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User trust and control in e-commerce

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Enabling electronic commerce:
Technological, business and legal aspects

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Abstract

With the Internet becoming evermore important and the World Wide Web growing at a staggering rate, especially in the area of e-commerce, fundamental knowledge about the issue of trust in e-commerce is essential. Trust is a complex construct that is tightly associated with risk, and risk taking is an important part of doing business.

In this report an overview of trust is given, describing the dominant factors of importance in the domain of e-commerce. From this the most important elements for research are described, and directions for future research are given. The most important results are that experimental data is required to learn about the difference of the trust build process and the degradation of trust due to trust violation. Trust violation can happen at different levels of abstraction, having different effect on the severity of trust degradation.

1 Introduction

The Internet, together with the World Wide Web, have emerged as a remarkable networked information source that is increasingly used for commerce. With low barriers of entry, almost everyone can set up a business providing a service, such as a physical product but also various types of information that are rapidly becoming a valuable commodity.

To enable commerce over the net, one needs to exchange information reliably and securely. This information can be product specifications, prices, orders, and payment. Especially when information is exchanged to transfer money, special care must be given to this process to make sure that this information cannot be abused. However, also in other phases of the process the reliability and security of
the information needs special care in order to build and maintain the trust of all parties involved.

2 Trust

Trust encompasses many elements. These are trust in the trading partner, commonly known as the agent, trust in the network, and trust in the applications that provide the user interface. Trust is difficult to grasp, it has several dimensions, each with their own characteristics. In general, trust is understood as the belief that the other party (agent) will do what you want. This embeds many elements, such as that it will do as you ordered the agent to do (reliability), that it will do as you expect the agent to do (predictability), and the costs involved when the outcome is not as expected (risk).

Trust is one of the key elements of importance in electronic commerce. One definition of trust in a commerce situation is "the willingness of a party to be vulnerable to the actions of another party based on the expectations that the other will perform a particular action important to the trustor, irrespective of the agility to monitor or control that other party" (Mayer et al., 1995). Other, more general definitions that can be found in the psychological literature are:

"the confidence that one will find what is desired from another, rather than what is feared" (Deutsch, 1973), "a generalized expectancy that the word, promise, oral or written statement of another individual or group can be relied on" (Rotter, 1980), "the degree of confidence you feel when you think about a relationship" (Rempel & Holmes, 1986), "Trust is a persons expectation that an interaction partner is able and willing to behave promotively towards the person, even when the interaction partner is free to choose among alternative behaviours that could lead to negative consequences for the person. The degree of trust can be said to be higher the stronger the individual holds this expectation" (Koller, 1988). Each of the definitions found in the literature focuses on a different aspect of the common understanding of "trust" in everyday use. Two other closely related concepts are faith and confidence. When there are no facts making it possible to estimate reliability, predictability, and risk, i.e. when there is no evidence, decisions are based on faith. In the situation where there is insufficient evidence decisions are based on trust, and with sufficient evidence for a certain result the decision is based on confidence. In the development of trust each of these three 'levels' will play a role.

When people start interacting with a system they learn how this system works. In this learning phase the outcome becomes more predictable and the user starts to develop some confidence that the system will do as he predicts. Through this confidence, the user will build trust in the system, learning more about its behaviour, its reliability, and the risks involved in using this system. The user develops an attribution of dependability, taken as evidence that the system can be relied on (Rempel et al., 1985). This requires extensive interaction between the user and the system so that the user can develop a reference model.
Most of the definitions of trust focus very much on predictability, reliability, and risk of a situation, not so much on the fact whether the user can actively manipulate the system and intervene in the process or not. Only very few studies include this aspect, mostly in the field of human-machine interaction (Muir, 1987, Lee & Moray, 1992). There are good reasons to include the risk of a failure, which can be malfunctioning machine, a human error or intentional failure, together with the possibility of control. If one can intervene in a system when the initial outcomes of the process are unfavorable the perceived total risk will be different from when this intervention is impossible. It is not even needed that the possibility of control indeed exists: the illusion of control is enough. The effect of control on trust and user behaviour will be discussed more extensively later.

3 Trust in organizations

When studying trust in the realm of business one can distinguish a contrast with other areas. “In a market type of economy, public trust in businesses is supposed to be limited entirely to technically competent performance” (Barber, 1983, p. 101). Along this line of reasoning is the control over public welfare that is not assigned to direct control but via the competitive mechanisms of the market. In reality, the situation is not that simple and businesses are more caring about trust than the market doctrine dictates.

In a business situation there is the problem of public interest versus company interest and the problem of company or personal interest versus the public interest. Various mechanisms are in place to reconcile these differences in interest but they will always be somewhat less than wholly successful. Business in a competitive market is an occupation that tends to be pursued merely for oneself and not so much for others. With the increasing professionalism of business this changes to a large extent because success of a company must also be sought in the relationship with customers and the community (Brandeis, 1933).

Trust is an important element within organizations and in business transactions. It is widely accepted that within and between organizations there are three control mechanisms: price, authority, and trust (Bradach & Eccles, 1989). However, there seems to be no consensus about how these three mechanisms actually function. Trust functions as a factor that permits all forms of risk taking (Luhman, 1988). Trust is a remarkably efficient lubricant to economic exchange that reduces complex realities far more quickly and economically than prediction, authority, or bargaining (Powell, 1990). However, trust needs to be developed and maintained. In the development of trust, Lewicky and Bunker (1996) recognize three stages. The first stage is calculus-based trust, based on assuring consistent behaviour. Individuals will do what they say because they fear the consequences of non-compliance. The second level of trust is knowledge-based trust. This trust is based on the other’s predictability, on experience, so that the other’s behaviour can be anticipated. This type of trust relies on information rather than deterrence. The third type of trust is based on the identification with the other’s desires and
intentions. "At this level, trust exists because the parties effectively understand and appreciate the other's wants" (Lewicky & Bunker, 1996, p.122). Some relationships remain at the first level of trust, most relations will develop to the second level of trust, and very few will evolve to the last level. What is clear is that in order for trust to develop, some deterrence mechanism is needed, and preferably experience and time.

Unfortunately, due to the number of different jurisdictions, there are no general mechanisms for deterrent and the time to develop knowledge-based trust is sparse in the situation of e-commerce. There is generally no way to know who the party is, and there is no time to develop trust. The other option is to develop a system that is trustworthy. This system consists of the Internet, trusted third parties, intermediary agents, together with their procedures, protocols, agreements, etceteras. The only two parties which are not included in this system are the two trading parties.

If the parties do not have a history of interaction, do not work in the same jurisdiction, do not know each other's identities, and do not have any means to trace back the other party, a better approach may be one based on distrust, and use mutually trusted intermediaries to come to a trusted transaction, or by using "trusted third parties" to verify the other's party identity and facilitate trustworthiness.

In a business situation the problem of trust is even more complex because employees make decisions for others. Managing such a system holds the problem of sustainability of these decisions and the uncertainty that is associated with these decisions. Decisions made on behalf of others might differ from those made on behalf of oneself. In these situations, a mechanism is required that ensures responsible decisions under risk. Profit maximization can be a serious risk for sustainability. A mechanism that prevents such short term behaviour must make sure that decisions are sustainable, that all necessary precautions are taken, and that there precautions are in place. From an economic point of view a definition of sustainability in relation to trust can be based on utility. One acts sustainable if the expected utility for a next generation is not less then the present (Scott, 1999).

In literature, the measurement of trust is largely neglected, especially when it comes to the measurement of trust in interorganisation collaboration (measuring of trust with persons will be discussed elsewhere). Curral and Judge developed and tested a questionnaire for trust between two individuals who provide the link between two organizations, so called boundary role persons (Currall & Judge, 1995). The measure of trust was based on the multidimensionality of trust and encompassed three groups of characteristics: the longevity of the relationship between the two boundary role persons, the anticipated future longevity of this relationship, and the ability of the boundary role persons to resolve conflicts. These factors were based on the work of Ajzen and Fishbein (1980) with their theory of reasoned action and dyad-level correlates. The survey and archival data were used to support the measure's construct validity, based on individual level factor-analysis.

All these issues can be looked at in the light of emerging supply-chain alliances and have had considerable attention in literature. It can be assumed trust is a crucial factor in the development of such alliances. Monzeka found that there are a number of attributes that are significantly related to partnership success. For this
both quantitative and qualitative data were collected from over 200 businesses. From the perspective of the buying company the attributes of importance were: trust and coordination, interdependence, information quality and participation, information sharing, joint problem solving, avoiding the use of severe conflict resolution tactics, and the existence of a formal supplier/commodity alliance selection process. Resource commitment and smoothing over problems were found to be poor predictors (Monczka, 1998). Relevant in this context are trust, coordination, and interdependence, aspects that will have a positive effect on future longevity.

When there is trust, there is the possibility of betrayal or violation of trust. Two types of betrayal can be distinguished: premeditated betrayal, in which the trustee enters the relationship and builds trust with the intent to betray in a later stage, and opportunistic betrayal, in which the trustee violates the expectations in a particular situation after considering the consequences. The first type of betrayal is very difficult to handle because of the criminal intent and the fact that the trustee changes the system. The second type is more interesting from an e-commerce point of view. The reason for betrayal can be different, but the major motive is self interest (Lake & Hills, 1979). For a precise description of betrayal we will use the definition by Elangovan and Shapiro (1988): “betrayal is a voluntary violation of mutual known pivotal expectations of the trustor by the trusted party (trustee), which has the potential to threaten the well being of the trustor”. The betrayal results from a decision process in which the betrayal is perceived as the most attractive, the one with the highest utility, of two options, are thereby willingly hurts the trustee. This type of betrayal can be manipulated to a certain level by setting appropriate levels of penalty severity and penalty probability.

4 Measuring trust

Theoretical writings on trust and interorganisational collaboration have neglected the measurement aspects of trust. Defining trust as an individual’s behavioral reliance on another person under a condition of risk, a questionnaire measure that assesses trust between the individuals who provide the linking mechanism across organizational boundaries, namely, boundary role persons (BRPs) can be developed. This was done in an experiment by Curral and Judge (1985). In this experiment the measure’s hypothesized multidimensionality was examined. The measure was tested in relation to a nomological network comprised of individual-level correlates based on Ajzen and Fishbein’s (1980) theory of reasoned action and dyad-level correlates regarding the longevity of the relationship between BRPs, the anticipated future longevity of their relationship, and their ability to manage conflict. Survey and archival data were used. Support for the measure’s construct validity came from individual-level confirmatory factor analyses. Further support came from analyses of individual-level and dyad-level correlates (Curral & Judge, 1995).

Although trust is a concept discussed in literature for many years there is very little experimental evidence for how trust behaves in various situations. One such
experiment has been done by Couch (Couch et al., 1996). In this research, a trust inventory has been developed based on two parts: a 40-item measure of trust in generalized others (Generalized Trust) and romantic partners (Partner Trust) is described. In addition, a third measure of trust was developed, the trust in friends and family (Network Trust). The importance of this study was that it showed that the trust scales are reliable, both internally and temporally, and that the Partner Trust and Generalized Trust Scales demonstrate both concurrent and construct validity. The resulting inventory is unique in its capacity to assess these types of trust simultaneously. Evidence supporting the discriminant validity of the Network Trust was mixed. The results showed little evidence of incremental validity of Network Trust. This study was later validated in a study with college students. In this study, it was again shown that General Trust and Partner Trust are distinctive types of trust. Measures of relational trust were significantly more strongly related to relationship quality and commitment, whereas measures of global trust were slightly more strongly related to indices of personality and emotion (Couch & Jones, 1997). Whereas Couch used a questionnaire to measure and study the characteristics of trust, studying trust can also be done by observing human behaviour.

Two experiments are reported which examined operators' trust in and use of the automation in a simulated supervisory process control task. Tests of the integrated model of human trust in machines proposed by Muir (1994) showed that models of interpersonal trust capture some important aspects of the nature and dynamics of human-machine trust. Results showed that operators' subjective ratings of trust in the automation were based mainly upon their perception of its competence. Trust was significantly reduced by any sign of incompetence in the automation, even one which had no effect on overall system performance. Operators' trust changed very little with experience, with a few notable exceptions. Distrust in one function of an automatic component spread to reduce trust in another function of the same component, but did not generalize to another independent automatic component in the same system, or to other systems. There was a high positive correlation between operators' trust in and use of the automation; operators used automation they trusted and rejected automation they distrusted, preferring to do the control task manually. There was an inverse relationship between trust and monitoring of the automation. These results suggest that operators' subjective ratings of trust and the properties of the automation which determine their trust, can be used to predict and optimize the dynamic allocation of functions in automated systems. (Muir & Moray, 1996)

5 Risk

Trust and risk are closely related. If there is no risk there is also no need to trust. How people deal with risk has been a research topic for a long time. This topic of risk taking has been studied in many different disciplines. In this section, three approaches are discussed: decision theory, risk perception, and heuristics and biases.
5.1 Decision theory

How trustworthy a system is considered to be is a decision based on past experience, generally on a series of samples. Other possibilities are transfer from similar systems and so-called ’swift trust’. If we are to study trust, a formal and preferably a mathematical description of trust is needed. One approach might be the so-called prisoner’s dilemma. The prisoner’s dilemma is a game with two players. Each has two choices: to cooperate or to defect. The choice must be made without knowing what the other will do. No matter what the other does, defection yields a higher payoff than cooperation. The dilemma is that if both defect, both will do worse than if they had cooperated. The prisoner’s dilemma is an abstract formulation of a situation in which what is best for each individually leads to mutual defection, whereas each is better off with mutual cooperation.

This game is especially illustrative in situations where there is no central authority. This is often the case in trade between different nations, and almost always the case in an e-commerce situation, where the jurisdiction is unclear to both parties. It is interesting to see that in this situation cooperation emerges without an authority to police the situation. Which factors are necessary for cooperation to emerge are largely unknown. It is clear that some form of trust is required for parties not only to pursue their own interest but also to cooperate for their mutual benefit.

There are several characteristics of this game that are very similar to an e-commerce situation. The first one is that the players cannot force the other party (the customer of the agent) to do something, or make a commitment to the other. This would mean that one can step outside the virtual world of e-commerce and step back to the conventional way of doing business. This would only be possible if the e-commerce business is conventionally structured, which is not necessarily the case. In a virtual world, businesses can be virtual too. Therefore, only if both parties are conventional businesses and if they fall under the same jurisdiction, there are possibilities to solve this dilemma. A second characteristic is that one cannot obtain information about transactions made by others. The only information a player has is the history of transactions between the two players. It is also impossible to include information about what the other is about to do in the decision to be made. The last characteristic is that all information is in the past. Promises have no value unless backed up by actions.

In its original form, the payoff scheme is very simple and clear to the parties involved. In real life, the situation is never that simple. In many situations the payoffs are not comparable at all. One can think of knowledge and money. Knowledge can be shared almost for free but price and value have no relationship to the costs of sharing the knowledge.

The payoffs do not have to be symmetrical from an objective point of view, as long as the payoff scheme is valid within the prisoners-dilemma paradigm. When exchanging information, the payoff scheme may be very different for each of the parties involved. This does not invalidate the model as long as each of the parties is confronted with the dilemma of cooperation or defection.
Associated with this is that the payoff does not have to be measured in absolute numbers. All numbers can be measured relative to each other, thereby broadening the applicability of this model enormously. Think for instance about ‘joy’, which has no price but is measured in psychological research.

People often do not behave rationally. Many of their actions are governed by factors like habit, procedures, rules of thumb, or imitation. It may even be that someone does not make a conscious choice but that the action is more or less the result of chance. If this is the situation, the prisoner’s dilemma is not a good model for human decision behaviour (Axelrod, 1984).

The prisoner’s dilemma can be played in two forms. The first type is a series of predetermined length, where information about when the series ends can be used to optimize personal gain. An extreme form of this type is the one-shot prisoner’s dilemma. The second type is a series of indefinite length, where one of the parties can leave at any moment. In this situation the players cannot be sure when the last interaction between them will take place. This is a normal situation in commerce.

Experiments have shown that one strategy is the most successful in the long run and is called tit-for-tat (Axelrod, 1984). The rules of this strategy are very simple: start to cooperate and, after that, do whatever the other party did. This strategy is very nice at the start and very forgiving. A characteristic about the prisoner’s dilemma is that cooperation is the most profitable situation. This is built in the rules of the game but it is also true in almost all other social situations. However, what is the most successful strategy is often not the strategy used by people. People are generally not that forgiving, they tend to cheat sometimes, and they very much take into account a thing called perceived risk and utility.

Trust has a large social element. The process of interaction is embedded in a social network that limits the possibilities for interaction. The trading parties may not have a relationship between them but they themselves are both embedded in a social structure that has a cultural evolution of cooperation. In this process there are two types of partners: neighbours and strangers. The cooperation between neighbours develop quickly and the process of cooperation stabilizes much faster than with strangers, making the development of relationships easy, something that benefits all parties. With strangers this process is much more complex. The partners will read the tell-tale sign of cooperation and base their trust on the outcome of this process (Frank, 1988). This process is much slower, thereby reducing the risks and slowing the process of a stable relationship within the population. Various mechanisms come into effect when free-riders move through the population, exploiting cooperation in one-shot interactions. People become rapidly more suspicious, reducing the willingness to cooperate, making use of tell-tale behavioural cues more dominant and reducing the possibilities for the free-riders, and eventually resulting in a new equilibrium (Enquist & Leimar, 1993, Frank, 1988).

5.2 Risk perception

Perceived risk is the subjective risk based on probability and value. In risk perception the utility is defined as the product of probability and value. The theory claims
that one must accept the risk when the utility is positive and reject it when the utility is negative. Experiments of many types have shown that humans do not make decisions this way. Losing is perceived as much more important than gaining, and subjective utilities are not linear functions of value and probability.

The utility of a risk is generally taken as the loss (or gain) multiplied by the probability of that event. Many experiments have been done in order to learn more about perceived risk. Most of these experiments are related to social issues, such as what people consider a larger threat: 200 traffic accidents in which people are killed or a plane crash, killing 200 people at one. This last one is considered a much larger threat. Another branch in this research is interested in how well people can estimate probabilities, i.e. their calibration. In general, people underestimate small probabilities and overestimate large probabilities. People tend to be very overconfident in general-knowledge items that are moderate to very difficult, for instance: how many kings or queens are there in Europe (e.g. Fischhoff, Slovic & Lichtenstein, 1977, Nickerson & McGoldrick, 1965, Pitz, 1974). Experts are, in general, much better calibrated. Murphy and Winter (1974, 1977) showed that weather forecasters were particularly well calibrated. This can lead to large discrepancies between what people and experts perceive as a risk.

A second effect when measuring utility is that people tend to weight losses much more than gains. They are very reluctant to bet a considerable amount of money in a situation that has a highly positive expectation. This means that the negative side of the utility curve is much steeper than the positive side. These curves can easily be obtained by looking at betting behaviour. It is clear to everyone that people are willing to participate in a sweep stake where they invest a few dollars, even if they know that the prices represent only about 30% of the invested amount. Playing double or nothing with considerable amount of money is considered only as an attractive game by few people.

Effects like the ones just described will have a considerable effect on trust in certain situations, like e-commerce. In general people will underestimate the risk of an incomplete transaction, especially when they think the amount of money involved is low.

5.3 Heuristics and biases

Special attention is needed with respect to decisions under uncertainty. Many studies have shown that people use various heuristics and have biases in order to cope with such situations. In situations where people have to decide how frequently a certain situation occurred, they often rely on availability. They try to remember situations that are representative for this special event. This means that their judgement is largely based on the retrievability of such instances. This heuristic is a very useful one because availability will be a representative of the size of a certain class: large classes will have a better availability than small classes. However, the availability not only depends on frequency, but also on how easy instances of that class can be retrieved, imaginably, situational conditions, and correlations. (Tversky & Kahneman, 1973, Galbraith & Underwood, 1973, Chapman & Chapman, 1969).
People's judgements on the frequency of an event is also affected by anchor points: When people start from an initial value they tend to stay close to this value. If they are told that a certain event is rare, they will arrive at another estimate than if they are told that this particular event is rather common. With complex events, this is even more complicated. People tend to overestimate conjunctive events, and underestimate disjunctive events. Together with the effects already mentioned, this can have serious consequences for the outcome. Highly unlikely outcomes can be judged as likely events. When confidence intervals are added, people tend to narrow the confidence region compared to the true distribution of an event (Bar-Hillel, 1973, Slovich & Lichtenstein, 1971, Winkler, 1967).

A dominant factor in biases' effects can be labeled representativeness. A concrete e-commerce example of this is that some people believe that a reliable business has a well designed web site. From this, people infer (or make the logical mistake) that if they see a well-designed web site, they rate that business as reliable. People are very vulnerable to this type of judgement errors, and this type of error tends to override factors that should influence the judgement of probability.

A factor related to this is that people tend to generalize from a too small sample-size and they do not appreciate the variability of small samples. If they are successful in a transaction for a few times, their trust in that type of transaction can grow much faster than can be defended objectively.

One of the factors that does not have an effect on the estimates, although it should have one, is the base-rate. If it is known a-priory that the probability of belonging to a certain class is 'a', this information should be used to estimate the probability in an actual situation with evidence. Unfortunately, even when people are given worthless evidence, they do not use the a-priory probabilities in their estimation, but base their estimation on this worthless information. For instance, if users were told that ten percent of all Internet sites were owned by con men, and they were asked to rate a certain site they would only use the information from that site and not their knowledge about the con men.

6 Trust and Distrust

As has become clear by now, trust is something that continuously updated during the development of a relationship. This is what makes trust a difficult concept in the e-commerce situation. E-commerce relationships are generally not long relationship, and to establish trust such a relationship is needed in order to do business. Trust normally develops between two people. When companies express mutual trust, this is generally a generalisation of some key figures in the organisation who trust each other. This type of trust is impossible in an business to consumer e-commerce situation. The consumer can judge most companies only by the web interface (with a few exceptions). To know how trustworthy the company is in the entire process, the consumes must do business, and for that he needs to provide sensitive information: name, address, and credit-card data. This dilemma cannot be solved in a straightforward manner. The companies doing business over the
Internet can use web sites that appear very trustworthy and try to establish names that are trustworthy. However, with the rapid development of the Internet and e-commerce, it is almost impossible for a customer to develop a level of trustworthiness of a company. The result may be that only a very few companies survive and the expected possibilities for small, new, and revolutionary companies will never come true.

Instead of developing trust on trustworthiness it may be better to base the entire transaction on distrust. In this situation every claim one of the two parties makes must be proven. When valuable data is exchanged this data can be verified by using a trusted third-party. This trusted third-party can even be a chain of parties if the two parties do not have one in common. In this approach, one obtains trustworthiness by proof rather than by belief.

7 Trust and control

One way to manipulate trust is by giving the users control. With the possibility of control, a situation becomes more trustworthy. In the business-to-business situation, some even suggest that trust and control are parallel concepts (Das & Teng, 1998). Firms feel more confident about cooperation when they have adequate control over their partner. This effect of control on trust in alliances between firms has been studied, e.g. Beamish (1988) and Sohn (1994).

There is very little literature on the relationship between control and trust in consumer to business situations. Some more literature can be found in the field of process control. Muir and Moray have shown that trust in automation was mainly based on the perception of the control unit's competence. The overall performance had hardly any effect on trust in the automation (Muir & Moray, 1996). It was also shown that there was a high correlation between the operators' trust in the system and the use of automatic control. This trust also had a significant effect on their monitoring behaviour.

This clearly shows that there is a need for more knowledge on trust and control at a fundamental level. For our purpose, the slightly different scope is chosen to study the relationship between behaviour, trust and control within the domain of e-commerce.

8 Trust and trust violation

From literature there are two ways known to measure trust: attitude research and behaviour. Attitude research is the more common. In this type of research, the subjects are asked about their subjective perception of using a questionnaires. Most of these questionnaires consist of several independent sub-scales and, by applying various statistical techniques, a level of trust is derived form the answers given.

The other approach is by studying behaviour. This is done in the study of Muir (1994), where subjects were given a control task. The task was to pasturise a product. The plant had an automatic control system, and this control system could be
switched on and off by the user. However this control system was not entirely reliable. So the user could switch it to automatic and experience some malfunction or control it manually. By letting the system fail it could be studied how people reacted to this unreliability.

A similar approach was taken in social psychological experiment by Barber (1983) in which students had to respond totally unpredictably to friends and family. The result was that many of these friends and family panicked because the students behaviour could not be predicted and relied on.

These two types of research provide two types of knowledge. With a questionnaire it is possible to learn how people perceive an event, with behavioural studies it is possible to learn how people react to an event.

In the situation of e-commerce, both types of knowledge can be very valuable. It is known from various experiments that people with the same perception of the situation react very differently, for instance, in life threatening situation some freeze, whereas other show a flight/flight type of reaction.

In the situation of e-commerce, there are many components involved, each of which have their specific effect on trust. The Muir experiment has shown that failure of one subcomponent does generally not mean the loss of general trust in the system, only for that specific part.

9 The e-commerce system

E-commerce as we know it today is based on internet technology. Internet, or internetwork, is a series of protocols that describe how each and every part of the network components must work together. In everyday use, most people when they refer to the Internet they mean the World-Wide-Web, a network based on hypertext documents which can be accessed by means of an application generally referred to as a browser. This particular application on the Internet has gained so much popularity thanks to its ease of use and graphical capabilities. Ease of use has only become possible because much of the functions needed are hidden from the user. The users trust the system supporting the connection. Only the interface of the application shows itself to the user, whereas data-presentation, session-control, transmission-control, network-protocol, and interfacing to the physical cable are not under control of the user. At the lower levels of control, robust strategies are applied to ensure a reliable data-connection. It is at these levels that one must make sure that trust is not threatened by data alteration, connection hijacking, and data interception. This process is hidden from the user entirely and the user has hardly any control over it. Users expect to be connected to the one he expects, that the information he receives is genuine, and nobody is listening in. Due to lots of publicity in the media most users are aware that listening in is very possible, but most users are rather unaware about the first two possibilities.

The level at which the user has control, the application level, is different from what most users expect. The user can only see what is presented through the graphical interface and has to trust that there is nothing else of importance to know. Most
applications hold information about themselves, the user, the computer it is running on, the history of sites visited and documents retrieved, and a database with special data-packages provided by some servers, so called cookies. Servers can retrieve (some of) this data, often without the knowledge or approval of the user. What information is available, what can be retrieved, and how this can be retrieved is often known by the developer of the application, information he may publicizes in special documents. Often the user can select which information may be provided to servers requesting this information. In order to increase browser functionality small programmes can be loaded into the application (or applets) by the server. Depending on the quality of the application and the settings selected by the user, this may have serious consequences because these applets may breach security, collect confidential information, or perform other functions that they are not expected to do. Here is a serious issue of trust in the application software.

On the server site, the situation is even more complicated. The server collects information about (potential) customers and uses this information to their benefit. The customer has virtually no control on what is stored and how this information is used. Due to the organisation of the network the databases may not even have a physical location: it may be scattered over numerous computers which are spread all over the world. This will be discussed in more detail in the next section.

9.1 Trust and e-commerce

E-commerce is a very special domain in the study of trust. One study is by Egger (1998), in which a framework for studying trust in this particular domain is laid out. Based on several studies Egger recognises five processes that have their effect on trust in a buyer-seller relationship:

- The first process is a calculative process: is the partner worth trusting? This is a cost/benefit analysis in which the costs and rewards are assessed associated with either cheating or staining in the process. Factors which can be included in this process are the investments already done, the partners size and reputation, willingness to customise, information sharing, and the length of the relationship.

- The second process is a prediction process: is the partner likely to stay trustworthy? Here one party tries to forecast the other party's behaviour. This is not only influenced by duration and number of interactions, but also by sharing of experiences in order to learn more about the other part (Doney & Cannon, 1997).

- The third process is the capability process: does the other have the means to stay trustworthy? This component focuses on the other party's credibility. One estimates the other party's resources to fulfill its promises.

- The fourth process is intentionally: why can the other party be trusted? In this process the other parties motives are assessed. In order to make the assessment one should look at the situation from the other party's perspective.

- The fifth process is transference: do third parties trust the other party? One will trust a party more easy when it is trusted by others one trust. It can be compared to asking references from another party. This process can be of particular importance when one has no prior experience with the other party. It is concluded by Egger that
these processes are of importance in developing a cooperative relationship (Egger, 1998).

Gadrey and Gallouj (1998) argued in an article that the provider-customer interface is of crucial importance for a company. This interface is not only a substitution of the other business services, but also a complement, and it provides new ways of interaction. This interface is a reflection of the company's internal structure, and the company's structure must adapt to the required interface for optimal interaction. Gadrey & Gallouj see the interface as a "moment of truth" (where the interface is a reflection of the organisation, part of the process interaction, and part on the consumer-client chain), a "moment of trust" (based on the various modes of interaction and the logic of the interface), and a "moment of thrust" (the result of innovation). With this analysis the writers show that the interface is not only of importance to the customer but also to the company.

There is currently a great deal of interest in the development of intelligent agents. While there is little agreement on exactly what constitutes an intelligent agent, many definitions embody a user-interface model that differs from the traditional one where users perform tasks with the help of computer-based "tools". In contrast, the "delegation" model associated with agents is based on entrusting tasks to an autonomous, sometimes anthropomorphized system, whose performance is monitored and evaluated. This change in user-interface model is a dramatic one since delegation can be a difficult and often-avoided behaviour in humans. Agent-interface designs need to overcome well-established drawbacks in delegation. For this purpose, designers should find the management sciences and organizational psychology literatures to be as relevant as that of traditional human factors (Milewski & Lewis, 1997).

An emerging way of interacting on the web is by applying agents, programmes that autonomously do certain well-defined tasks for the "owner". A special type of agent is the mobile agent, which does not remain on the computer of the owner, but goes out on the web to special servers to interact with other agents in order to achieve its goal. Such goals may be finding information or purchasing products. Their applicability largely depends on security techniques. At present their are still many issues to be resolved (e.g. Greenberg et al., 1998). When these issues are resolved, it is still unknown how users will apply them.

### 9.2 Trust in e-shopping

When discussing e-shopping it is important to make clear what the process of e-shopping incorporates. We limit e-shopping to rationally selecting and buying a product that fulfills a need. A model of this process can be found in figure 1.

Important in this model is the fact that the decision is based on a criterion using objective information from the company's databases. On the left-hand side the data-space with products is explored, and on the right-hand side is the decision process. Two horizontal links at the second and third level represent level-specific criteria than help improving the criterion. Special a-priori knowledge can be applied to skip the selection process, represented by the two curved lines. Only this
Figure 1: A rational model of buying in an e-shop environment
type of purchase is considered in this report.

When we talk about trust in a e-commerce situation, there are various parts that play a role. The first part is the connection: is the user connected to the intended party?, is the information unaltered?, and is nobody listening in on the line? Each of these three issues are far for trivial and very hard to handle by the average user. There are a number of technologies available which make it very hard for a fraudulent party to apply each of the three possibilities mentioned but they also complicate the ease of use of web-based access.

The second part plays a role in e-commerce trust is the web-site itself. All companies will try to make their web site appealing for the customer, but making it trustworthy is different. Several studies have been done on what a trustworthy site should have. Issues like colour scheme's, feedback on product selection and purchases, feedback on product and delivery progress, information the supplier wants from the customer, about the company itself, and on how the company deals with privacy and security are all factors that have their effect on customer trust.

A third factor is the company's name and its reputation. This is something that is not the result from the interaction between company and customer, but information retrieved in other ways like magazines and newspapers, experience from colleagues, friends, and others. Two elements are very important in the reputation of an off-line company: age and size. Most people assume that when a company is longer in business it is more trustworthy because companies that are trustworthy cannot stay in business. It is also accepted by people that larger companies are more trustworthy because companies can only grow if they prove to be a trustworthy partner. These hypotheses have been confirmed in several studies.

A very important factor in trust is the exchange of payment information. At a certain point, the customer wants to purchase the selected goods and make sure that they will arrive, and the company wants to make sure that he receives money for the products shipped. Both parties want therefore to ensure the identity of the other party and the validity of the information, which is something that is very hard to achieve at present. Payment systems are lagging behind the e-commerce technology. With the exchange of credit-card information, the merchant or producer receives too much information required for the transaction but at the same time the merchant or producer has too few means to validate the information, and the customer pays for products who are not in his possession yet. This is a serious threat for e-commerce trust. Studies have shown that inexperienced users see these issues as major barriers, whereas more experienced buyers seem to have overcome their reluctance, although this may be the result of population selection. It has also been shown that people who have more experience with the Internet are less reluctant than novices.

Many studies have shown that control is very important in building trust. The customer wants feedback on the situation and positive control on his purchase actions. The customer also wants to provide no more information to the merchant than is necessary for the transaction at that stage. The more control the customer has, the more trust he will develop.

From the previous section we may conclude that one way to obtain trustworthi-
ness is obtained by providing control.

### 9.3 Implications for e-commerce

Our conceptualization of the relationship between customer satisfaction and loyalty has generally relied upon Hirschman's (1970) exit-voice framework from economics. Yet, there are a variety of organizational, political, social, and technological aspects of a customer's purchase and consumption environment that are likely to influence the satisfaction-loyalty relationship. These factors comprise a customer's trust environment. Johnson and Auh describe in their paper the conceptualization of the satisfaction-loyalty relationship to encompass this trust environment. Additionally they developed research propositions that describes how the trust environment affects the satisfaction-loyalty relationship. (Johnson & Auh, 1998)

One of the issues of trust and Internet purchases is culture. Whereas for most people Internet commerce was largely synonymous with the U.S.A.-based e-commerce, but Internet commerce in Europe is growing rapidly and the rest of the world is expected to follow. This raises questions about the cultural effects of trust. A .com-address is no longer synonymous with a U.S.A.-based merchant (which is different from for instance a .de- or a .nl-address, which are owned by German and Dutch-based companies). Not knowing the origin of the company may be a factor in issues of trust, and the origin of the consumer may also have impact on trust.

Many have speculated that trust plays a critical role in stimulating consumer purchases over the Internet. Most of the speculations are based on U.S. consumers purchasing from U.S.-based online merchants. The global nature of the Internet raises questions about the robustness of trust effects across cultures. Culture may also affect the antecedents of consumer trust; that is, consumers in different cultures might have differing expectations of what makes a web merchant trustworthy. Jarvenpaa and Tractinski (1999) show that different cultures do have different approaches to trust. It was shown that U.S. consumers do show more initial trust than consumers from Japan. Company reputation and sense of control was found to be very important in Japan (see also Hayashi et al., 1999).

Several theories of relationship marketing propose that customers vary in their relationships with a firm on a continuum from transactional to highly relational bonds. Few empirical studies have segmented the customer base of an organization into low and high relational groups to assess how evaluations vary for these groups. Using structural equation analysis, the authors analyze the relationships of satisfaction, trust, and commitment to component satisfaction attitudes and future intentions for the customers of a New York off-Broadway repertory theater company. For the low relational customers (individual ticket buyers and occasional subscribers), overall satisfaction is the primary mediating construct between the component attitudes and future intentions. For the high relational customers (consistent subscribers), trust and commitment, rather than satisfaction, are the mediators between component attitudes and future intentions (Garbarino & Johnson, 1999).

When studying trust there are two factors that must be taken into account: risk
and benefit. Most consumers have very little knowledge of the risks they are facing. As a result they do not apply all existing security safeguards or do not apply them correctly. The problems related to these issues will be discussed later. Although consumers do have concerns about the security of their purchasing activities, the security issues are outweighed by the merits offered by on-line shopping (Furnell & Karweni, 1999). Their lack of awareness or understanding of the risks involved, or their shortcoming in applying the techniques that are available do suggest that when critical data must be exchanged over an open network, a more usable technology must be developed.

With the arrival of large numbers of new users from the “general public” on the Internet, the difference between those who develop and maintain the Internet and the average user increases rapidly. The trust and confidence in the Internet is largely dependent on the perception of the general public on these professionals, on how honest, capable, competent, and accountable they are. The open nature of the Internet is both its strength and weakness: everybody can study the internal structure of the network, add new features, and improve existing features. This development model has proven to be very successful during the entire history of the Internet. On the other hand, because it is possible to know all the internals of the internet, someone knowledgeable might try to find its weaknesses and abuse this knowledge. In a study on the user needs by Feldman, five factors were dominant: real time information availability; accurate and precise data and information; usability and usefulness of information platforms; ease-of-use of communication systems; and access and accountability to users of Internet developers and data providers (Feldman, 2000).

10 Directions for research

At present there is an urgent need for experimental validation of our knowledge of trust issues in e-commerce. In this study we can distinguish between the development of trust over time, which elements enhance our trust in an e-commerce situation, and the effect of the violation of trust.

When studying the development of trust, interviews and questionnaires seem the appropriate approach for this issue. Behaviour may not always be rational in a logical sense, but when people have the time to think about their decisions, they are generally well aware what they do, how they do it, and why they do it. Information retrieved from following subjects asked to purchase a product in an e-commerce situation can provide this type of information. If the subject is asked to rate all elements of importance a process model of trust can be developed. Such a model can be seen as an extension of the work of Egger (1998), in which he describes MoTEC (Model of Trust for Electronic Commerce), and uses this model to evaluate online shops (or e-shops) by applying a checklist.

In the dynamic process of the violation of trust, this approach will not be the best because people by definition do not have the knowledge about what the situation is: their knowledge and expectations are violated. In such a situation, be-
havioural studies are more appropriate. These violations can happen at different levels of cognition. One can compare this to human errors described by Reason (1990). In his book, Reason discusses the source and effect of human errors at three levels of decision making: skill-, rule-, and knowledge based. At the skill level, errors happen frequently but are easy to detect and correct. Almost the opposite is the case with knowledge-based errors, which are very hard to detect, because what one expects is happening, and therefore very hard to correct.

At at low level of the interface, violations will show a direct effect, but it can be expected that it is short lasting. Inconsistencies and errors in labeling, tagging, colorisation, etceteras. At a higher level of abstraction, where logical, rule-based conclusion are drawn, violations have a more serious impact. One level of abstraction higher is the rules-based level. Violations at this level are expected to have a more serious effect on trust. One can think of the type of problem if, when you add an item to your order, the number of items does not increase. The highest level, the knowledge based level, is expected to have the most dramatic and long lasting effect. One example of such a violation could be to withdraw the amount of money from an account the moment a product is selected.

One aspect of trust violation is the severity of the effect due to the level of abstraction. A second aspect is how user will deal with this. The problem the user has to solve is a conflict between an expectation drawn from information collected previously and new information that violates this expectation. At a very low level one might expect that the user will use redundant information in order to resolve the conflict. This redundancy can often be found in other information provided with the conflicting information. On higher levels of abstraction this means that much more information from various places must be consulted in order to construct an additional abstraction of the situation which can be used to evaluate the situation and decide on the trustworthiness of the situation. This information can even be drawn from sources outside the domain in use. The ultimate decision will be either to trust or to bail out.

One way to increase trust is to provide control. Users require more control when the trustworthiness of the system is considered to be too low. When this control is provided, trustworthiness increases, independently of the objective level of risk. This mechanism of manipulating trust may provide an experimental opportunity. It might be an interesting topic for research to see how people react to illusionary control: they are provided with control inputs but only input that is demanded by the system is actually accepted, or, the user must provide input and the system provides 'optimal' data as guidance. A measure of trust might be to see when users switch from simply accepting the lead to when they change the guidance data. One can think in the domain of e-shops of providing an 'optimal' product choice, based on user input and preferences.

In the process of an e-commerce transaction, two very distinctive stages can be recognised: product selection and purchase. In the selection phase, the risks for the customer are limited. In the purchase phase the risks are much higher for both parties because the product must be exchanged for money. It is therefore expected that violations in the stage of information collection prevent the development of
trust, whereas violation in the purchase phase will seriously reduce trust. Only when the level of trust built during the information collection phase is high enough the user will be willing to make a deal. Trust violation in the purchase phase will make the user abort the process.

Buying a product is a complex process in which a number of stages must be taken in the right order, each ending with the desired outcome. The precise specification of the product by the merchant, the price which must be paid by the customer, the delivery conditions for the product, the payment conditions for the customer, each element is bound by a complex set of actions. Part of this has been developed by good business traditions, part of this is embedded in law. To make sure that all conditions are met and all aspects of the transaction are clear to both the parties control is needed by both these parties. There are various ways of control, most depending on feedback. Based on the fact that feedback increases trust, and trust is expected to be of more importance in closing up the transaction, one can expect that feedback is of significance at all stages of legal importance.

An issue that is related to trust, but probably not directly part of it, is privacy. Both parties can collect data and use it for purposes other than the transaction itself. Privacy issues encompass collecting too much information (e.g. why does the bookseller need to know the client's age), storing and combining information (e.g. there is no need to keep the book-purchase record for 10 years), and trading purchase-information (e.g. combining information from different companies to improve targeted marketing). Both parties must balance which information is required to provide service to the customer and what would be desirable to improve the marketing position. From a trust point of view, it would be interesting to see how the three privacy issues affect trust. There are several problems with an experimental approach. One issue is that customers tend to prefer short term benefit over long-term costs (e.g. small bonuses at the counter various a serious reduction of the diversity of products). A second issue is that customers lack the knowledge about how much information they provide and how this can be combined (e.g. supermarket purchases and health-insurance premium).

When discussing e-commerce, this is generally a synonym for e-shops, web-based stores (e.g. Amazon.com). With the success of the Internet, which seems to be of more importance than the introduction of the telegraph and telephone, many more types of services will be provided. In fact, the entire way of production might change now that the customer can directly interact with the producer. The Internet also provides very specialised producers a world-wide market, possibly reversing the trend of an ever reducing number of world dominating companies. These specialised producers will often provide another type of service than can be sold via an e-shop. We need to focus on other types of Internet based services also. In a society where information is at a premium, the classical way of ordering a product, which is delivered by a shipping company is inappropriate. The principal characteristics of different types of services must be identified and their trust issues described.

In order to do this type of research it is needed to have an experiment environment in which users' needs, attitudes, and knowledge can be studied and
their behaviour can be monitored under various conditions set by the researcher. A real-life situation is only suitable for a very limited part of this research. First because at present only a few services are actually provided, and secondly because the conditions cannot be controlled. By its very nature, this type of research is complex. When setting up an experiment for this domain, services must selected and developed carefully in order to cover a significant part of the domain. One can think of various types of services: an e-shop selling a network-deliverable user-specified product (e.g. software), an information-broker who does not have or own the information but knows where to buy the different components and can combine all components to obtain the desired information (voyage-planning for trucks), a travel agent who provides custom made trips, a service to bring employers and potential employees together, etceteras.

One of the mechanisms applicable to increase trust is the use of so called Trusted Third Parties (TTPs) (Skevington & Hart, 1997). These TTPs are organisations or companies who can verify the identity of a partner and help with secure information exchange. TTPs are considered of crucial importance for the growth of e-commerce. In the study of trust and e-commerce it is of importance to know when in the transaction the information TTPs may provide is needed. Identity verification is crucial during the closure of a transaction, but it may turn out that, for the development of trust, identity verification is important in the very early stages together with additional information about the other party. A second question with respect to TTPs is what makes users trust these TTPs. Right now the existing TTPs are companies like all others which is why the problem of company trust is shifted. It may even be that because of their crucial role users are even more reluctant to trust TTPs. The last issue with respect to TTPs is how to use the information in their databases. For such a crucial function, it must be easy and reliable to use, and it must be clear to the user what the provided data actually means.

Earlier, we discussed the issue of trust and distrust. Trust is a very important mechanism for the development of cooperation. So one could argue that we must learn to trust and keep the risks to an acceptable level. However, with the Internet as it is developing, a true world-wide network that can potentially be accessed by six milliard people, developing trust outside a very small circle of partners may be more difficult than we hope for. One approach to this problem may be a transaction model entirely based on distrust. The other party is not trusted on its promises, the other party must prove, all based on the motto: “trust is good, control is better”. One realisation of this type of transaction is by using a trusted middle-man (or a chain of these), a middle-man who collects the vital information of both parties and only sends the information through when all is complete and in order. It would be very interesting to see if such a transaction model would enhance consumers’ trust of web-based transactions by making the system trustworthy.
II Conclusion and discussion

This report described the state of knowledge about trust applicable to the e-commerce domain. Trust is a multifaceted construct that is largely subjective and has very strong ties with risk-taking behaviour. In this instance we tried to describe trust in the domain of e-commerce. Whereas trust in general is very subjective and therefore hard to grasp, in the ill-defined domain of e-commerce it is even harder to understand. E-commerce is only defined in its way of communication, constraining the possibilities of the types of information that can be exchanged. How this communication is applied, what exactly is communicated, who the parties are, and what their intentions are rather diverse. This makes doing research on general trust in e-commerce almost impossible.

On the other hand, there is a lot of knowledge available on trust in general, especially on risk taking and there is some knowledge about the role of trust in business. From this one can expect that business is impossible without some level of trust by both parties. One can also expect that the development of trust by behaving as expected and even promotively towards the other party is very different from the breaking down of trust by violating this trust placed upon the other party. We argued that different types of violation will have different effects. Violation which can be classified as skill based errors or slips will have a small and very local effect, whereas knowledge based violations, or intentional violations, can have devastating effects.

It is also expected that in the two major phases in the process, the collection of information and the actual transaction, users will behave very different because of the direct consequences (risks) involved. It is therefore expected that in the information collection phase the development of trust is much more important than in the transaction phase.

Trust from an organisational point of view is different from a personal point of view. In a business situation, the employee represents the company and must ensure positive long-term consequences of his actions. In a personal situation, the actor will be much more directly involved in risk-taking behaviour.

Issues of privacy are of importance but are not expected to have a major effect on trust, which may become a serious and very important issue. This will be especially true when short-term benefits ‘hide’ long-term risks. It is therefore very important to study the effect of these short-term benefits on risk-taking behaviour. This short term risk taking behaviour might be a serious threat to trust on the long run. E-commerce is rising so rapidly thanks to the convenience and ease of use of Internet communication, but when the risks are neglected these strong advocates may become its most serious threat.
Projects on e-commerce at IPO

In 1999 at IPO/TUE a number of projects on the topic of human-machine interaction in e-commerce have been initiated. In the development of these projects it is tried to cover the most relevant issues as they exist at present. The topics selected are trust in the user interface design, the development of payment systems for user acceptability, and the development of new e-commerce services.

Title: MUST: Maximising Usability and Trustworthiness in business to consumer electronic commerce.
PhD-study of Florian Egger
Date of project acceptance: 4 January 1999
Description:
Maximising usability and trustworthiness in e-commerce system design is increasingly viewed as a sine qua non condition for online vendors to attract and retain new customers. This project will therefore investigate the psychological nature of trust on one hand and explore the relationship between a system’s experienced trustworthiness and its usability on the other. The main objective of this piece of research is to develop a Method for Usability and Trustworthiness Evaluation and Design (MUTED) that bears a specific relationship to the domain of business-to-consumer e-commerce. An adapted trust and usability engineering lifecycle will be presented, introducing, amongst others, a multidisciplinary trust-requirements engineering method, as well as a Checklist for Usability and Trustworthiness Evaluation (CUTE).

Title: User-related factors in electronic payment systems for e-commerce
PhD-study of Dennis Abrazhevich
Date of project acceptance: 1 April 2000
Description:
The explosive development of the e-commerce in recent years makes the issue of how to pay for goods and services over the open networks very actual. The problem with conventional ways of paying do not work properly over the Internet. They fall short on aspects as trust and security. The Aim of this project is to develop a framework for a business-consumer payment system in an e-commerce environment. This payment system will be optimised with respect to consumer acceptability. In the design four groups of properties will be taken into account: user-, transaction-, database-, and security-related. The result will be implemented and evaluated in an experimental setup.

Title: A virtual e-commerce world at the TUE campus
The ’99 group of USI-students (19 TwAIO’s)
Date: from 1 September 1999 until 1 August 2000
Description:
The goal of this project is to build an integrated series of web-services which have e-commerce qualities. A central element in these web-services is the bank, which can be accessed by all web-users and which is used for the financial transactions between the services and the users. In addition to the bank there are five services available. In contrast to most e-commerce plans, these services are not e-shops but new services that have an added value to the customer. The task for each of the six groups of USI's is to develop a plan for a service, design and build the service, integrate it in the web, connect it to the bank, develop a marketing plan, and do an evaluation of the service with actual users.
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Mailing list

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