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Incorporating trust-in-technology into Expectation Disconfirmation Theory

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ABSTRACT

Continued use of strategic information systems is not always a given. This study proposes that users' trust in the system may influence their satisfaction and continuance intention. While trust has been found to have strategic implications for understanding consumers' technology usage, relatively little research has examined how trust's influence operates over time. To gain insight into trust's influence on strategic system usage over time and to explain how trust relates to satisfaction and continuance intention, we integrate trust-related constructs with the Complete Expectation Disconfirmation Theory (EDT) Model. Our results demonstrate that trust plays a central role in the EDT process and that the EDT process helps explain trust's role more completely. The study shows that technology trusting expectations influence trusting intention through performance, disconfirmation, and satisfaction. We also show that technology trusting intention adds predictive power to EDT's satisfaction construct as together they predict usage continuance intention. For research, our results provide a strong combined EDT and trust theory base for future studies that examine expectation management and system development projects. For practice, our study informs systems implementation strategies for technologies that have fewer human-like characteristics and more technology-like characteristics. Our findings underscore that managers need to adopt an EDT process-based view when seeking to build trust, satisfaction, and continuance intention in strategically important information systems.

1. Introduction

Strategic information systems like ERP systems can enhance operations by allowing lower-level employees to act more autonomously and make decisions that were once relegated to mid- and upper-level management (Bloom et al., 2010). Despite these benefits, workers' satisfaction and continued use of these systems is not always assured. For example, Dorset County Council in the UK recently implemented a multi-million-pound ERP system that staff is unsatisfied with because jobs that used to take only a minute now take an hour (Dorset Echo, 2010). As another example, Infosys Technologies Ltd. implemented a customer relationship management system that sales and delivery personnel initially accepted, but did not continue using because it was difficult to use, and did not provide real-time information sharing (Chatterjee and Watson, 2006).

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These examples illustrate the need to increase satisfaction and continued use of strategic information systems among lower-level, front-line users.

One way in which this might be done is by increasing users' trust in technology. Trust plays an important role in many organizational strategies involving information systems (IS) such as e-commerce (Gefen et al., 2003), virtual teams (Kanawattanachai and Yoo, 2002), and inter-organizational relationships (Nicolaou et al., 2011). Most past IS trust research has examined trust in humans or human organizations such as the e-commerce vendor, virtual team member, or trade partner. However lately, despite differences between human-technology exchanges and interpersonal exchanges, more and more researchers acknowledge that many people also trust the technological artifact itself. This type of trust is what we mean by trust in technology. This view of human-technology relationships has motivated researchers to study trust in strategic IS applications such as online recommendation agents (Wang and Benbasat, 2005), business information systems (Lippert and Swiercz, 2005; Lippert, 2007), m-commerce portals (Vance et al., 2008), and knowledge management systems (Thatcher et al., 2011).

While this emerging research area finds that trust in technology plays an important role in IT adoption, it is unclear how technology trusting expectations and subsequent experiences with the technology contribute to important IT-related outcomes. Understanding how trust relates to outcomes such as satisfaction or continuance intention is important, because they can shape long-term use of strategically important IT. When users' hands-on experience with a technology matches their technology trust expectations, users may express higher satisfaction and continuance intentions. By contrast, unmet expectations may have negative consequences that could lead users to not use or abandon the technology. For example, one reason for the failure of the customer relationship management system for Infosys was unmet user expectations. IS researchers agree that expectation management is a key component of system development and implementation success or failure (Al-Mashari et al., 2003; Brown et al., 2012; Ginzberg, 1981; Lyytinen and Hirschheim, 1987).

In this study, we use Expectation Disconfirmation Theory (EDT) to better understand how technology trusting expectations influence subsequent usage perceptions and outcomes. EDT explains how IS users follow a process of expectation formation, trial, and disconfirmation to form satisfaction and continuance intentions (Bhattacherjee and Premkumar, 2004). IT *expectations* means projections of how the technology will perform in the future in terms of certain attributes (Bhattacherjee and Premkumar, 2004; Spreng and Page, 2003). *Disconfirmation* means the extent to which a technology performs either better or worse than one initially expects on those attributes (Bhattacherjee and Premkumar, 2004). Examining the relationship between expectations and subsequent experiences using EDT is an important area of inquiry in many domains including IS (see Brown et al., 2008 for a discussion). Linking EDT with trust in technology seems natural because trust researchers have described trust-building as an expectation–disconfirmation process (Lewicki and Bunker, 1995; Lewicki et al., 2006). Further, by integrating two research streams—trust-in-technology and EDT, research can provide a richer understanding of both phenomena (Venkatesh et al., 2011). Using all the EDT variables along with trust provides a more complete way of examining how trust and expectations work. Not only can it help explain the technology trust-building process, it can expand the generalizability and applicability of the EDT model. By teasing out these complex relationships, trust-in-technology research could provide practical guidance for software developers and organizations implementing strategic IS.

This study advances our understanding of trust's role in the EDT process for strategic IS by integrating two trust-in-technology components, technology trusting expectations (expectations that the technology has desirable attributes) and technology trusting intention (the willingness to depend on a technology), with the Complete EDT Model (Oliver, 1997). Using both technology trusting components preserves the dual meaning of trust (as beliefs and an intention) as depicted in prominent trust research (Mayer et al., 1995; Rousseau et al., 1985). Also, this research underscores that a technology or IT artifact, rather than an organization or e-vendor, may serve as the EDT trust object.

This integrative research contributes in two ways to the theoretical understanding of trust, EDT, and information systems strategy. First, we incorporate technology trusting expectations into our EDT model. Prior IT EDT literature has examined various IT-related expectations such as usefulness and ease of use (Bhattacherjee and Premkumar, 2004; Brown et al., 2008; Venkatesh et al., 2011), and information, system, and service quality type expectations (Bhattacherjee, 2001; McKinney et al., 2002) (see Table 1 for sample IT EDT studies). One study that examines trust-related expectations uses *human-like* technology-trust attributes (integrity, competence, and benevolence) (Venkatesh et al., 2011). We build on this research by using *technology* trusting expectations (see McKnight et al., 2011) that are based on system-like technology trusting attributes (reliability, functionality, and helpfulness). We demonstrate that these system-like technology trusting attributes conceptually relate to the more human-like attributes and argue that they may be more appropriate to use for less human-like technologies like business information systems. Our research contributes by being the first that connects system-like trust expectations to EDT.

Second, we incorporate technology trusting intention into EDT. We empirically investigate how technology trusting expectations influence technology trusting intention *through performance, disconfirmation, and satisfaction*. While IT trust research finds a direct relationship between trusting expectations and trusting intention (Lowry et al., 2008), this study contributes by examining the indirect relationship between trusting expectations and trusting intention through EDT variables. Individuals first assess the technology's performance and whether the performance was better or worse than initially expected before deciding their willingness to depend on the system. By including disconfirmation and performance in the research model, we examine this process. We also demonstrate that usage continuance intention is predicted by both satisfaction and trusting intention toward the system. While EDT research finds the first effect and trust research the latter, this is the first study to our knowledge to hypothesize and show how their effects complement each other.

Table 1
Sample IT EDT studies (partially adapted from Lankton and McKnight (2012)).

Study	EDT paths[a]	Focal attribute(s)	Technology
Bhattacherjee (2001)	D → S	Experience, service level, overall	Online banking
Bhattacherjee and Premkumar (2004)	E → D, E → S, D → S	Usefulness	Computer-based training, development software
Bhattacherjee et al. (2008)	D → S	Usefulness	Document management system
Brown et al. (2008)	E → S	Usefulness, ease of use	Common banking system
Deng et al. (2010)	D → S, P → S	Service level, benefits, performance	Mobile Internet service
Hsu et al. (2006)	D → S	Experience, service level, overall	e-Commerce website
Khalifa and Liu (2003)	D → S, P → D, P → S	Overall offerings	Online knowledge community
Khalifa and Liu (2002–2003)	E → D, D → S, P → D, P → S	Overall offerings	Online knowledge community
Kim et al. (2009)	E → D, E → S, D → S, P → D	Experience, service, overall	e-Commerce websites
Lankton and McKnight (2012)	E → D, E → P, E → S, D → S, P → D, P → S	Usefulness, ease of use	Database software
Lankton and Wilson (2007a)	E → S	Usefulness, ease of use, enjoyment	e-Health
Lankton and Wilson (2007b)	E → P, E → S, P → S	Responses, communication, access, information	e-Health
Limayem et al. (2007)	D → S	Experience and benefits	Internet
Lin et al. (2005)	D → S	Overall experience and service level	Web portal
McKinney et al. (2002)	No structural model	Information and system quality	Internet
Premkumar and Bhattacherjee (2008)	E → D, E → S, D → S, P → D, P → S	Ability, knowledge, flexibility, grades	Computer-based training
Suh et al. (1994)	D → S, P → S	Information and system quality	Business application
Susarla et al. (2003)	E → S, D → S, E → P, P → S	Functional capability, technical service guarantees	Application service provider
Szajna and Scamell (1993)	E → S	Level of MIS and management support	Organizational system
Thong et al. (2006)	D → S	Experience and overall service levels	Mobile Internet service
Venkatesh and Goyal (2010)	E → S	Usefulness	Human resource IS
Venkatesh et al. (2011)	E → D, E → S, D → S	Usefulness, ease of use, facilitating conditions, trust	e-Government system

[a] E = Expectations, D = Disconfirmation, P = Performance, S = Satisfaction.

We test our proposed research model using student subjects learning to use a database software application. This context contributes to the strategic information systems literature because database software is a key organizational asset. To realize value from such systems, entry-level workers or those just undergoing training for such systems must form continuance intentions. These intentions often lead to organizations implementing even more crucial strategic systems such as data warehouses and dashboards. For example, because of its continuing success with an SAP ERP system, Unipart Group, a third party logistics provider, was able to also implement a dashboard system that helps employees spend less time collecting data and more time analyzing it (http://www54.sap.com/solutions/analytics/business-intelligence/customer-reviews.html).

2. Technology trusting expectations

Technology trust researchers use various attributes to represent technology trusting expectations. For example, recognizing that people often ascribe human-like attributes to technology, Wang and Benbasat (2005) chose three common interpersonal trust attributes—competence, integrity, and benevolence—to study Internet recommendation agents. In this case, applying human-like trust attributes to online agents is appropriate, because these agents provide interactive functions and customized advice—much as human advisors would. However, this may not be the case with every IT. For example, some business information systems are less interactive and have fewer human-like attributes than do recommendation agents. It may be unnatural for individuals to think that these systems possess human traits like integrity, competence, or benevolence. In this circumstance, ascribing human-like traits to a non-human-like object is probably an unwarranted anthropomorphism (McKnight, 2005). Instead, it may be more natural for individuals to ascribe system-like technology trusting attributes to these technologies.

In our study, we examine the three system-like expectations: functionality, reliability, and helpfulness. These trusting expectations have been used to study trust in less human-like technologies (Lippert and Swiercz, 2005; Muir and Moray, 1996; McKnight et al., 2011; Thatcher et al., 2011).[3] Not only are these attributes more appropriate for studying trust in more

[3] Trust-building, risk ameliorating characteristics distinguish these three trust-in-technology expectations from system quality and other technology expectations including perceived usefulness and ease of use. For example, while system quality expectations like reliability are geared toward satisfying the user through the expectation–disconfirmation process, they are not geared towards also developing user trusting intention through this process. We chose reliability based on trust theory—because for users to depend on the system, reliability is crucial. System quality researchers select attributes like reliability for other reasons, including whether it describes a technology standard or value (Nelson et al., 2005). Also, system acceptance researchers have developed usefulness and ease of use expectations to predict subsequent system use (Bhattacherjee and Premkumar, 2004; Davis, 1989). These expectations are also less geared towards reducing risk and developing user trusting intention than our trusting attributes. In sum, the ability to build trusting intention and to address risk differentiates our attributes from system quality or other expectations.

system-like technologies because they depict how a technology demonstrates trust, they are conceptually connected to Wang and Benbasat's (2005) human-like technology trusting attributes. Functionality can be mapped conceptually to competence, reliability to integrity, and helpfulness to benevolence based on how each trustee (the human versus the technology) demonstrates the attribute. Table 2 maps human-like trusting expectations to system-like trusting expectations. For example, to demonstrate competence, human trustees can perform a task well, give good advice, or make a good decision (Table 2: row 1, column 3). A business information system cannot perform all these tasks. It can only perform a function well or provide features the user needs to accomplish some task (row 1, column 6). The software does not do the whole task, but plays a 'limited partner' role by providing the person task-related tools. The user would ascribe high ability-like perceptions to software that does this well. Since providing features for a task is often considered a software function, it forms a functionality-providing software attribute. Researchers call this attribute functionality, and define it as the expectations that the specific technology has the capability, functionality, or features to do for one what one needs to be done (McKnight et al., 2011; Thatcher et al., 2011). Functionality is a trust expectation because it can reduce task-related risks. For example, because Microsoft Word has the functionality to produce tables, one can format a paper. If it did not have this functionality, one's paper formatting goal would be thwarted.

A human trustee demonstrates integrity by keeping commitments, telling the truth, and by being reliable and consistent (Table 2: row 2, column 3). Integrity's essence is that you do what you say you will do, so people can rely on you. Software has no volition and therefore cannot make and keep *explicit* promises. Yet each piece of software comes with the *implicit* promise or commitment that it will function reliably (row 2, column 6). For example, people could not trust Microsoft Excel if it did not calculate correctly, which was a recent problem (Raby, 2008). A software trustee can demonstrate integrity by performing its functions the way it is designed to perform them—reliably and consistently. This concept's core meaning is to operate reliably, so it is named reliability, meaning the degree to which one expects that the technology will consistently operate properly (McKnight et al., 2011).

Humans demonstrate benevolence by acting in the trustor's best interest, showing concern, and being helpful, supportive, and responsive to the trustor (Table 2, row 3, column 3). Software does not possess these human motives and felt responsibilities. Individuals may have a difficult time attributing volition or moral agency to more system-like information systems (McKnight et al., 2011). While a technology cannot be benevolent (i.e., caring), it can be responsive to user needs and questions based on the designer's intentions or motives (Lee and Moray, 1992). For example, software agents can be programmed to greet users, engage in small talk, and inform users that they care about their needs (Cassell and Bickmore, 2000; Wang and Benbasat, 2005). Software can also be programmed to address users' interests by providing helpful and responsive user aid through a help function. Since this is not the volitional, moral, caring benevolence people display, it is called helpfulness, meaning the degree to which one expects the software will provide adequate and responsive help for users (McKnight et al., 2011). By being helpful, the risk that the software might cause harm to the user as it carries out its functions and processes is reduced. Users may need systems to help them with certain questions or needs, regardless of how well built systems are.

In summary, we posit that IT users have an overall technology trusting expectation that is composed of separate, yet related, expectations about the software's functionality, reliability, and helpfulness. The three trusting expectations display theoretically and practically important properties. First, they build on existing trust theory by representing the ability, integrity, and benevolence attributes most commonly used in human-like trust research. Second, they do not reify the technology.

Table 2
Conceptual mapping of technology trusting attributes.

Human-like technology trust			System-like technology trust		
Attribute	Basic meaning (Mayer et al., 1995)	Demonstrating the attribute: What a human trustee can do for the trustor	Attribute	Basic meaning (McKnight et al., 2011)	Demonstrating the attribute: What a technology trustee can do for the trustor
Ability/competence	Having a group of skills, competencies, and characteristics that enable a party to have influence within some specific domain	Perform a task well, provide good advice, give a good speech, make a good decision	Functionality	Having the functions or features needed to accomplish one's task(s)	Perform a function for the user, provide system features the user needs to do a task, provide the user appropriate functionality
Integrity	Adhering to a set of principles that the trustor finds acceptable	Keep commitments, tell the truth, exemplify moral principles, show sincerity, negotiate honestly, be reliable, consistent	Reliability	Continually operating properly or in a flawless manner	Perform functions reliably, do what the function says it will do, give accurate and unbiased facts and information, calculate correctly, do not crash
Benevolence	Wanting to do good to the trustor, aside from an egocentric profit motive	Do things in the trustor's best interest, be helpful and supportive, be responsive to the trustor's needs, show concern and caring	Helpfulness	Providing adequate and responsive aid	Provide help, understand and cater to needs, do not cause harm, be responsive to user needs and requests

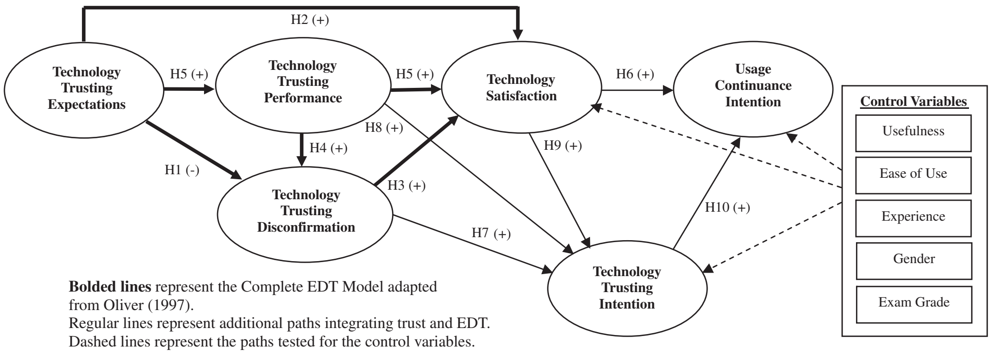

Fig. 1. Research model integrating EDT and trust in technology.

They reflect what technology can realistically do for the human trustor, not what another human can do for the trustor. Third, these attributes represent a remedy for felt risks and uncertainties about whether the technology can do what they want it to do. Unless the technology is reliable, functional, and helpful, individuals may fail in the task for which they depend on it. Thus, these technology-trusting expectations allay risk.

Consistent with prior research, we conceptualize these three technology trusting expectations as first-order factors constituting the overall technology trusting expectation, performance, and disconfirmation second-order constructs (McKnight et al., 2002a; Thatcher et al., 2011; Wang and Benbasat, 2005). We model the first-order dimensions as reflective (not formative) constructs of the second-order trust factors for reasons discussed in Hardin et al. (2008) and Polites et al. (2012). First, trust components tend to be consistent with each other due to human cognitive consistency tendencies (McKnight et al., 1998). Prior research finds that the first-order dimensions covary strongly (McKnight et al., 2002a; Wang and Benbasat, 2005). Further, most theory depicts trust as a psychological construct that exists apart from any attempt to measure it. Hence, trust will influence its components. Finally, we use reflective first-order factors because we are interested in the generalizability of the trust measures rather than in explaining variance in the trust concept itself.

3. Research model and hypotheses development

The research model integrates technology trusting expectations and technology trusting intention with the Complete EDT Model (i.e., the Complete Expectation Disconfirmation with Performance Model, Oliver, 1997) (Fig. 1). While IT EDT researchers have examined different EDT models that employ subsets of the EDT constructs and examine different paths among these constructs (Table 1), we use the Complete EDT Model because our study focuses on understanding the trust-building expectation–disconfirmation process. To fully model trust's role in the EDT process, it is necessary to examine the Complete EDT Model as it depicts the full set of theoretical relationships among expectations, performance, disconfirmation, and satisfaction (Oliver, 1997).[4] By doing so, our research contributes to the IT literature by increasing understanding of how the expectation–disconfirmation process forms satisfaction with IT (Lankton and McKnight, 2012) (Table 1). In this section we first present hypotheses (H1–H5) for the Complete EDT Model, and then hypotheses (H6–H9) for the paths relating to technology trusting and usage continuance intention.

3.1. The Complete EDT Model

The Complete EDT Model depicts how trusting expectations relate to disconfirmation (Oliver, 1997). Typically, this is a negative relationship. Expectations represent a comparison standard that provides a point of reference for judgments about performance. Higher expectations are more likely to be negatively disconfirmed (i.e., performance perceived as lower than expected) as it is more difficult for performance to meet the higher expectations. For example, one's expectation of breaking the world high-jump record is likely to be negatively disconfirmed. Likewise, lower expectations are more likely to be positively disconfirmed (i.e., performance perceived as greater than expected) as the standard is more easily achieved (Oliver, 1977). For example, one's expectation of earning at least a "C" grade is likely to be positively disconfirmed. Trust theory also explains how individuals undergo a disconfirmation process and compare the trustee's behaviors to their initial expectations suggesting that expectations play a key role in forming disconfirmation comparisons (Kim and Tadisina, 2007; Lewicki et al., 2006; Lindskold, 1978). Further, research finds a negative relationship between trusting expectations and disconfirmation for a website (Venkatesh et al., 2011).

[4] Researchers suggest that the direct measurement of disconfirmation can distort the joint effects of expectations and performance on outcomes (Irving and Meyer, 1995). However, by including both expectations and performance in our model in addition to disconfirmation, we are able to hypothesize and test for these effects.

H1. Technology trusting expectations will negatively influence technology trusting disconfirmation.

The Complete EDT Model also posits that expectations and disconfirmation positively predict satisfaction (Oliver, 1997). The expectation → satisfaction link represents an assimilation effect, meaning that if individuals find the difference between initial expectations and technology performance small enough they will rely on initial expectations when forming satisfaction. The disconfirmation → satisfaction link represents a contrast effect, whereby the difference between initial expectations and technology performance is large enough that individuals will magnify and rely on the discrepancy when evaluating satisfaction (Oliver, 1997). If the discrepancy is positive (i.e., performance is better than expected), individuals feel more pleasure and are more satisfied than if the discrepancy is negative (i.e., performance is worse than expected) (Spreng and Page, 2003). Assimilation and contrast effects occur in trust relationships as sometimes individuals emphasize differences between themselves and others whereas sometimes they emphasize similarities (Lewicki et al., 2006). This in turn can lead to positive or negative affect. For example, an individual who focuses on trust violations may be less satisfied than an individual who focuses on common identities (Lewicki et al., 2006).

H2. Technology trusting expectations will positively influence technology satisfaction.

H3. Technology trusting disconfirmation will positively influence technology satisfaction.

In the Complete EDT Model, performance has two roles. First, it relates positively to disconfirmation because holding expectations constant, the higher the performance, the more likely performance will exceed expectations, resulting in positive disconfirmation (Spreng and Page, 2003). Technology trusting performance should influence technology trusting disconfirmation because in trust relationships individuals attend to evidence of one's trustworthy behaviors or their trusting performance when deciding whether to confirm or disconfirm behavior (Lewicki et al., 2006). In fact, trust evolves from seeing the trustee in different contexts, and experiencing the trustee's behaviors.

H4. Technology trusting performance will positively influence technology trusting disconfirmation.

Performance's second role is mediating the relationship between expectations and satisfaction. This mediating role can better reflect the assimilation effect of performance on expectations in creating satisfaction than can the direct influence of expectations (Spreng et al., 1996). If individuals perceive the discrepancy between technology trusting expectations and performance is small enough, performance should have a significant mediation effect.

H5. Technology trusting performance will mediate the relationship between technology trusting expectations and technology satisfaction.

3.2. Trusting and continuance intention hypotheses

In the EDT literature, satisfaction leads to the intent to perform a behavior, usually a repurchase behavior (Oliver, 1980). Learning theorists and consumer behaviorists have long contended that satisfying or pleasurable experiences are more likely to be repeated (Oliver, 1980; Thorndike, 1911). Recalling that satisfaction is an affect-type variable, indirect support for this link comes from TRA, which posits that attitude toward using the system (an affect variable) influences intentions. In IT research, satisfaction leads to the intent to use a technology because users who find the system use experience more pleasing are more likely to continue using it (Bhattacherjee and Premkumar, 2004).

H6. Technology satisfaction will positively influence usage continuance intention.

We present three hypotheses that integrate technology trusting intention and EDT. The first relates to the relationship between disconfirmation and trusting intention. While disconfirmation's main influence in EDT is through satisfaction, researchers find that in some contexts it can also influence intentions (Bhattacherjee and Premkumar, 2004). Positively disconfirming one's expectations during the trial period assures one that the software will work, increasing one's willingness to depend on the technology. Negatively disconfirming expectations will lead one to doubt future outcomes with the software, decreasing willingness to depend on the technology. Stated another way, having an experience with the technology that is worse than expected will lower one's willingness to be vulnerable to it. This is supported by research about how positive experiences with the trustor can increase intentions to trust (Deutsch, 1973; Lewicki and Bunker, 1995), and more specifically by research about how positively disconfirmed trusting expectations can lead to increased trusting intention (Lewicki et al., 2006).

H7. Technology trusting disconfirmation will positively influence technology trusting intention.

We also predict that performance will positively influence technology trusting intention. Having positive experiences with a technology means that the trustor (i.e., the software) has demonstrated it has trustworthy attributes. Because of this, users will be more willing to depend on the technology and become vulnerable to it. This is supported by research about how positive experiences with the trustor can increase intentions to trust (Deutsch, 1973; Lewicki and Bunker, 1995), and empirical work finding that in some contexts performance influences intentions (Mittal et al., 1998). Further, some researchers suggest that trusting intention is an attitude because it represents a trustee's evaluative stance toward a trustor (Benamati et al., 2010). Based on the prediction from the theory of reasoned action that beliefs influence attitudes, and empirics showing that trusting beliefs influence trusting intention (Benamati et al., 2010), we propose the following:

H8. Technology trusting performance will positively influence technology trusting intention.

Satisfaction can also influence trusting intention. Consumer research finds that in a risky situation, people anticipate possible negative consequences (Cooke et al., 2001). Product satisfaction decreases the felt risk of negative outcomes, making it easier to make the leap of faith required to have trusting intention (i.e., to be willing to depend on that product). Satisfaction can thus increase trusting intention by increasing the likelihood of willingness to depend. Also, a consumer who finds an interaction more emotionally pleasing will be more likely to depend on the trustor in the future. Empirical research finds that satisfaction increases trust within job relationships (Garbarino and Johnson, 1999).

H9. Technology satisfaction will positively influence technology trusting intention.

We predict that trusting intention will influence usage continuance intention. Trusting intention is important for long-term interpersonal relationships (Morgan and Hunt, 1994). When one has trusting intention, one makes a conscious choice to put aside doubts and move forward with the relationship (Holmes, 1991). Being willing to depend on the trustor is a volitional preparedness to make oneself vulnerable and is typically demonstrated by engaging in trusting behaviors (McKnight et al., 2002a). Because it is difficult to measure behaviors, many studies instead examine the relationship between trusting intention and other behavioral intentions. For example, researchers find that trusting intention influences intentions to make online purchases, share personal information, and re-use web services (Jarvenpaa et al., 2000; McKnight et al., 2002b). Consumers have decided to depend on the e-commerce vendor by engaging in transactions that may entail risks including not receiving purchased goods or identity theft. Similarly, technology trusting intention can also lead to future technology use intention. This means one with high technology trusting intention will intend to continue using the technology in the future to complete tasks and accomplish goals.

H10. Technology trusting intention will positively influence usage continuance intention.

We include the effect of five control variables on satisfaction, trusting intention, and continuance intention. Four of these control variables, usefulness, ease of use, gender, and experience have been shown to influence these factors in EDT and other acceptance research (Bhattacherjee and Premkumar, 2004; Venkatesh et al., 2003, 2011). We also control for respondents' grade on a software skills exam.

4. Methodology

We test the model with students learning to use Microsoft Access, which is an appropriate technology for our study because it is representative of larger scale strategic database systems like ERP systems. Also, Access is an IT that has fewer human-like and more system-like characteristics than do online recommendation agents. For example, online recommendation agents typically display images and/or animation that communicate with the user. These features increase a technology's humanness and individuals' ability to respond to it like it is human (Cyr et al., 2009; Baylor and Ryu, 2003; Gefen and Straub, 2003). Access does not have animation or images. Also, by helping consumers find suitable products, recommendation agents may appear more responsive and interactive (and thus more human-like—see Wang et al., 2007) than Access, in spite of its help function. Thus, more system-like technology trusting expectations are likely to apply to Microsoft Access.

Our students were business undergraduates enrolled in an IS course in the Midwest U.S. They are appropriate for three reasons. First, business students form a fairly homogeneous sample that controls for extraneous factors. Second, student subjects who have limited experience with the target technology can represent entry-level employees using common business software (Bhattacherjee and Premkumar, 2004). A recent meta-analysis of the technology acceptance model found that differences between students and employed respondents were minimal (King and He, 2006). Third, the course setting suggests subjects will have Access-related trusting expectations. Trust becomes more salient with increases in risk and uncertainty (Mayer et al., 1995), and students feel uncertain about how Access will perform. While the students learned about Access in a controlled computer lab, they did their assignments on their own computers or in outside labs. This makes it possible to encounter Access problems that could harm their grade. Given that Access work accounted for 8% of their grade, subjects felt Access-related course risk. To confirm this, we asked 31 students taking the same course in a different semester, "Considering what you do on Microsoft Access for school, how would you rate the overall risk of doing your school assignments using Microsoft Access:" Responding on a scale from (1) extremely low to (7) extremely high, respondents' mean response was 3.26. This suggests that respondents felt a modest level of risk in their use of Access.

Subjects were 48% male and their prior average Access experience was 2.9 on a 1 (no experience) to 7 (extensive experience) scale. The average grade on an Access skills exam given after the study was 83%.

Table 3
SPSS factor loadings and cross-loadings.[a]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Reliability E 1	**.85**	.04	.07	.01	.11	.04	.09	.08	.02	.03	.01	.08	.09	.01
Reliability E 2	**.91**	.05	.04	.03	.09	.05	.07	.11	.02	.02	.05	.00	.02	.05
Reliability E 3	**.80**	.12	.02	.08	.20	.00	.02	.05	.03	.00	.02	.07	.12	.06
Functionality E 1	.08	**.86**	.01	.00	.06	.04	.02	.02	.07	.05	.03	.05	.06	.02
Functionality E 2	.01	**.93**	.00	.01	.05	.04	.00	.00	.06	.02	.01	.00	.04	.03
Functionality E 3	.04	**.90**	.09	.01	.05	.01	.02	.03	.01	.03	.03	.01	.03	.04
Helpfulness E 1	.00	.00	**.94**	.03	.03	.00	.03	.00	.01	.03	.07	.01	.03	.03
Helpfulness E 2	.00	.03	**.96**	.01	.05	.05	.01	.00	.02	.02	.06	.06	.01	.01
Helpfulness E 3	.05	.12	**.82**	.04	.01	.09	.06	.00	.04	.02	.00	.06	.01	.04
Reliability P 1	.02	.07	.02	**.73**	.01	.00	.08	.14	.03	.01	.12	.01	.02	.07
Reliability P 2	.00	.07	.08	**.87**	.07	.02	.02	.02	.02	.04	.01	.03	.00	.03
Reliability P 3	.02	.06	.06	**.74**	.04	.09	.22	.10	.05	.02	.01	.07	.03	.02
Functionality P 1	.05	.00	.03	.14	**.61**	.03	.01	.07	.01	.03	.01	.11	.12	.15
Functionality P 2	.03	.05	.01	.09	**.76**	.04	.01	.05	.11	.03	.09	.04	.07	.01
Functionality P 3	.00	.09	.00	.04	**.68**	.07	.06	.12	.04	.01	.08	.04	.16	.04
Helpfulness P 1	.01	.01	.03	.00	.06	**.89**	.02	.05	.01	.02	.08	.02	.01	.03
Helpfulness P 2	.02	.02	.01	.03	.02	**.75**	.00	.02	.17	.02	.01	.05	.06	.09
Helpfulness P 3	.01	.03	.02	.04	.09	**.68**	.04	.03	.17	.01	.01	.05	.05	.13
Reliability D 1	.03	.02	.00	.02	.04	.04	**.82**	.13	.03	.00	.06	.01	.01	.04
Reliability D 2	.03	.01	.04	.02	.02	.01	**.70**	.03	.03	.04	.04	.07	.03	.07
Reliability D 3	.05	.03	.03	.13	.00	.05	**.69**	.05	.11	.06	.07	.01	.04	.03
Functionality D 1	.02	.00	.04	.03	.05	.02	.05	**.80**	.03	.04	.02	.01	.09	.02
Functionality D 2	.02	.01	.01	.02	.02	.04	.08	**.85**	.02	.03	.02	.02	.01	.06
Functionality D 3	.01	.00	.03	.01	.01	.01	.03	**.84**	.04	.01	.07	.05	.01	.01
Helpfulness D 1	.07	.02	.02	.04	.02	.16	.02	.02	**.80**	.07	.06	.04	.05	.07
Helpfulness D 2	.00	.01	.01	.01	.02	.02	.00	.03	**.93**	.00	.04	.03	.01	.00
Helpfulness D 3	.04	.04	.02	.01	.01	.02	.02	.00	**.89**	.02	.02	.03	.06	.09
Satisfaction 1	.01	.09	.02	.01	.14	.08	.05	.03	.15	**.50**	.17	.06	.09	.18
Satisfaction 2	.05	.02	.01	.04	.04	.06	.06	.03	.02	**.68**	.09	.00	.02	.23
Satisfaction 3	.03	.02	.03	.00	.06	.10	.02	.05	.03	**.91**	.04	.02	.01	.10
Satisfaction 4	.02	.05	.03	.12	.06	.03	.01	.04	.06	**.76**	.06	.07	.04	.02
Trusting intention 1	.00	.03	.03	.05	.04	.07	.04	.08	.06	.04	**.83**	.01	.01	.00
Trusting intention 2	.07	.03	.01	.04	.04	.02	.06	.02	.05	.01	**.85**	.04	.02	.07
Trusting intention 3	.05	.05	.00	.05	.01	.04	.07	.01	.03	.02	**.82**	.03	.05	.05
Trusting intention 4	.02	.02	.01	.02	.02	.05	.05	.08	.04	.06	**.74**	.05	.08	.02
Continuance intention 1	.01	.00	.00	.03	.03	.01	.05	.01	.04	.01	.02	**.92**	.04	.01
Continuance intention 2	.00	.01	.00	.05	.04	.04	.02	.03	.01	.03	.01	**.94**	.01	.00
Continuance intention 3	.00	.03	.01	.01	.01	.08	.04	.01	.04	.02	.02	**.94**	.01	.00
Usefulness 1	.01	.01	.01	.01	.04	.02	.02	.04	.03	.01	.06	.01	**.91**	.01
Usefulness 2	.01	.04	.02	.00	.00	.02	.03	.01	.02	.00	.05	.02	**.94**	.01
Usefulness 3	.02	.02	.01	.01	.02	.04	.02	.02	.00	.01	.03	.04	**.95**	.02
Usefulness 4	.02	.03	.02	.01	.05	.03	.07	.01	.00	.05	.00	.05	**.78**	.02
Ease of use 1	.02	.02	.00	.12	.09	.04	.02	.02	.05	.02	.18	.04	.00	**.71**
Ease of use 2	.03	.01	.02	.03	.06	.07	.04	.11	.04	.01	.01	.00	.05	**.86**
Ease of use 3	.02	.04	.04	.03	.06	.05	.07	.03	.05	.06	.03	.01	.02	**.80**
Ease of use 4	.04	.05	.03	.02	.06	.05	.10	.01	.01	.06	.00	.07	.08	**.73**

E = Expectations, P = Performance, D = Disconfirmation.
[a] SPSS principal components analysis using direct oblimin rotation.

4.1. Procedure

350 students completed the first questionnaire, which measured expectations, gender, and prior Access experience. The researchers administered this questionnaire after a short lecture on Access software, practice with an Access tutorial CD, and two short quizzes with general information about Access tables and queries. This short orientation period is similar to that used in other IT EDT research (Bhattacherjee and Premkumar, 2004).

The second questionnaire measured disconfirmation, satisfaction, trusting intention, continuance intention, usefulness, and ease of use. 296 of the 350 students took this second questionnaire six weeks later after completing the Access database assignments and skills exam. Thus, the final sample is 296. Students received extra credit points (1% of total) for completing both surveys. We found no significant differences for any variable between time two responders and time one responders who dropped out.

4.2. Measurement scales

We adapted prior scales with good psychometric properties (Appendix A), including scales for usefulness, satisfaction, and usage continuance intention (Bhattacherjee and Premkumar, 2004), technology trusting intention (McKnight et al., 2002a—willingness to depend), ease of use (Davis, 1993), and functionality, helpfulness, and reliability (McKnight et al.,

Table 4
Latent construct correlation matrix with means, CAs, DGRs, and AVEs.[a]

Latent construct	Mean	CA	DGR	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. Reliability expectations	4.94	.86	.92	.79	**.89**																
2 Functionality expectations	5.24	.91	.95	.85	.48	**.92**															
3. Helpfulness expectations	5.08	.93	.96	.88	.44	.55	**.94**														
4. Reliability performance	4.55	.87	.92	.80	.23	.23	.18	**.89**													
5. Functionality performance	5.02	.93	.95	.87	.19	.28	.19	.63	**.93**												
6. Helpfulness performance	4.28	.94	.96	.90	.10	.12	.21	.34	.39	**.95**											
7. Reliability disconfirmation	4.29	.92	.95	.87	.22	.22	.19	.66	.53	.42	**.93**										
8. Functionality disconfirmation	4.80	.94	.97	.90	.12	.19	.12	.50	.63	.44	.67	**.95**									
9. Helpfulness disconfirmation	4.06	.93	.96	.89	.07	.03	.15	.27	.26	.78	.40	.44	**.94**								
10. Satisfaction	4.16	.90	.93	.77	.13	.18	.15	.50	.48	.44	.62	.61	.46	**.88**							
11. Trusting intention	4.37	.96	.97	.90	.21	.22	.19	.58	.65	.54	.69	.68	.45	.67	**.95**						
12. Usage continuance intention	4.22	.96	.98	.93	.12	.26	.18	.33	.48	.44	.45	.54	.35	.57	.61	**.96**					
13. Usefulness	4.56	.97	.98	.91	.14	.22	.18	.53	.67	.45	.58	.62	.37	.57	.70	.59	**.96**				
14. Ease of use	4.18	.94	.96	.85	.14	.18	.13	.54	.63	.52	.55	.59	.41	.67	.69	.51	.65	**.92**			
15. Experience	2.94	na	na	na	.08	.20	.05	.09	.09	.14	.13	.14	.10	.14	.17	.21	.14	.15	**na**		
16. Gender	na	na	na	na	.08	-.06	-.13	.09	.04	.07	.07	.03	.03	.06	.07	-.02	.04	.15	.01	**na**	
17. Exam grade	82.84	na	na	na	.03	.06	-.12	.09	.09	.11	.14	.11	.09	.23	.10	.18	.09	.23	.06	.00	**na**

[a] CA = Cronbach's Alpha, DGR = Dillon–Goldstein Rho, AVE = average variance extracted, diagonal elements are the square root of the AVE, off-diagonal elements are correlations between latent constructs.

2002a). Where applicable the technology name was changed to Access. For trusting intention, we changed the object of trust from an e-vendor/supervisor to Access, and while we retained the core meaning of the items (e.g., "I can depend on" and "I can always rely on"), we changed the contextual wording to coincide with a task. To aid content validity (Straub et al., 2004) in adapting the technology trusting expectations (functionality, helpfulness, and reliability) from the interpersonal trust items in McKnight et al. (2002a), the co-authors made sure they properly represented the content meaning of each construct definition. We pilot tested the items along with those for trusting intention with 233 students using Microsoft Access from the same course the previous semester. The pilot items had Cronbach alphas from 0.88 to 0.96. After the pilot study, we changed only two reliability items to direct responders' attention to software's consistency and accuracy. Finally, because the pilot items referred to pre-usage and post-usage beliefs, the expectation items were re-worded to be forward looking, the disconfirmation items to be comparative, and the performance items to be backward looking. That is, the expectation items asked, "Based on my experience so far, I expect Microsoft Access *will*..." The disconfirmation items asked, "*Compared* to your initial expectations, the ability of Microsoft Access ... was better/worse than expected." The performance items asked, "Based on your experience with Microsoft Access, it *was*..."

5. Data analysis and results

We tested the measurement and structural models using XLStat's PLSPM software. We chose PLS for the data analysis because it is more suitable than covariance-based approaches for more complex models including models with hierarchical (second-order) constructs (Chin et al., 2003; Wetzels et al., 2009). Our model is large (11 variables—including controls), complex, and contains three second-order factors: technology trust expectations, technology trusting disconfirmation, and technology trusting performance. PLS also makes minimal demands on measurement scales (Fornell and Bookstein, 1982; Ringle et al., 2012). In this study, some of the control variables are one-item measures (experience, exam grade, and gender), and one is a nominal variable (gender). Before using XLStat, we ran a principal component analysis in SPSS to perform item culling. All items loaded between 0.60 and 0.96, except the first satisfaction item, which loaded at .50. Because this item and the other items did not cross-load more than 0.30 (Table 3), we retained all items in the subsequent analyses.[5]

[5] Because of the low loading, we also ran the analysis without the first satisfaction item. The reported significance does not change except for the path from satisfaction to trusting intention, which decreases to $p < .05$ ($\beta = .11$).

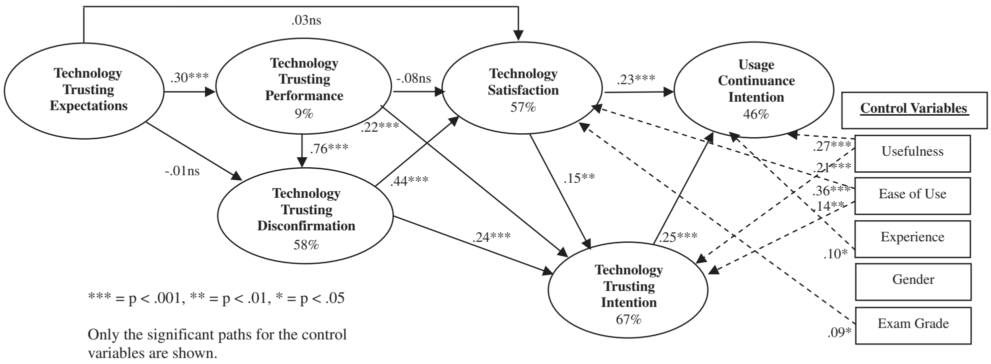

Fig. 2. Structural model results.

The measurement model demonstrated adequate convergent and discriminant validity. That each construct's consistency reliabilities (Cronbach's Alpha and Dillon–Goldstein Rho) exceeded 0.80 and average variance extracted (AVE) exceeded 0.50 (Fornell and Larcker, 1981) confirmed convergent validity (Table 4). Also, that each square root of the AVE was greater than any correlation in that construct's row or column (Fornell and Larcker, 1981) and all PLS cross-loadings for each factor were less than the loadings for the factor, suggested discriminant validity.

We also evaluated the influence of multicollinearity and common method variance. Multicollinearity is not a problem because condition indexes are below 30 and no variable has two variance decomposition proportions greater than 0.50 (Belsley et al., 1980). Common method variance is not a problem because in the principal components analysis, the first factor did not account for the majority of the covariance in the independent and dependent variables (Podsakoff et al., 2003).

We conceptualize the three technology trusting expectation, performance, and disconfirmation factors as reflective first-order factors making up their overall second-order constructs (McKnight et al., 2011; Wang and Benbasat, 2005). This is appropriate given the first-order factors have moderate to high correlations (.34–.67) (Jarvis et al., 2003) (Table 4). To construct the second-order model we used the latent factor scores generated in the first-order model as items for the second-order technology trusting expectations and disconfirmation constructs (e.g., reliability, functionality and helpfulness) (Thatcher et al., 2011).

Fig. 2 shows the structural model results. Contrary to predictions, technology trusting expectations does not have a significant influence on disconfirmation. Thus, H1 is not supported. Also, H2 is not supported because technology trusting expectations do not have a significant influence on satisfaction. H3 is supported as disconfirmation significantly influences satisfaction. Regarding the performance construct, H4 is also supported as performance significantly influences disconfirmation. H5 is not supported. Even though expectations significantly predict performance, performance has no influence on satisfaction, indicating no mediation. Satisfaction significantly influences usage continuance intention, which supports H6. Also, all hypotheses related to trusting intention are supported. Disconfirmation, performance, and satisfaction significantly predict trusting intention (H7, H8, and H9), and trusting intention predicts usage continuance intention (H10). Several of the control variable relationships are also significant. We find that ease of use and exam grade predict satisfaction, usefulness and ease of use significantly predict trusting intention, and usefulness and experience significantly predict continuance intention.

Unlike other IT EDT studies in which individuals lacked experience before the initial training (Bhattacherjee and Premkumar, 2004), some respondents in this study had previous Access experience. According to EDT, prior experience can result in more realistic expectations, which could affect our results. Therefore, we ran a supplemental analysis in XLStat to compare the model for different experience levels: those with no experience (i.e., answering 0 on the experience scale, $n = 62$) to those with any amount of experience (i.e., answering from 1-7 on the experience scale, $n = 234$). We find that there are two significant differences. First, the path from performance to disconfirmation is significantly smaller ($p < .01$) in the no experience group ($\beta = .51$, $p < .001$ versus $\beta = .83$, $p < .001$). Second, the path from technology trusting expectations to satisfaction is significant in the no experience group (.26, $p < .01$) and is not significant in the experience group. This difference is significant at $p < .01$.

Because our model implies that the effects of technology trusting expectations, performance, and disconfirmation on trusting intention and usage continuance intention are mediated by satisfaction and trusting intention, we also tested a model that includes these paths: expectation-trusting intention, expectation-usage continuance intention, performance-usage continuance intention, and disconfirmation-usage continuance intention. We find that none of these paths are significant, and that none of the other reported relationships change in significance. These results show that satisfaction fully mediates the effects of expectations on trusting intention, whereas it only partially mediates the effects of disconfirmation and performance on trusting intention. However, trusting intention does fully mediate the effects of technology trusting expectations, performance, and disconfirmation on continuance intentions.

We also ran model comparisons (Table 5). First, we compared our model to a model with only the control variables predicting satisfaction, technology trusting intention, and usage continuance intention. We find that our model predicts

Table 5
Model comparisons.

Dependent variable	Full model R^2	(Nested) model R^2	Change in R^2	Effect size[b]
Comparison 1: Full research model versus model with only control variable effects[a]				
Satisfaction	.57	.49	.08, $p < .001$	$f^2 = .19$ medium to large
Trusting intention	.67	.57	.10, $p < .001$	$f^2 = .30$ medium to large
Continuance intention	.46	.39	.07, $p < .001$	$f^2 = .12$ small to medium
Comparison 2: Full research model versus model without technology trusting intention				
Continuance intention	.46	.44	.02, $p < .001$	$f^2 = .04$ small

[a] The model with only control variable effects contains the paths from each of the control variables (usefulness, ease of use, experience, gender, and exam grade) to each of the dependent variables (satisfaction, trusting intention, and continuance intention).
[b] $f^2 = [R^2(\text{Full model}) - R^2(\text{Nested model})]/[1 - R^2(\text{Full model})]$. A pseudo F statistic is calculated as $f^2 * (n - k - 1)$, with p, $n - (k + p + 1)$ degrees of freedom where n is the sample size, k is the number of independent variables in the nested model and p is the number of additional variables in the full model (Mathieson et al., 2001). An effect size of .02 is small, .15 is medium, and .35 is large (Cohen, 1988).

significantly more variance than the control variable only model and the effect sizes corresponding to the increases in variance explained range from small to large. We also ran a comparison between our model and a model without technology trusting intention. The increase in variance explained when including trusting intention is significant, but the effect size is small.

Finally, because recent research finds nonlinear effects of expectations and performance on outcome variables (Venkatesh and Goyal, 2010), we also tested several polynomial regression models. These models included the second-order technology trusting expectations and performance constructs in addition to their squared (expectations × expectations and performance × performance) and interaction terms (expectations × performance) as predictors of satisfaction, trusting intention, and continuance intention. We find no significant effects of the second-order terms on the outcomes, and no significant increases in variances explained for these models versus the research model. Based on these tests, we conclude that the linear depiction of EDT and technology trust is appropriate for our sample.

6. Discussion and limitations

While many IT studies have examined how trust influences intentions to use technology, this study is one of the first to empirically examine how trust-building follows an expectation–disconfirmation process. It is important to understand how changes in trust can affect usage continuance, especially for front-line, entry-level strategic information system users. By combining technology trust and EDT, we predict 57% of the variance in satisfaction, 67% of the variance in technology trusting intention and 46% of the variance in usage continuance intention. These results can help researchers and practitioners ensure that the intended benefits of strategic information system investments are realized. We discuss these implications and directions for future research below.

6.1. Trusting intention

This paper contributes by being the first to include trusting intention in the Complete EDT Model. We find that performance, disconfirmation, and satisfaction, in addition to usefulness and ease of use, have significant effects on trusting intention. We also find that trusting intention predicts usage continuance intentions nearly as well as usefulness and better than does satisfaction, which are both more oft-used EDT variables. Overall, technology trusting intention fits well with the IT EDT model because it is predicted well by EDT variables and is a good predictor of continuance intention. Strategic information systems researchers should consider users' trusting intention in future studies to provide a richer understanding of the technology trust-building expectation–disconfirmation process and its link to usage continuance intention. Because our study is the first to include trusting intention in an expectation–disconfirmation model, future research should investigate whether our findings generalize to other contexts. Also, because trust and risk are highly related, the effects of trusting intention on continuance intention may be even more significant, and outweigh the influence of other more oft-used EDT variables, for strategic systems with a higher risk component like those in a health-care setting.

6.2. Expectation management and trust-building

This paper provides some interesting insights about expectation management, which is important during all phases of complex system development projects, and is an important indicator of system success (Al-Mashari et al., 2003; Skulmoski and Hartman, 2009). We examine technology trusting expectations. The trust literature explains that trust can be both strengthened when expectations are met and harmed when expectations are violated (Lewicki et al., 2006; Robinson, 1996). However, little-to-no research has examined the process by which this occurs. In the extant literature, the trust process is vague or unclear because few have studied the "dynamics of . . . trust" across time (Van de Ven and Ring, 2006, p. 154).

In our study technology trusting expectations formed upon initial use of the software do not influence disconfirmation or satisfaction as hypothesized, but do influence performance beliefs about the users' experiences with the technology. The finding that there is no relationship between expectations and disconfirmation is consistent with Spreng and Page (2003), and Irving and Meyer (1995). Oliver (1997) suggests that expectations and disconfirmation may not be related because individuals may forget their initial expectations or adjust them because expectations were not accurate or well-formed. Further, Irving and Meyer (1995) explain that when individuals are asked if their expectations have been met, they may first determine whether their current experiences (i.e., performance) are positive, and then form disconfirmation judgments that are consistent with performance rather than comparing initial expectations with performance. This can result in a non-significant path between expectations and disconfirmation and a significant one between performance and disconfirmation. In our study the six week period between measuring expectations and disconfirmation, while less than in other IT EDT studies (e.g., Venkatesh et al., 2011), could have caused individuals to forget their initial expectations when making the disconfirmation comparison. Because of the time lag, it may have been easier for users to focus on their current performance and/or compare it to adjusted expectations when making disconfirmation judgments. However, such time lags might be natural when studying real-life strategic information system development projects. Expectation management researchers could survey users about their disconfirmation at different points to determine if expectations are influential earlier in the process. Researchers could also remind users of their initial expectations to help them make the comparison.

The significant influence of expectations on performance means that experiences are shaped at least somewhat by initial expectations. Rather than being used as a comparison standard, initial expectations are used by individuals to perceive how trustworthy the technology is during use (Irving and Meyer, 1995). This is an assimilation effect, although it differs from the hypothesized assimilation effect (H5) because performance does not significantly affect satisfaction. Further, expectation's strong effect on performance ($.30^{***}$) along with performance's strong effect on disconfirmation ($.76^{***}$) contributes to expectations having a positive *indirect* effect on disconfirmation through performance ($.30^{***} \times .76^{***} = .23^{***}$). This effect cannot be detected in EDT models that do not include both performance and disconfirmation. So expectations are important for predicting the level of technology trust performance, and for indirectly effecting disconfirmation through performance.

Disconfirmation and performance are also valuable in explaining the trust-building process because of their strong effects on the outcome variables. Because disconfirmation has a significant effect on satisfaction and performance does not, satisfaction is explained by a contrast effect. This means that individuals focused more on discrepancies than similarities when making satisfaction judgments because the difference between their current experience and expectations, albeit adjusted expectations, was outside their zone of tolerance. Oliver (1997) explains that contrast effects are more likely to occur when individuals are more involved in the use experience, which could be the case in our study because of the class setting. Stakeholders in strategic IS projects may vary in how involved they are (or will be) with the system, so future researchers should consider this issue when trying to understand these relationships. Disconfirmation and performance also had strong effects on trusting intention as predicted.

In all, our findings define a specific cognitive chain of events from initial trusting expectations to final trusting intentions via performance, disconfirmation, and satisfaction perceptions. We know of no other paper that makes this link using *technology trust concepts within the EDT framework*. The only other IT EDT study that includes technology trust as the focal attribute shows a different chain of events (Venkatesh et al., 2011). It includes neither technology trusting performance nor trusting intention. Including performance and trusting intention can benefit expectation management and system development research because of their ability to show how expectations develop into a willingness to depend on the technology, which in turn can lead to longer-term use. To further understand the cognitive chain of events we find in this study, researchers should employ complementary research methods. For example, Lewicki et al. (2006) suggest that case studies, diary accounts, and in-depth interviews can be used to track the way individuals build trust over time. While researchers already use methodologies like case studies to study system development and expectation management (e.g., Gutierrez and Friedman, 2005), these methods could be used to triangulate with our more quantitative approach of studying the trust-building and expectation management process.

6.3. Incorporating system-like technology-trust concepts into EDT

Our study contributes by incorporating system-like technology-trust concepts into EDT. EDT has been studied in Marketing and related fields for several decades (Oliver, 1980). Many variables and configurations of variables have been used in this literature, including many product and service attributes (Oliver, 1997), In the IS literature many system attributes have been chosen to represent expectations (Table 1). However, to our knowledge, no one has created expectation, performance, and disconfirmation variables based on system-like technology-trust concepts. This is entirely new for the EDT literature.

By examining these system-like technology-trust concepts, this paper contributes to the IS strategy research that has mostly studied interpersonal trust, for example, in inter-organizational relationships (Nicolaou et al., 2011). We also increment the trust-in-technology literature by explaining how research needs to provide different trust concepts for non-human-like technologies like databases, because these strategically important technologies have different attributes than do humans. Table 2 explains that a technology trustee does different things for the trustor than a human trustee does. We argue that the type of trust concept may need to be modified to match a technology's capacity. The need for this logic is highlighted by Friedman et al. (2000, p. 36), who argued that trust in technology does not exist: "People trust people, not technology." By contrast, we show that people do trust a less-human technology, but they trust it in a different way than they trust people because people and such technologies have different attributes. By showing how to viably theorize about trust in a non-human-like technology, we provide a conceptual advance that will enable trust in technology to be applied to many strategic information systems. Without this adjusting of the trust concept to match the trustee's capacities, researchers like Friedman were correct in expressing discomfort with applying trust to technology.

Based on this paper's conceptual explanation, we anticipate new studies of trust in strategic IT artifacts will arise. To increase their generalizability, these technology-trust concepts should be applied to different types of strategic information systems like open source software, knowledge collaboration systems, and dashboard systems. Also, while we found that the three trusting expectations are distinct from each other, future research could explore the extent to which these factors are distinct from the interpersonal constructs from which they are derived. The distinction between system-like and human-like trust constructs may be clearer for some strategic information systems than for others based on the system's characteristics. For example we argued earlier that databases are more system-like than recommendation agents. However, knowledge collaboration tools may be even more human-like, which could make the system-like technology-trust concepts less applicable for these strategic systems.

6.4. Other research implications

We choose the EDT model to examine usage continuance as it is among the best-recognized models of IS usage continuance (Venkatesh et al., 2011). We compare our model with other models, for example, a control-variables-only model (Table 5), a model without trusting intention (Table 5), and a polynomial model (discussed in Section 5). Our model performs as well, if not better, than these models in terms of explaining the trust-building process and the resulting variance in continuance intention. We also incorporated the EDT variable "performance" that is often excluded from EDT models, yet is valuable for disentangling the effects of the separate components of disconfirmation. For example, in our model performance is more likely to have a direct effect on disconfirmation than expectations, and has similar effects as disconfirmation on trusting intention. It was beyond the scope of our research to examine how trust in technology integrates with other continuance models such as the unified theory of acceptance and use of technology (UTAUT), which has been used to study important strategic information systems (Venkatesh et al., 2003). It was also beyond our scope to compare our model to most other acceptance models. A key future research question will be: which models work best in which circumstances?

6.5. Practical implications

The overall practical implication from our results is for managers and developers involved in strategic information system implementations to recognize that trust-building is a process that involves users' expectations, performance, disconfirmation, and satisfaction. This trust-building process can be important for ensuring entry-level, front-line users' intentions to continue using strategic information systems, which as noted earlier, is not always a given. The detailed nature of our EDT-based model provides practitioners more ways to diagnose what went right, what went wrong, and how to fix any problems that arise. In other words, the detailed nature of the model removes "black boxes" and shows how each part of the user's thought process works. We detail some of these below.

An important practical implication of our research is that lowering expectations is not a strategy for increasing disconfirmation and other technology-related outcomes. Because we find no support for H1, but do find support for H5, our study shows that in regards to trust, lowering expectations will have no effect on disconfirmation and will decrease users' performance perceptions. This could be detrimental to development projects. We show that practitioners can increase users' performance and build trust in strategic information systems by increasing technology trusting expectations. A trust building strategy that should help increase technology trusting expectations is to communicate favorably about structural assurances, which can include security, data safeguards, and the ability of the IT department to support the new system (McKnight et al., 2002a). These assurances could be communicated during implementation or through a company's IT governance initiatives, such as security awareness programs (Wilson and Hash, 2003). While we show that there is no polynomial relation between expectations and satisfaction, trusting intention, or continuance intention, raising expectations inappropriately might eventually lead to other adverse results. It will be important for practitioners to weigh our results in conjunction with those of other trust in technology studies.

Because both technology trusting performance and disconfirmation have significant effects on trusting intention in our model, practitioners should emphasize these factors throughout the testing, implementation, and early usage stages as users gain more experience with the system's trustworthy characteristics. Management should communicate the trustworthy attributes of the technology, especially those that are "better than expected" (Gutierrez and Friedman, 2005). Embedding IT personnel at the business unit level can help highlight, for example, how the system's functionality can best be used to perform tasks. These actions can make user experiences more positive, and encourage users to depend on the technology.

Our findings also imply that embedding social cues in technology is not necessary for garnering user trust in all technologies. We show that users were quite willing to trust and depend on a system that has almost no human-like images or animation, and that offers no interpersonal interaction. Microsoft's failed animated office assistants (USA Today, 2002) demonstrates that adding human-like attributes to more system-like technologies may in fact decrease trust. Relying on previous literature, findings about what makes technologies more/less human-like can help practitioners distinguish where their systems lie in the humanness continuum. Then, based on how humans and systems demonstrate trust, as discussed in this study, they can then pick the best approach to increasing trust. For example, in a more system-like technology, increasing helpfulness can be achieved by ensuring the system's help function has guidance that is actually used and appreciated, perhaps through user ratings or comments. In a more human-like system such as a recommendation agent, benevolence—the conceptual counterpart to helpfulness—could be communicated through the animated figure by its responsiveness and appearance of concern. In this way, designing systems that are helpful and/or benevolent could become a strategic competence for software development firms.

6.6. Limitations

Because the subjects were students learning to use a technology, the results generalize primarily to entry-level or new-to-a-technology users. Using students was a tradeoff necessary for obtaining a longitudinal sample of comparable subjects using the same technology. Other EDT studies have used similar subjects because it is hard to find use-controlled longitudinal samples in firms (Bhattacherjee and Premkumar, 2004). Also, because the technology use involved a classroom situation, the students may have had high system expectations because they knew the professor selected it for class use. Still, this is not dissimilar to a corporate setting in which the company picks out specific software based on expert recommendations. We also did not measure how often subjects used Access during the six week period. Individuals who used the software more during the trial period could have different performance perceptions or trusting intentions than those who used it less because deep experience can make one more knowledgeable with the system. While we assume all subjects had roughly similar amounts of in-class experience, future research could investigate whether frequency of use influences the study variables.

7. Conclusion

This research provides a theoretical model of the technology-trust-building process that can answer the questions—what causes trust-in-technology to grow and change over time, and how do these changes affect usage continuance intention? Answering these questions is especially important for strategic information system implementations where the stakes associated with user discontinuance are high. For managers, the findings demonstrate that technology trusting intention is formed through a process whereby individuals first develop technology trusting expectations, and then, after using the technology confirm or disconfirm expectations based upon the technology's trusting performance. Our findings also underscore that managers need to understand that trusting intention plays a key role in the EDT process. Further, the paper highlights trust concepts that are derived from interpersonal trust but have been tailored to reflect the attributes of less human technology on which people arguably depend.

Appendix A. Questionnaire items

A.1. Measured in questionnaire 1

Technology trusting expectations (adapted from McKnight et al. (2002a)).
Based on my experience so far, I expect that Microsoft Access will:
Functionality

1. have the functionality I need.
2. have the features required for my tasks.
3. have the overall capabilities I need.

Helpfulness

1. provide the help I need to complete tasks successfully.
2. provide competent guidance through a help function.
3. supply my need for help through a help function.

Reliability

1. not fail me.
2. not malfunction for me.
3. provide error-free results.

Experience
I would rate my level of experience with Microsoft Access as (circle one): (*7-pt Likert scale from (1) no experience to (7) extensive experience*).

A.2. Measured in questionnaire 2 six weeks later

Technology trusting disconfirmation (measured on a Likert scale from 1-Much Worse than Expected to 7-Much Better than Expected) (adapted from McKnight et al. (2002a)).

Compared to your initial expectations, the ability of Microsoft Access:

Functionality

1. to provide the functionality I needed was...
2. to provide the features required for my tasks was...
3. to provide the overall capabilities I need was...

Helpfulness

1. to provide the help I needed to complete tasks successfully was...
2. to provide competent guidance through a help function was...
3. to supply my need for help through a help function was...

Reliability

1. to not fail me was...
2. to not malfunction for me was...
3. to provide error-free results was...

Technology trusting performance (adapted from McKnight et al. (2002a)).

Based on your experience with Microsoft Access it:

Functionality

1. had the functionality I needed.
2. had the features required for my tasks.
3. had the overall capabilities I needed.

Helpfulness

1. provided the help I needed to complete tasks successfully.
5. provided competent guidance through a help function.
6. supplied my need for help through a help function.

Reliability

4. did not fail me.
5. did not malfunction for me.
6. provided error-free results.

Technology satisfaction (measured on a 7-point Likert scale using the endpoints indicated below) (adapted from Bhattacherjee and Premkumar (2004)).

I am ______ with my use of Microsoft Access:

1. Extremely Displeased/Extremely Pleased.
2. Extremely Frustrated/Extremely Contented.
3. Extremely Miserable/Extremely Delighted.
4. Extremely Dissatisfied/Extremely Satisfied.

Technology trusting intention (adapted from McKnight et al. (2002a) and McKnight and Chervany (2005)).

1. When I have a tough task, I feel I can depend on Microsoft Access.
2. I can always rely on Microsoft Access in completing a tough task.
3. Microsoft Access is a product on which I feel I can fully rely when working on an essential task.
4. I feel I can count on Microsoft Access when working on an important task.

Usage continuance intention (adapted from Bhattacherjee and Premkumar (2004)).

1. In the near future, I intend to continue using Microsoft Access.
2. I intend to continue using Microsoft Access to create databases.
3. I plan to continue using Microsoft Access after this class.

Usefulness (adapted from Bhattacherjee and Premkumar (2004)).
Based on your experience with Microsoft Access, it:

1. increased my productivity.
2. improved my performance.
3. enhanced my effectiveness.
4. was useful.

Ease of use (adapted from Davis (1993)).
Based on your experience with Microsoft Access, it:

1. was easy to get to do what I want it to do.
2. was easy for me to learn to use.
3. was easy for me to become skillful at.
4. was easy to use.

All items measured on a Likert scale from 1-Strongly Disagree to 7-Strongly Agree unless indicated.

References

Al-Mashari, M., Al-Mudimigh, A., Zairi, M., 2003. Enterprise resource planning: a taxonomy of critical factors. European Journal of Operational Research 146, 352–365.
Baylor, A.L., Ryu, J., 2003. Does the presence of image and animation enhance pedagogical agent persona? Journal of Educational Computing Research 28 (4), 373–395.
Belsley, D.A., Kuh, E., Welsch, R.E., 1980. Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. John Wiley & Sons, New York.
Benamati, J.S., Fuller, M.A., Serva, M.A., Baroudi, J., 2010. Clarifying the integration of trust and TAM in e-commerce environments: implications for systems design and management. IEEE Transactions on Engineering Management 57 (3), 380–393.
Bhattacherjee, A., 2001. Understanding information systems continuance: an expectation–confirmation model. MIS Quarterly 25 (3), 351–370.
Bhattacherjee, A., Premkumar, G., 2004. Understanding changes in belief and attitude toward information technology usage: a theoretical model and longitudinal test. MIS Quarterly 28 (2), 229–254.
Bhattacherjee, A., Perols, J., Sanford, C., 2008. Information technology continuance: a theoretic extension and empirical test. The Journal of Computer Information Systems 49 (1), 17–26.
Bloom, N., Garicano, L., Sadun, R., Van Reenen, J., 2010. The Distinct Effects of Information Technology and Communication Technology on Firm Organization. Harvard Business School, Working Paper 11-023.
Brown, S.A., Venkatesh, V., Kuruzovich, J., Massey, A.P., 2008. Expectation confirmation: an examination of three competing models. Organizational Behavior and Human Decision Processes 105 (1), 52–66.
Brown, S.A., Venkatesh, V., Goyal, S., 2012. Expectation confirmation in technology use. Information Systems Research 23 (2), 474–487.
Cassell, J., Bickmore, T., 2000. External manifestations of trustworthiness in the interface. Communications of the ACM 43 (12), 50–56.
Chatterjee, D., Watson, R., 2006. Infosys Technologies Limited: unleashing CIMBA. In: Khosrow-Pour, M. (Ed.), Cases on Strategic Information Systems. Idea Group Publishing, Hershey, PA, pp. 1–15.
Chin, W.W., Marcolin, B.L., Newsted, P.R., 2003. A partial least squares latent variable modeling approach for measuring interaction effects: results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. Information Systems Research 14 (2), 189–217.
Cohen, J., 1988. Statistical Power Analysis for the Behavioral Sciences, second ed. Lawrence Erlbaum, Hillsdale, NJ.
Cooke, A.D.J., Meyvis, T., Schwartz, A., 2001. Avoiding future regret in purchase-timing decisions. Journal of Consumer Research 27, 447–459.
Cyr, D., Head, M., Pan, B., 2009. Exploring human images in website design: a multi-method approach. MIS Quarterly 33 (3), 536–539.
Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly 13 (3), 319–340.
Davis, F.D., 1993. User acceptance of information technology: system characteristics, user perceptions and behavioral impacts. International Journal of Man Machine Studies 38 (3), 475–487.
Deng, L., Turner, D.E., Gehling, R., Prince, B., 2010. User experience, satisfaction, and continual usage intention of IT. European Journal of Information Systems 19 (1), 60–75.
Deutsch, M., 1973. The Resolution of Conflict: Constructive and Destructive Processes. Yale University Press, New Haven, CN.
Dorset Echo, 2010. Dorset County Council Computer Problems Continue. <http://www.dorsetecho.co.uk/news/localnews/8625142.Dorset_County_Council_computer_problems_continue/> (accessed 04.10.13).
Fornell, C., Bookstein, F.L., 1982. Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. Journal of Marketing Research 19, 440–452.
Fornell, C., Larcker, D.F., 1981. Evaluating structural equations with unobservable variables and measurement error. Journal of Marketing Research 18 (1), 39–50.
Friedman, B., Kahn Jr., P.H., Howe, D.C., 2000. Trust online. Communications of the ACM 43 (12), 34–40.
Garbarino, E., Johnson, M.S., 1999. The different roles of satisfaction, trust, and commitment in customer relationships. Journal of Marketing 63 (2), 70–87.
Gefen, D., Karahanna, E., Straub, D.W., 2003. Trust and TAM in online shopping: an integrated model. MIS Quarterly 27 (1), 51–90.
Gefen, D., Straub, D., 2003. Managing user trust in B2C e-services. E-service Journal 2 (2), 7–24.
Ginzberg, M.J., 1981. Early diagnosis of MIS implementation failure: promising results and unanswered questions. Management Science 27 (4), 459–478.
Gutierrez, O., Friedman, D.H., 2005. Managing project expectations in human services information systems implementations: the case of homeless management information systems. International Journal of Project Management 23, 513–523.

Hardin, A., Chang, J., Fuller, M.A., 2008. Formative vs. reflective measurement: comment on Marakas, Johnson, and Clay 2007. Journal of the Association for Information Systems 9 (9), 519–534.
Holmes, J.G., 1991. Trust and the appraisal process in close relationships. In: Jones, D.W., Perlman, D. (Eds.), Advances in Personal Relationships. Jessica Kingsley, London, pp. 57–104.
Hsu, M.H., Yen, C.H., Chiu, C.M., Chang, C.M., 2006. A longitudinal investigation of continued online shopping behavior: an extension of the theory of planned behavior. International Journal of Human–Computer Studies 64 (9), 889–904.
Irving, P.G., Meyer, J.P., 1995. On using direct measures of met expectations: a methodological note. Journal of Management 21 (6), 1159–1175.
Jarvenpaa, S.L., Tractinsky, N., Vitale, M., 2000. Consumer trust in an internet store. Information Technology and Management 1 (1–2), 45–71.
Jarvis, C.B., MacKenzie, S.B., Podsakoff, P.M., 2003. A critical review of construct indicators and measurement model misspecification in marketing and consumer research. Journal of Consumer Research 30 (2), 199–218.
Kanawattanachai, P., Yoo, Y., 2002. Dynamic nature of trust in virtual teams. The Journal of Strategic Information Systems 11 (3–4), 187–213.
Khalifa, M., Liu, V., 2002–2003. Satisfaction with internet-based services: the role of expectations and desires. International Journal of Electronic Commerce 7(2), 31–49.
Khalifa, M., Liu, V., 2003. Determinants of satisfaction at different adoption stages of Internet-based services. Journal of the Association for Information Systems 4 (5), 206–232.
Kim, E., Tadisina, S., 2007. A model of customers' trust in e-business: micro-level inter-party trust formation. Journal of Computer Information Systems 48 (1), 88–104.
Kim, D.J., Ferrin, D.L., Rao, H.R., 2009. Trust and satisfaction, two stepping stones for successful e-commerce relationships: a longitudinal exploration. Information Systems Research 20 (2), 237–257.
King, W.R., He, J., 2006. A meta-analysis of the technology acceptance model. Information & Management 43 (6), 740–755.
Lankton, N.K., McKnight, D.H., 2012. Examining two expectation disconfirmation theory models: assimilation and asymmetry effects. Journal of the Association for Information Systems 13 (2) (article 1).
Lankton, N.K., Wilson, E.V., 2007a. Antecedents and dimensions of online service expectations. IEEE Transactions on Engineering Management 54 (4), 776–788.
Lankton, N.K., Wilson, E.V., 2007b. Factors influencing expectations of e-health services within a direct-effects model of user satisfaction. E-Service Journal 5 (2), 85–111.
Lee, J., Moray, N., 1992. Trust, control strategies and allocation of function in human-machine systems. Ergonomics 35 (10), 1243–1270.
Lewicki, R.J., Bunker, B.B., 1995. Trust in relationships: a model of trust development and decline. In: Bunker, B.B., Rubin, B.B. (Eds.), Conflict, Cooperation, and Justice. Jossey-Bass, San Francisco, pp. 133–173.
Lewicki, R.J., Tomlinson, E.D., Gillespie, N., 2006. Models of interpersonal trust development: theoretical approaches, empirical evidence, and future directions. Journal of Management 32 (6), 991–1022.
Limayem, M., Hirt, S.G., Cheung, C.M.K., 2007. How habit limits the predictive power of intention: the case of information systems continuance. MIS Quarterly 31 (4), 705–737.
Lin, C.S., Wu, S., Tsai, R.J., 2005. Integrating perceived playfulness into expectation–confirmation model for web portal context. Information & Management 42 (5), 683–693.
Lindskold, S., 1978. Trust development, the GRIT proposal, and the effects of conciliatory acts on conflict and cooperation. Psychological Bulletin 8 (3), 772–793.
Lippert, S.K., 2007. Investigating postadoption utilization: an examination into the role of interorganizational and technology trust. IEEE Transactions on Engineering Management 54 (3), 468–483.
Lippert, S.K., Swiercz, P.M., 2005. Human resources information systems (HRIS) and technology trust. Journal of Information Science 31 (5), 340–353.
Lowry, P.B., Vance, A., Moody, G., Beckman, B., Read, A., 2008. Explaining and predicting the impact of branding alliances and web site quality on initial consumer trust of e-commerce web sites. Journal of Management Information Systems 24 (4), 199–224.
Lyytinen, K., Hirschheim, R., 1987. Information systems failures––a survey and classification of the empirical literature. Oxford Surveys in Information Technology 4, 257–309.
Mathieson, K., Peacock, E., Chin, W.W., 2001. Extending the technology acceptance model: the influence of perceived user resources. The DATA BASE for Advances in Information Systems 32 (3), 86–112.
Mayer, R.C., Davis, J.H., Schoorman, F.D., 1995. An integrative model of organizational trust. The Academy of Management Review 20 (3), 709–734.
McKinney, V., Yoon, K., Zahedi, F., 2002. The measurement of web-customer satisfaction: an expectation and disconfirmation approach. Information Systems Research 13 (3), 296–315.
McKnight, D.H., Carter, M., Thatcher, J.B., Clay, P.F., 2011. Trust in a specific technology: an investigation of its components and measures. Transactions on Management Information Systems 2 (2), 1–15.
McKnight, D.H., 2005. Trust in information technology. In: Davis, G.B. (Ed.), The Blackwell Encyclopedia of Management. Management Information Systems, vol. 7. Blackwell, Malden, MA, pp. 329–331.
McKnight, D.H., Chervany, N.L., 2005. What builds system troubleshooter trust the best: experiential or non-experiential factors? Information Resources Management Journal 18 (3), 32–49.
McKnight, D.H., Choudhury, V., Kacmar, C., 2002a. Developing and validating trust measures for e-commerce: an integrative typology. Information Systems Research 3 (3), 334–359.
McKnight, D.H., Choudhury, V., Kacmar, C., 2002b. The impact of initial consumer trust on intentions to transact with a web site: a trust building model. Journal of Strategic Information Systems 11 (3), 297–323.
McKnight, D.H., Cummings, L.L., Chervany, N.L., 1998. Initial trust formation in new organizational relationships. Academy of Management Review 23 (3), 473–490.
Mittal, V., Ross, W.T., Baldasare, P.M., 1998. The asymmetric impact of negative and positive attribute-level performance on overall satisfaction and repurchase intentions. Journal of Marketing 62 (1), 33–47.
Morgan, R.M., Hunt, S.D., 1994. The commitment-trust theory of relationship marketing. Journal of Marketing 58 (3), 20–38.
Muir, B.M., Moray, N., 1996. Trust in automation. Part II. Experimental studies of trust and human intervention in a process control simulation. Ergonomics 39 (3), 429–460.
Nelson, R.R., Todd, P.A., Wixom, B.H., 2005. Antecedents of information and system quality: an empirical examination within the context of data warehousing. Journal of Management Information Systems 21 (4), 199–235.
Nicolaou, A., Sedatole, K., Lankton, N.K., 2011. Information systems integration and alliance partner trust. Contemporary Accounting Research 28, 1018–1045.
Oliver, R.L., 1977. Effect of expectation and disconfirmation on postexposure product evaluations: an alternative interpretation. Journal of Applied Psychology 62 (4), 480–486.
Oliver, R.L., 1980. A cognitive model for the antecedents and consequences of satisfaction. Journal of Marketing Research 17 (3), 460–469.
Oliver, R.L., 1997. Satisfaction: A Behavioral Perspective on the Consumer. McGraw-Hill, United States.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903.
Polites, G.L., Roberts, N., Thatcher, J., 2012. Conceptualizing models using multidimensional constructs: a review and guidelines for their use. European Journal of Information Systems 21, 22–48.
Premkumar, G., Bhattacherjee, A., 2008. Explaining information technology usage: a test of competing models. Omega 36 (1), 64–75.

Raby, M., 2008. Microsoft Patches Excel Calculation Bug. <http://www.tgdaily.com/content/view/34308/140/> (accessed 21.02.08).

Ringle, C.M., Sarstedt, M., Straub, D.W., 2012. A critical look at the use of PLS-SEM in MIS Quarterly. MIS Quarterly 36 (1), iii–xiv.

Robinson, S.L., 1996. Trust and breach of the psychological contract. Administrative Science Quarterly 41 (4), 574–599.

Rousseau, D.M., Sitkin, S.B., Burt, R.S., Camerer, C., 1985. Not so different after all: a cross-discipline view of trust. The Academy of Management Review 23 (3), 393–404.

SAP, 2013. <http://www54.sap.com/solutions/analytics/business-intelligence/customer-reviews.html> (accessed 22.04.13).

Skulmoski, G.J., Hartman, F.T., 2009. Information systems project manager soft competencies. Project Management Journal 41 (1), 61–80.

Spreng, R.A., MacKenzie, S.B., Olshavsky, R.W., 1996. A reexamination of the determinants of consumer satisfaction. Journal of Marketing 60 (3), 15–32.

Spreng, R.A., Page, T.J., 2003. A test of alternative measures of disconfirmation. Decision Sciences 34 (1), 31–62.

Straub, D., Boudreau, M., Gefen, D., 2004. Validation guidelines for IS positivist research. Communications of the Association for Information Systems 13, 380–427.

Suh, K., Kim, S., Lee, J., 1994. End-user's disconfirmed expectations and the success of information systems. Information Resources Management Journal 7 (4), 30–39.

Susarla, A., Barua, A., Whinston, A.B., 2003. Understanding the service component of application service provision: an empirical analysis of satisfaction with ASP services. MIS Quarterly 27 (1), 91–123.

Szajna, B., Scamell, R.W., 1993. The effects of information system user expectations on their performance and perceptions. MIS Quarterly 17 (4), 493–516.

Thatcher, J.B., McKnight, D.H., Baker, E.W., Arsal, R.E., Roberts, N.H., 2011. The role of trust in postadoption IT exploration: an empirical examination of knowledge management systems. IEEE Transactions on Engineering Management 58 (1), 56–70.

Thong, J.Y.L., Hong, S.J., Tam, K.Y., 2006. The effects of post-adoption beliefs on the expectation–confirmation model for information technology continuance. International Journal of Human–Computer Studies 64 (9), 799–810.

Thorndike, E.L., 1911. Animal Intelligence. MacMillan, New York, NY.

USA Today, 2002. Microsoft Banks on Anti-clippy Sentiment. <http://usatoday30.usatoday.com/tech/news/2001-05-03-clippy-campaign.htm> (accessed 23.03.10).

Van de Ven, A.H., Ring, P.S., 2006. Relying on trust in cooperative inter-organizational relationships. In: Bachmann, R., Zaheer, A. (Eds.), Handbook of Trust Research. Edward Elgar, Cheltenham, UK, pp. 144–164.

Vance, A., Elie-Dit-Cosaque, C., Straub, D., 2008. Examining trust in information technology artifacts: the effects of system quality and culture. Journal of Management Information Systems 24 (4), 73–100.

Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., 2003. User acceptance of information technology: toward a unified view. MIS Quarterly 27 (3), 425–478.

Venkatesh, V., Goyal, S., 2010. Expectation disconfirmation and technology adoption: polynomial modeling and response surface analysis. MIS Quarterly 34 (2), 281–303.

Venkatesh, V., Thong, J.Y.L., Chan, F.K.Y., Hu, P.J.H., Brown, S.A., 2011. Extending the two phase information systems continuance model: incorporating UTAUT predictors and the role of context. Information Systems Journal 21 (6), 527–555.

Wang, W., Benbasat, I., 2005. Trust in and adoption of online recommendation agents. Journal of the Association for Information Systems 6 (3), 72–101.

Wang, L.C., Baker, J., Wagner, J.A., Wakefield, K., 2007. Can a retail web site be social? Journal of Marketing 71 (3), 143–157.

Wetzels, M., Odekerken-Schröder, G., van Oppen, C., 2009. Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. MIS Quarterly 33 (1), 177–195.

Wilson, M., Hash, J., 2003. Building an Information Technology Security Awareness and Training Program. NIST Special Publication 800-50, Washington, U.S. Government Printing Office.