth between t2 and t4.

After having established the basic form of our LGM, we now focus on investigating whether this form remains stable taking differences among our participants into account. We highlighted that prior research showed that experience impacts trust. Thus, we assess whether the LGM is different for participants that are in their first semester of studies (no experience with prior systems, and no experience with the provider, n = 76) compared to students in the second semester or above (these students have experiences with both, the prior systems and the provider, n = 208). First, we again take a look at the trajectories of trust in IT artefacts for experienced and new students (Figure 4).

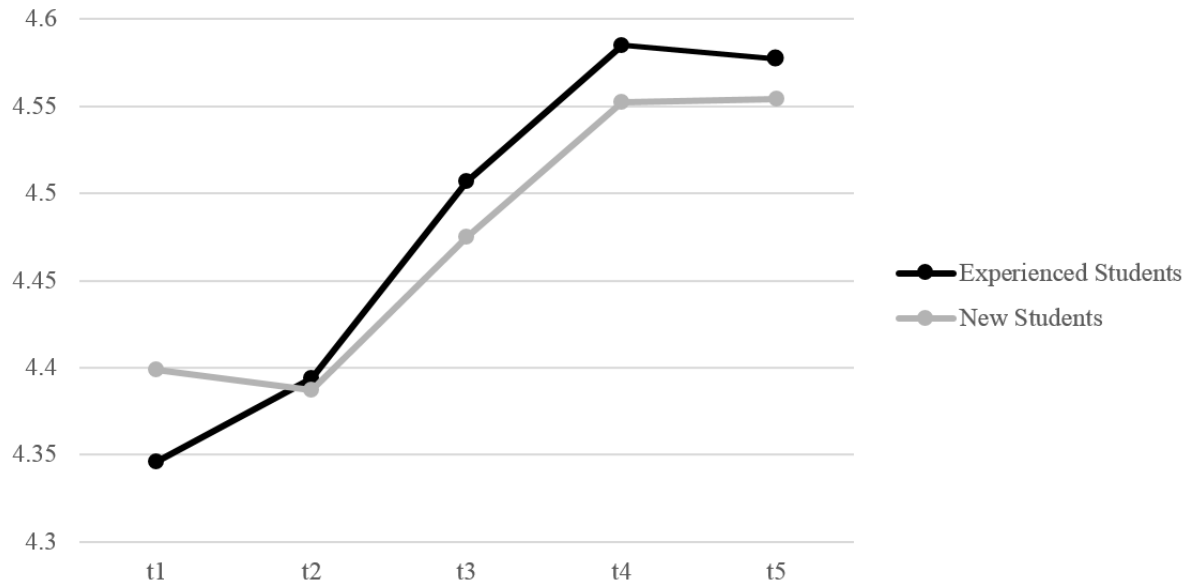

Figure 4. Trajectory of the mean of trust in IT artefacts over time (experienced vs. new students).

Looking at the two trajectories indicates that the LGMs for new and experienced students are quite comparable. For new students, we observe a slightly higher initial level of trust (intercept at t1), followed by a slow decline in t2, and afterwards, we observe the same trend as in our unconditional LGM, a linear growth until t4, followed by a no growth period. For experienced students we observe a lower initial level of trust, followed by a slight growth in t2, and again followed by our well-known pattern – a linear growth until t4 and no growth, or here a very small decrease in trust in t5. These observations already indicate that the development of trust in IS generally holds across differences in experience with prior systems and the provider. To further evaluate this observation, we specify a model in Mplus that constrains the LGM for both model to be equal (equal intercept, slope, variances, correlation between intercept and slope as well as residual variances). The results of the estimation of this model showed a very good fit to the data, chi^2 (30) = 26.346ns, CFI = 1.000, TLI = 1.003, RMSEA = 0.000. Consequently, the empirical evaluation confirms our observation that the form of our LGM remain stable comparing new and experienced students. This indicates that experience with prior systems or the provider has no impact on the development of trust in IT artefacts.

6 Discussion

6.1 Implications to Theory and Practice

Our results provide several important implications to both, theory and practice. Regarding our first research question on how trust in IT artefacts develops over time, we observed a piece-wise growth with an initial no growth period between t1 and t2 – about 3 weeks – a period of linear growth between t2 and t4 – about 6 weeks, and another no growth period between t4 and t5. Regarding our second research question on how stable this development is regarding differences in experience, we could not observe significant differences in the development of trust comparing new and experienced users.

The piece-wise growth is not completely in line with existing theory, since we had expected that the trust building phase starts right after the users started using the system (Gefen, Benbasat and Pavlou, 2008). Instead, we experienced an initial period of no growth before the users started to build trust. Furthermore, the comparison of new and experienced users show that this initial period slightly differs –we need to keep in mind that our model comparison supported the view that the models are identical,

so this there is not empirical support for differences in this phase. We believe that this observation can be explained based on the expectation-confirmation theory (ECT, Bhattacherjee, 2001; Oliver, 1980). ECT has its origins in marketing and suggests that a customer has certain expectation when buying a new product, and once he or she bought the product, he or she forms perceptions about the performance of the product and afterwards determines the extent to which the expectation is confirmed. If the performance does not match the expectations of the customer, disconfirmation is present. This disconfirmation can either be positive – performance is better than expected – or negative. In our case, it seems that this theory helps us to understand the development of trust in a new IS over time. In t1, we measured the users' initial trust in the IS. Afterwards the users determined the extent to which the IS meets their expectations, and they adjust their trust accordingly. Our data indicates that this phase which we call *confirmation of initial trust* lasts for about 3 weeks (t1 – t2). Once this stage is completed, we observed a gradual linear increase of trust in line with the expectation by Gefen, Benbasat and Pavlou (2008) indicating that we entered the trust building stage. In our case, this stage lasted about 6 weeks (t2 – t4), and afterwards the users enter the fourth stage trust stability. Consequently, we revised our theory-based trust lifecycle based on our data, and entered the stage *confirmation of initial trust* between the phases of initial trust building and trust building (see Figure 5). We furthermore added the information that this phase lasts for about 3 weeks, and the information that the trust building phase lasts for about 6 weeks, and the growth follows a linear form.

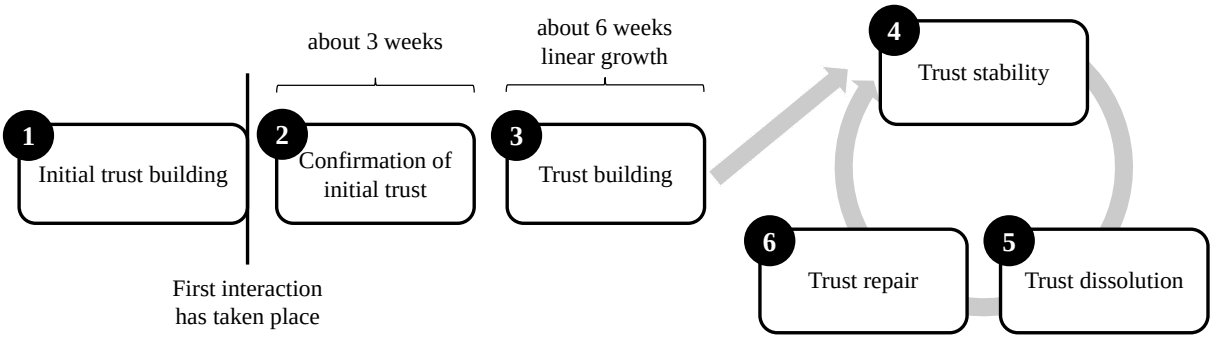

Figure 5. Revised trust lifecycle based on the results of our study.

The fact that we did not find any differences in the development of trust between new and experienced students is surprising, but offers interesting implications for theory and especially practice. This finding indicates that organizations do not need to develop different strategies for ensuring the development of user trust in a new system. Furthermore, an assessment of initial trust in a new system might be a suitable proxy for the overall trustworthiness of all systems in an organization, since we observed higher initial trust by new students as compared to experienced students, and during the confirmation phase these two judgements were adjusted and resulted in identical judgements in t2. Consequently, the new students expected the IS to be more trustworthy and experienced negative disconfirmation – slight decline – whereas the experienced students experienced positive disconfirmation – the system was more trustworthy than expected. As a result one could argue that the initial trustworthiness of this IS compared to the existing ones increased, but is still lower as expected by newcomers. However, we need again highlight that this interpretation is not based on statistically significant differences, since our results indicate that the development of trust for both groups is similar. Consequently, this is an exploratory interpretation, but resembles an interesting avenue for future research.

6.2 Limitations

This study is not without limitations. A first limitation is related to the group of participants in our study – students. Even though there is not a big difference comparing the introduction of a new student information system at a university, and the introduction of a new system in an organization, the differ-

ence in the age of employees of a company is typically higher than of students. Consequently, the average student is typically more tech-savvy than the average employee. However, in our case, the system was rolled out for all students, no matter if they study computer science, business or arts. Here we think, we are faced with a higher heterogeneity compared to the introduction of an organizational system that often only impacts a more homogeneous group of employees. To sum up, our results are to some extent limited to our population – students – but we do not expect the development of trust to be very special in exactly this group of people. Nevertheless, future research should investigate whether our results hold across different groups of users, as well as different cultural and organizational settings. A second limitation is related to the system we used in our study. In reality a plethora of different systems with different design and functionalities exist. Consequently, future research should investigate whether our results hold across different systems, such as enterprise resource planning or customer relationship management systems were prior literature highlighted issues, such as user resistance. A third limitation is related to the trust relationship we investigated. We investigated how people develop trust in IT artefacts – non-human trustee. Consequently, our results are limited to trust relationships between people and IT, and should not be generalized to trust relationship between people (IT-mediated or not). As a result, future research should investigate the development of trust in people, and compare those findings to our findings to identify similarities and differences between human trust building in IT and people. A fourth limitation is related to the duration of our study. We investigated the introduction of a new system for a total of 13 weeks, and could not generate detailed insights on the later stages of the trust lifecycle – especially trust stability, dissolution and repair. Consequently, future research should try to investigate how trust develops in these stages.

7 Conclusion

In this paper, we addressed two research question: 1) how does trust in a new IS develop over time? and 2) how stable this development is regarding differences in experience. Regarding the first question, we observed a piece-wise growth of trust in a new system with an initial no growth period between t1 and t2 – about 3 weeks – a period of linear growth between t2 and t4 – about 6 weeks, and another no growth period between t4 and t5. Regarding our second research question on how stable this development is regarding differences in experience with the provider, we could not observe any differences in the development of trust comparing new and experienced users. Based on our results, and relying on ECT, we introduce a sixth stage to the trust lifecycle, called *confirmation of initial trust*. This stage is right in between the stages of *initial trust building* and *trust building*. Our results further indicate that it takes people about 3 weeks to adjust their initial trust, and afterwards, about another 6 weeks of trust building (we observed a linear growth) until stability is reached.

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Appendix A. Measurement Instrument

Dimension	Indicator	Statement	Source
Trust in IT artefacts (reflective-formative hierarchical construct)			
Performance (reflective)	Perf1	____ has the functionality I need.	McKnight *et al.* (2011)
	Perf2	____ has the features required for my tasks.	
	Perf3	____ has the ability to do what I want it to do.	
	Perf4	____ performs well in helping me to organize my studies	Vance, Elie-Dit-Cosaque and Straub (2008)
Helpfulness (reflective)	Help1	____ supplies my need for help.	Based on McKnight *et al.* (2011)
	Help2	____ provides competent guidance (as needed).	
	Help3	____ provides whatever help I need.	
	Help4	____ provides sensible and effective advice, if needed.	
Predictability (reflective)	Pred1	I am quite certain about what ____ will do.	Gefen and Straub (2004)
	Pred2	I am quite certain what to expect from ____.	
	Pred3*	I do not expect surprising activities of ____.	Schumann *et al.* (2010)
	Pred4	____ deals with me in a predictable way.	

Indicator *Pred3* was dropped due to continuously low loadings across all measurement periods.

Appendix B. Formative Part of the Measurement Model

Construct	Dimension	T	VIF	Factor Weights
Trust in IT artefacts	Performance	t1	2.112	0.438***
		t2	2.178	0.433***
		t3	2.418	0.431***
		t4	2.958	0.419***
		t5	2.829	0.415***
	Helpfulness	t1	1.955	0.443***
		t2	2.186	0.448***
		t3	2.482	0.442***
		t4	2.759	0.429***
		t5	3.108	0.423***
	Predictability	t1	1.273	0.324***
		t2	1.207	0.328***
		t3	1.218	0.324***
		t4	1.333	0.320***
		t5	1.433	0.314***

*** indicates significance at the level of 0.001