Manuscript: Trust in Mediated Interactions
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Jens Riegelsberger, M. Angela Sasse, John D. McCarthy

Department of Computer Science
University College London

ABSTRACT
With an increasing number of technologies supporting interaction at a distance, trust in mediated interactions has become a key interest in the field of human computer interaction (HCI). Research covers the role of trust in mediated interactions with other individuals (e.g. in virtual teams) and organisations (e.g. via e-commerce web sites). This chapter synthesises current research into a framework that introduces the key factors that affect trust and trustworthy behaviour. These are *contextual properties* (motivation based on *temporal*, *social*, and *institutional embeddedness*), and the *actor's intrinsic properties* (*ability*, and motivation based on *internalized norms* and *benevolence*). Knowledge of these underlying factors can help designers in structuring the design space and researchers in planning and generalising from studies on trust in mediated interactions.

1. INTRODUCTION

Examples of trust issues in mediated interactions range from potential e-commerce customers staying away from a technology for fear of being defrauded (Consumer Web Watch, 2002) to virtual organisations struggling because *"trust requires touch"* (Handy, 1995). Hence, there has been a surge in online trust research in the field of human computer interaction (HCI). This research mainly addresses two areas (Feng, Lazar, & Preece, 2004): trust in websites, in particular those of B2C e-commerce vendors, and trust in other people, with whom one interacts via online technologies (e.g. email, instant messaging, video-conferencing) in virtual team settings. The findings of this research are highly relevant for companies providing such technologies and services, but also for regulators, consumer protection agencies, and researchers who are concerned about the social transformations induced by new technologies.

However, HCI trust research lacks an agreed theoretical basis in terms of concepts and research methodologies. This has led to a situation where many researchers who claim to investigate trust in online interactions are in fact studying rather distinct aspects of trust. Unsurprisingly, many apparently contradictory findings have been reported and it is difficult to reconcile them without a common terminology and a common frame of reference.

In this chapter, we present a brief overview on the background of trust research and its relevance. We then introduce a framework for trust in mediated interactions that draws on existing models and findings, and applies to human trust in other humans, organisations (e.g. e-commerce vendors), and technology (e.g. web sites). Beyond incorporating variables related to the trusting and the trusted actor, the framework accommodates key contextual factors. Rather than treating trustworthiness as a relatively stable attribute of the trusted actor, the framework considers how trustworthiness is influenced by these contextual factors. We believe that this framework will help researchers in aligning disparate research findings and that it can be a step towards in building a theory of trust in human-computer interactions. For designers the benefit lies in helping them to fully explore the available design space systems that fostering trust in mediated interactions.

After a short introduction to the background of trust research (Section 2), this chapter outlines the framework (Section 3) and applies it to research findings on trust in e-commerce (Section 4) and trust in virtual teams (Section 5).A more detailed version of the framework can be found in Riegelsberger, Sasse, & McCarthy (2005).

2. TRUST

The term *trust* is used in everyday language, but its meaning is only loosely defined and varies considerably with context. In the scientific community, the situation is unfortunately not very different. Trust has been studied for many years in many disciplines and there is a plethora of trust definitions researchers can choose from (Corritore, Kracher, & Wiedenbeck, 2003b). The definitions contrast on various dimensions and are applicable to different situations. In addition, the methods used range from social dilemma games, via self-report questionnaires, ethnographic studies – again with ample differences in the constructs that are measured or the phenomena observed. The sociologist Uslaner (2002) concedes that it "works somewhat mysteriously" (p. 1). There is no widely accepted theory of trust – rather research is fragmented across several disciplines, divided by conceptual and methodological boundaries (Gambetta, 1988).

While the definition and measurement of trust are subject to much disagreement, the relevance of trust is, rarely disputed. Trust reduces the need for costly control structures, and thus enables exchanges that could otherwise not take place and makes social systems more adaptable (Uslaner, 2002). Not surprisingly, generalised trust correlates well with macro-economic indicators such as productivity or health (O'Neill, 2002; Uslaner, 2002; Putnam, 2000; Fukuyama, 1999). Empirical studies by economists did also find a positive effect of trust on productivity in joint ventures and within work teams (Uslaner, 2002; Fukuyama, 1995; Sitkin & Roth, 1993). In research on consumer decision-making, trust in the vendor and the product has been identified as an important factor for purchasing decisions (Aaker, 1996; Kotler, 2002)

Trust permeates most of our actions, because modern life is characterized by a high dependency on others' actions (Giddens, 1990). As an example, making ourselves dependent on others allows us to focus on specialised professional activities, while others ensure the safety of our possessions, the supply of food, or the education of our children. Relinquishing direct control of critical activities by externalising them to others frees resources for activities at which we are more productive. In many situation trust will be given so fully and habitually that it is not recognised as such, but is experienced as mere "expectation of continuity" [Luhmann].

Most researchers, however, agree that the question of trust is experienced in situations in which there is some level of experienced uncertainty regarding the outcome and where this outcome has some value to the individual (i.e. if there is some risk; Mayer, Davis, & Schoorman, 1995; Luhmann, 1979). Uncertainty arises from the dependence of the outcome on the actions of actors in whose reasoning or functioning the trusting individual has only limited insight (Giddens, 1990).

The discourse on trust held within the field of HCI with a view to optimising design should also be seen within the wider sociological debate on the effects of technology on society and – more specifically – *social capital*[1]. Several researchers have argued that the drop in indicators of social capital seen in modern societies in recent years can partially be attributed to the transformations of social interactions brought about by advances in communication technologies (Putnam, 2000). Interactions that used to be based on long-established personal relationships and face-to-face interaction are now conducted over distance or with automated systems – a process also described by Giddens (1990) as *dis-embedding*. According to this view, by conducting more interactions over distance or with computers rather than with humans, we deprive ourselves of opportunities for trust building. A similar view can be found in the field of organisational theory. Some authors claim that reported failures of systems to yield the expected productivity gains in organizations (Landauer, 1996) partially stem from a reduction in opportunities to build social capital that came with their introduction (Resnick, 2002). Trust, goes the argument, can be formed as a by-product of informal exchanges, but if new technologies make many such exchanges obsolete through automation, trusting relations between humans may not be formed.

While this view is not universally shared (systems may, for example, be designed in such a way that they encourage personal interaction; Resnick, 2002), it suggests that trust is a highly relevant subject for the design of systems that support mediated interactions. Several researchers responded to this situation by creating models of trust in mediated interactions (e.g. Tan & Thoen, 2000; McKnight and Chervany, 2000, 2001; Corritore, Kracher, and Wiedenbeck, 2003, Fogg 2003a). Most of these models focus on the factors that contribute to the perception of trustworthiness. Our framework outlined in Section 3 references these models, but it broadens the focus to include factors that motivate trustworthy behaviour. Signals for trustworthiness are then considered in a secondary step.

3. FRAMEWORK FOR TRUST IN MEDIATED INTERACTONS

3.1 The Basic Model

We develop the framework from the sequential interaction between two actors, the *trustor* (trusting actor) and the *trustee* (trusted actor) – e.g. a human or an e-commerce vendor and its technology. Figure 1 shows a model of a prototypical trust-requiring situation[2]. Both actors can realize some gain by conducting an exchange. Prior to the exchange, trustor and trustee perceive signals (1) from each other and the context. The trustor's level of trust will be influenced by the signals perceived. Depending on her level

[1] *"… social capital inheres in the structure of relations between actors and among actors."* (Coleman, 1988, p. S98) Social capital becomes manifest in obligations and expectations, information channels, and social norms. Trust is an important factor of social capital (Fukuyama, 1995; Coleman, 1988; Glaeser et al., 2000).

[2] This situation is captured by the Trust Game (Berg et al., 2003; Bacharach & Gambetta, 2003).

of trust and other factors (e.g. the availability of outside options), the trustor will either engage in trusting action (2a), or withdraw from the situation (2b). *Trusting action* is defined as a *behaviour that increases the vulnerability of the trustor* (Corritore et al., 2004). This can apply to anything of value to the actors: money, time, personal information, or psychological gratification. A trustor will engage in trusting action if she can realize a gain when the trustee fulfills his part of the exchange (3a). However, the trustee may lack the *motivation* to fulfill, and decide to exploit the trustor's vulnerability, or he might simply not have the *ability* (Deutsch, 1958). Both possibilities result in non-fulfillment (3b).

In the hypothetical absence of any other motivating factors, being trusted and then refusing to fulfill (3b) is the outcome with the highest gain for the trustee. However, in most real-world situations, we observe trusting actions and fulfillment in spite of incentives to the contrary: vendors deliver goods after receiving payment, banks pay out savings, individuals do not sell their friends' phone numbers to direct marketers. In many such cases, trustees' actions are motivated by *trust-warranting properties* (Bacharach & Gambetta, 2003), i.e. intrinsic or contextual factors that provide incentives for fulfilment. Identifying and reliably signalling trust-warranting properties is the key concern for the emergence of trust and trustworthy behaviour.

If we had accurate insight into the trustee's reasoning or functioning, trust would not be an issue (Giddens, 1990). Uncertainty, and thus the need for trust, stems from the lack of detailed knowledge about the trustee's trust-warranting properties. Information about these is only available in the form signals (1). If trustor and trustee are separated in space, their interactions are mediated (e.g. by mail, email, telephone), and some of the signals that are present in face-to-face encounters may not be available or become distorted. This effect is captured in communication theory by models of *channel reduction* (Döring, 1998). These include *social presence* (Short, Williams, & Christie, 1976), *presence* (Lombard & Ditton, 1997; Biocca, Harms, & Burgoon, 2003), and *media richness* (Daft & Lengel, 1986; Rice, 1992). This loss of information is often considered to increase uncertainty and result in lower trust (e.g. Handy, 1995). However, such channel reduction models have also been criticised because they do not account for the ability of technology to supply information that otherwise would not be available in a face-to-face situation (e.g. reputation rating scores; Section 2.3.1; [Doering]). Mediation may also increase the delay between trusting action (2a) and fulfillment (3a), for example if an exchange relies on the postal system. This separation in time prolongs the period of uncertainty for the trustor. Thus, temporal as well as spatial separation of trusting action and fulfillment can increase uncertainty and thus the need for trust (Giddens, 1990; Brynjolfsson & Smith, 2000).

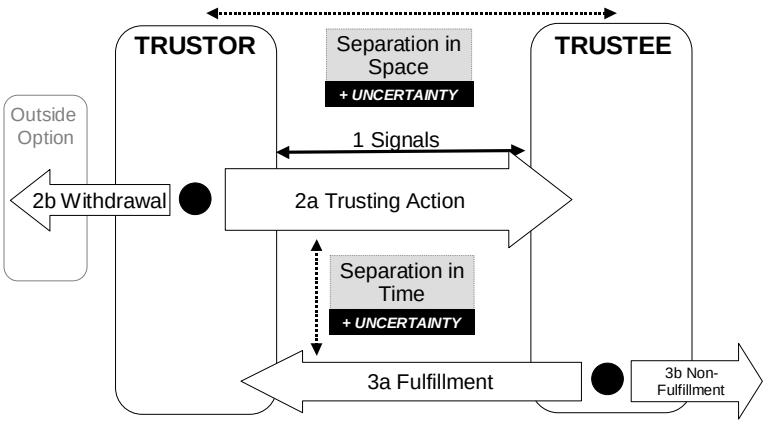

Figure 1. The trust-requiring situation.

3.2 Signalling Trustworthiness: Symbols and Symptoms

Signals from the trustee and the context allow the trustor to form expectations of behaviour. A stable identity (e.g. provided by facial recognition) is an example of an important signal for the assessment of trustworthiness in a given situation, as it allows the trustor to form expectations based on previously observed behaviour.

As many mediated interactions are relatively novel, the observed lack of trust may partially be explained by a lack of experience in decoding signals and making inferences about baseline probabilities of untrustworthy behaviour (Riegelsberger & Sasse, 2001). Lack of trust is also a result of *mimicry* (Bacharach & Gambetta, 2003): non-trustworthy actors trying to *appear trustworthy* in order to obtain the benefits. In the view of many consumers, moving interactions online makes mimicry easier (Riegelsberger et al., 2001). To understand how mimicry can operate we draw on semiotics, and distinguish between two types of signals: symbols and symptoms (Riegelsberger, Sasse, & McCarthy, 2003b; Bacharach & Gambetta, 2003).

Symbols of trustworthiness. Symbols have an arbitrarily assigned meaning, they are specifically created to signify the presence of trust-warranting properties. Examples of symbols for such properties are e-commerce trust seals. Symbols can be protected by making them very difficult to forge, or by threatening sanctions in the case of misuse. They are a common way of signalling trustworthiness, but their usability is currently limited. Because they are created for specific settings, the trustor has to know about their existence and how to decode them. At the same time, trustees need to invest in emitting them and in getting them known (Bacharach & Gambetta, 1997).

Symptoms of trustworthiness. Symptoms are not specifically created to signal trust-warranting properties; rather, they are given off as a by-product of trust warranting properties. Symptoms come at no cost to trustworthy actors, but mimicking them requires some effort from untrustworthy actors. Interpersonal cues (e.g. eye-gaze) are often considered to be symptomatic of emotional states, and thus thought to give insight into people's trustworthiness (Baron & Byrne, 2004). However, this widely held belief is only partially supported by research in social psychology and will be discussed in more depth in Section 2.3.2.

3.3 Trust-Warranting Properties

Having established the terminology to describe trust-requiring situations, we introduce the factors that support trustworthy behaviour. In the interest of creating a parsimonious framework, we delineate the main classes of trust-warranting properties, rather than describing all specific motivational factors or attributes of ability.

3.3.1 Contextual Properties

Raub & Weesie (2000b) identified three categories of factors that can lead trustees to fulfill. These are *temporal*, *social* and *institutional embeddedness* (see Figure 2). These contextual properties allow trustors to make themselves vulnerable, even if they know very little about the personal attributes of the trustee.

Temporal embeddedness. If trustees have reason to believe that they will interact again with a given trustor in a situation where they are recognizable (i.e. have stable identities), fulfillment can become preferable. While a trustee could realize a large gain from non-fulfillment, he also knows that the trustor would not place trust in future encounters. Non-fulfillment in the present encounter thus prevents gains that could be realised in future exchanges (Friedman, 1977; Axelrod, 1980). In a more trustor-centric view of *temporal embeddedness*, repeated interactions also allow the trustor to accumulate knowledge about the trustee, and thus to make better predictions about his future behaviour. Hence, assuming stability of a trustee's attributes, repeated interactions can decrease uncertainty. By extrapolating from past behaviour, trust in future encounters can be won (Luhmann, 1979).

Social embeddedness. This property is included in many models of trust in the form of reputation (e.g. Corritore, Kracher, & Wiedenbeck, 2003; Fogg, 2003). From the perspective of these models reputation is historic information about trustors' attributes such as *honesty*, *reliability*, or *dependability* (McKnight & Chervany, 2000; Sapient & Cheskin, 1999; Corritore et al., 2003; see 2.3.2). Assuming stability of such attributes across time and context, they can form the basis of trust in present encounters. However, trust based on reputation alone is vulnerable to strategic misuse, as inherently untrustworthy actors can build up a good reputation to 'cash in' by not fulfilling in the final transaction. Anecdotal evidence of such behaviour exists for online-auction sites (Lee, 2002), but it has also been shown in laboratory experiments with social dilemma games (e.g. Bohnet, Huck, & Tyran, 2003). Reputation also has a second function, as the trustor's ability to tarnish the trustee's reputation provides an incentive to fulfill. Reputation can thus act as a *"hostage"* in the hands of socially well-embedded trustors (Raub & Weesie, 2000a; Einwiller, 2001).

Factors that influence the effect of reputation are *identifiability* and *traceability*, the *social connectedness* of the trustor (Glaeser at al., 2000), the topology of the *social network* (Granovetter, 1973), the cost of capturing and disseminating *reliable past information* (McCarthy & Riegelsberger, 2004), and the degree to which such information itself can be trusted to be truthful (Bacharach & Gambetta, 2003).

Institutional Embeddedness. Institutions often take the form of organisations that influence the behaviour of individuals or other organisations. Examples of institutions are law enforcement agencies, judicial systems, trade organisations, or companies. Institutions are often embedded in wider networks of trust where one institution acts as guardian of trust for another one (Shapiro, 1987). As most everyday interactions are conducted within a web of institutional embeddedness, the effect of institutions often does not come to mind as long as a situation conforms a template of *situational normality*

(Rousseau et al., 1998; Shapiro, 1987; McKnight & Chervany, 2000). When new technologies transform the way in which people interact, their templates of situational normality may not apply any more. Additionally, if technology increases the spatial distance between the actors, the trustee may be based in a different society or culture, and consequently the trustor may be less familiar with the institutions that govern his behaviour (Jarvenpaa & Tractinsky, 1999; Brynjolfsson & Smith, 2000).

In summary, contextual properties provide incentives for the trustee to behave in a trustworthy manner. Their presence allows trustors to engage in trusting action without detailed knowledge of the trustee. However, trust – some would say reliance (see 2.4) – when solely based on these properties - is bound to break down in their absence.

3.3.2 Intrinsic Properties

While contextual properties can motivate trustees to fulfill, they do not fully explain how actors behave empirically (Riegelsberger et al., 2003b). Contextual properties are complemented by intrinsic properties, which we define as relatively stable attributes of a trustee that provide the ability and intrinsic motivation for fulfillment (Deci, 1992).

Ability. This property is the counterpart to motivation in Deutsch's (1958) classic definition of trustworthiness. Mayer, Davis, & Schoorman (1995) define ability for human and institutional actors as a *"… group of skills, competencies, and characteristics that enable a party to have influence within some specific domain"* (p. 717). Ability also applies to technical systems in the form of *confidentiality*, *integrity (accuracy, reliability)*, *authentication*, *non-repudiation*, *access-control*, and *availability* are aspects of the abilities of a technology (Ratnasingam & Pavlou, 2004).

Internalized norms. Granovetter's (1985) classic example of the economist, who – against all economic rationality – leaves a tip in a roadside restaurant far from home[3] illustrates the effect of *internalized norms*. In many cases, norm compliance will be internalized to such an extent that it becomes habitual (Fukuyama, 1999). The foundation is laid in individuals' socialization, in which they are "*culturally embossed"* with basic social norms of their culture (Brosig, Ockenfels, & Weimann, 2002). However, social norms differ across groups and cultures, they have to evolve over time, and triggering them may depend on the trustor's signalling of group membership (Fukuyama, 1999). Not all norms are desirable *per se*, as strong in-group reciprocity may come at the cost of hostility or aggression towards non-members (Fukuyama, 1999).

Benevolence. The intrinsic property *benevolence* captures the trustee's gratification from the trustor's well-being and his company. Hence, it is different from the expectation of future returns that is the source of motivation arising from the contextual property *temporal embeddedness*. The capacity for *benevolence* is an attribute of the trustee, but the specific level of *benevolence* in a trust-requiring situation is an attribute of the relationship between trustor and trustee. A trustee may act benevolently towards one trustor, but not towards another one. Strong benevolence is typical for long-standing or romantic relationships (Rempel, Holmes, & Zanna, 1985), but it can also be present – to a lesser degree – among work colleagues or business partners (Granovetter, 1985; Macauley, 1963).

Interpersonal Cues and Intrinsic Properties. Interpersonal cues play a special role in signalling and triggering intrinsic trust-warranting properties in interactions

[3] This situation is not embedded temporally (he will not visit the restaurant again), socially (the waiter cannot tell relevant others about his behaviour), or institutionally (there is no formal way of enforcing tipping).

between humans. As mediating face-to-face interactions or replacing them with human-computer interaction often leads to the loss of some interpersonal cues (Döring, 1998), their role merits a brief discussion.

The presence of intrinsic trust-warranting properties is widely believed to manifest itself through interpersonal cues (Bacharach & Gambetta, 2003; Goffman, 1959). The symptomatic nature (see 2.2) of interpersonal cues is supported by empirical studies (Baron et al., 2004; Hinton, 1993) – but these also found that such cues can be subject to impression management (Hinton, 1993), i.e. trustees' deliberate use of interpersonal cues to create the desired impressions. Interpersonal cues can create some level of affective trust, even if there is no rational basis for such trust attributions. Reeves and Nass (1996), in their studies with computers as social actors, provide examples of this effect: even a synthetic animated character that exhibited only very simplistic interpersonal cues was found to increase trust (Rickenberg & Reeves, 2000).

In summary, intrinsic properties provide motivation and the ability for trustworthy behaviour that is independent from contextual incentives. Interpersonal cues are widely believed to give information about intrinsic properties, but there is only limited empirical evidence. Figure 2 shows the framework, based on the abstract situation introduced in Figure 1, with contextual and intrinsic properties added.

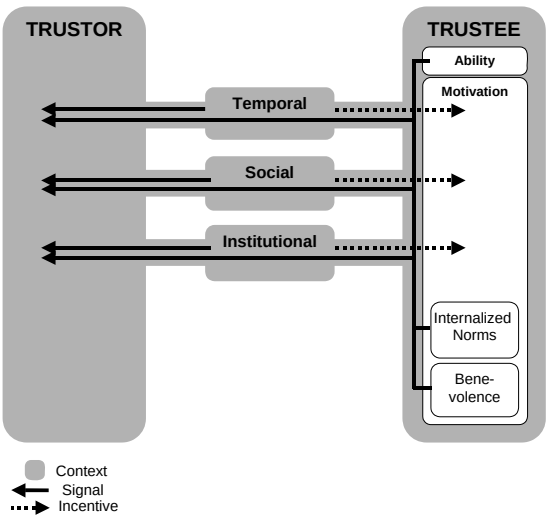

Figure 2. The complete framework.

3.4 Forms of Trust

In this section we discuss how the different types of trust identified by other researchers can be accommodated by the framework. Each type of trust relates to a belief about a specific configuration of trust-warranting properties. Subsequently, types of trust differ in the way trustworthiness is signalled and perceived, in their stability over time, how wide their scope is, and what types of vulnerabilities are normally covered by them (Corritore et al, 2003). Our fundamental distinction between contextual and intrinsic properties is reflected in the discussion of other researchers.

Contextual Properties

Trust based on contextual properties is also called *reliance* or *assurance-based trust* (Lahno, 2002; Yamagishi & Yamagishi, 1994). Describing a similar concept, Rousseau et al. (1998) and Koehn (2003) use the terms *calculus-based trust* or *calculative trust*, respectively. Other terms that have been coined are *guarded trust* (Brenkert, 1998; Corritore et al., 2003), *deterrence-based trust* (Lewicki & Bunker, 1996; Lewis & Weigert, 1985), and *control trust* (Tan & Thoen, 2000). *Institutional trust* (Lahno, 2002) specifically captures the effect of the contextual property *institutional embeddedness*. Rousseau et al. (1998) see it as a backdrop that envelopes and safeguards our everyday interactions, thus closely matching McKnight & Chervany's (2000) concept of *situational normality*. *Technology trust* (Ratnasingam & Pavlou, 2004) and *Internet trust* (Lee & Turban, 2001) are largely based on the *ability* of a technology to support interactions as expected by the user. However, as they are embedded in socio-technical systems, technology trust commonly also entails other types of trust in organisations or institutions that safeguard technology.

Intrinsic Properties

Types of trust that are mainly based on intrinsic properties of the trustee are *relational* (Rousseau et al., 1998), *party* (Tan & Thoen, 2000), *partner* (Ratnasingam & Pavlou, 2004), *knowledge-based* (Koehn, 2003), or *respect-based trust* (Koehn, 2003). Types of trust that rely on intrinsic properties develop over time and are founded on a history of successful exchanges. They have a higher *bandwidth* (Rousseau et al., 1998; Corritore et al., 2003), i.e. ensures risk-taking across a wider range of situations. Table 1 maps types of trust to the level of acquaintance.

Level			**Source**
Early	**Medium**	**Mature**	
Deterrence-based	Knowledge-based	Identification-based	Lewicki & Bunker (1996)
Calculus-based		Relational	Rousseau et al. (1998)
Basic/Guarded		Extended	Corritore et al. (2003)
Swift			Meyerson et al. (1996)
Calculative		Knowledge-Based, Respect-Based	Koehn (2003)
Mainly based on Contextual Properties		**Mainly based on Intrinsic Properties**	

Table 1. Different types of trust linked to levels of acquaintance.

4. TRUST IN E-COMMERCE WEB SITES

This section provides an overview on research into the trustworthiness of web sites. While some researchers looked at trust in health information sites (Sillence et al., 2004) and into the credibility of news sites (Fogg et al., 2001; Schweiger, 1999), the majority of web site trust research addresses user trust in e-commerce sites. This section first discusses how the framework can be used to structure an analysis of signifiers of trustworthiness in e-commerce and then gives an overview on existing design guidelines.

4.1 Applying the Framework

E-commerce transactions are subject to several risks such as loss of privacy, interception of financial data, lack of fulfillment, etc. (Riegelsberger & Sasse, 2003a; Egger, 2001). While not all of these risks are related to the actions of e-commerce vendors, we focus our discussion on activities that can be undertaken by individual vendors to build user trust.

Temporal Embeddedness. Vendors can indicate that they are in interested in continued interactions. This may be achieved by showing that the company had been in business for a long time, or that it is linked to a *long-standing off-line brand*, or even by making clear that considerable *investment* had been made in the site or the brand (e.g. through advertising). Another way to show trustworthiness in terms of temporal embeddedness is *customer relationship management* (Egger, 2001). Vendors can demonstrate an interest in a continued relationship by giving *first-time purchase price incentives* (e.g. Amazon's first time visitor's voucher), by *eliciting feedback* (e.g. publicly, as does Amazon.com on its site), or by offering *loyalty schemes* (Egger, 2001).

Social Embeddedness. This property is an important factor for purchase decisions. Users – in particular first-time ones – pay much attention to their friends' and families' *recommendations* when deciding where to shop online (Riegelsberger et al., 2003a; Kotler, 2002; Murray, 1991). Recognizing this process, several marketing methods have sprung up that aim to influence the dissemination of reputation information in informal networks. These include *viral marketing* and *targeting opinion leaders* (Kotler, 2002). The Internet itself can be used to facilitate the formation and dissemination of reputation information in informal networks: services such as *Epinions*[4] or *Bizrate*[5] that collect customer feedback on many products and services. Amazon's *affiliate programme* is another example of using the Internet to communicate reputation information. An individual vendor can display social embeddedness through *endorsements* (e.g. from well-known experts), or through positive *customer comments*.

Institutional Embeddedness. *Trust seal programs* (Sapient & Cheskin, 1999) are an example of a prominent institutional approach to building trust in e-commerce. Such programs work by establishing rules of conduct (e.g. with regard to security technology or privacy policies) and checking their members' performance against these rules. Complying members are awarded trust seals: small icons they can display on their site. These seals are commonly linked to the certifying body's site to enable checking their veracity. The disadvantage of many such programs is that the certifying organisations are not well known, and thus have no trust they could transfer (Riegelsberger et al., 2003a). Trust seals given by well-known organisations that 'sublet' their trust by endorsing unknown vendors are more promising, because they put their established reputation at stake. Amazon's *zShops* go beyond giving seal-based endorsements by hosting independent vendors and enforcing codes of conduct.

Ability. This property takes the shape of professionalism in the context of e-commerce. Professionalism in site design can be seen as a symptom for competence or ability to fulfil (Egger, 2001). To appear professional, a vendor needs to comply with off-line business standards (e.g. *consistent graphic design, absence of technological failures, clear assignment of responsibilities, upfront disclosure of terms & conditions, shipping costs and availability*) and with web standards (e.g. *easy to remember URL, good*

[4] www.epinions.com
[5] www.bizrate.com

usability, privacy policy, similarity in interaction design to well known sites; Egger, 2001; see Table 2).

Internalized Norms. This property is easily identified in the case of human trustees - with an e-commerce vendor, however, the mapping is more difficult. An organisation can aim to influence the internalized norms of its employees by promoting appropriate values, norms, and performance targets through mission statements, training programs, and selection processes (Kotler, 2002). These intrinsic properties can then be communicated in the form of advertising, public-relations activities, but also through the e-commerce interface. However, potential users are unlikely to read corporate mission statements or philosophies in detail. Hence, the interface design must communicate these by allowing users to experience them while they are fulfilling their task. This can be achieved through visual design, through the use of language, and through appropriate conceptual modelling. As an example, the way in which a system responds to incorrect customer entries gives much information about an organisation's attitude towards its customers (Cooper & Reimann, 2003).

Benevolence. Strong *benevolence* as identified in long-standing relationships between humans does not apply to e-commerce. However, with a continued business relationship, a form of *benevolence* between vendor and customer can grow in the shape of strong brand loyalty (Riegelsberger & Sasse, 2002).

Interpersonal Cues and Intrinsic Properties. In the context of e-commerce marketing photos or other media representations of 'friendly people' are often used with the aim to build trust. This approach harnesses the immediate visceral effect such interpersonal cues have – even in mediated form. Empirical evidence suggests that this approach can sway superficial impressions – but there is also evidence for negative effects on the usability of e-commerce systems (Riegelsberger et al., 2002; Steinbrueck et al., 2002; Fogg et al., 2001).

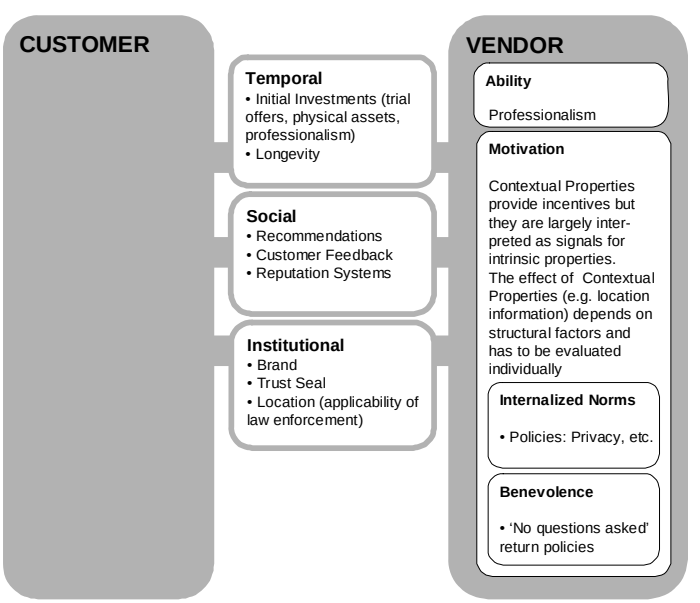

Figure 3. The framework applied to trust in consumer e-commerce.

4.2 Existing guidelines for trust in e-commerce

HCI research on trust in e-commerce is largely focused on creating interface design guidelines that are derived from user interviews or observations. The resulting guidelines have been very helpful for designers of e-commerce sites. However, they have also been criticised for focusing too narrowly on increasing trust, rather than aiming to support correctly placed trust (Riegelsberger et al., 2005).

In one of the earliest studies on consumer trust in e-commerce, Jarvenpaa & Tractinsky (1999) identified *perceived size* and *reputation* of existing e-commerce vendors as predictors of trust and willingness to buy. These findings were, however, not linked to specific e-commerce design elements. One of the earliest studies that focused exclusively on the effect of interface elements on consumer trust was conducted by Sapient & Cheskin (1999). The fundamental building blocks of trust identified in this study were *seals of approval*, *quality of presentation*, *navigation*, *branding*, *fulfilment* and use of *secure, error-free technology*. The findings related to interface elements are included in Table 2. The most comprehensive e-commerce trust model linked to interface design guidelines has been developed by Egger (2001). Factors in his MoTEC model include:

- *Pre-interactional* filters refer to factors that affect a new customers' *a priori* trust. These are personal propensity to trust, knowledge about the industry and the brand, as well as trust transferred via recommendations.
- *Interface properties* are those surface cues that determine the first impression of a web site; they are included in Table 2.
- *Informational content* refers to interface surface cue that require a more detailed exploration of the site, such as policies and company information – they are also included in Table 2.
- *Relationship management* refers to the vendor's actions after a transaction incurred. Here, trust building activities include various channels of contact, rapid turnaround for questions, and order tracking.

Table 2 summarises the key elements from Egger's (2001) and Sapient & Cheskin's (1999)'s model, and adds findings from guidelines and reviews that were subsequently published. It also shows which trust-warranting properties are addressed by individual design recommendations.

Recommendation	Property Addressed	Source
Absence of errors (Absence of outdated information)	Ability	Nielsen (1999), Sapient (1999)
Aesthetic Design	Ability, Norms	Nielsen (1999), Egger (2001), Dayal et al. (2001), Sapient (1999)
Affiliations (Linking to others, link backs, cooperating with trusted brands, customer references, third party endorsements, trust seals, testimonials)	Social, Institutional Embeddedness	Nielsen (1999), Dayal et al. (2001), IBM (2003), Shneiderman (2000), Bailey et al. (2001), Grabner-Kraeuter & Kaluscha (2003), de Ruyter, Wetzels, & Kleijnen (2001), Ratnasingam et al. (2004), Jarvenpaa et al. (1999)
Branding	Institutional Embeddedness	Egger (2001), Bailey et al. (2001), Sapient (1999)
Detailed Product	Ability	Dayal et al. (2001), Egger (2001),

Information		Nielsen et al. (2000)
Information about past performance	Temporal Embeddedness	Shneiderman (2000)
Openness / Transparency (Providing background on company, contact information, photographs)	Ability, Norms, Benevolence	IBM (2003), Egger (2001), Nielsen et al. (2000), Grabner-Kraeuter et al. (2003), Gefen (2005), de Ruyter et al. (2001)
People and Social Presence (Showing staff, customers – giving interpersonal cues, see 2.3.2)	Interpersonal Cues to signal intrinsic properties	Grabner-Kraeuter et al. (2003), Egger (2001), Nielsen et al. (2000)
Physical Assets (Showing or describing company's buildings, offices)	Institutional embeddedness, temporal embeddedness	Grabner-Kraeuter et al. (2003), Gefen (2005), de Ruyter et al. (2001)
Privacy Policy	Norms	Egger (2001), Cranor, Reagle, & Ackerman (1999)
Security (e.g. encryption)	Ability (technological)	IBM (2003), Egger (2001), Sapient (1999), Nielsen et al. (2000)
Size (Perceived size of the site / organisation)	Temporal Embeddedness, Ability	Jarvenpaa & Tractinsky (1999), Bailey et al. (2001), Grabner-Kraeuter et al. (2003)
Trials (low risk initial interactions)	Benevolence, reduction of risks (Riegelsberger et al., 2003a)	Dayal et al. (2001)
Upfront Disclosure (Privacy policy, shipping cost, corporate philosophy)	Norms, Benevolence	Nielsen (1999), IBM (2003), Shneiderman (2000), Egger (2001), Bailey et al. (2001), Nielsen et al. (2000)
Usability (Good Navigation)	Ability	Nielsen (1999), Egger (2001), Bailey et al. (2001), Sapient (1999) Grabner-Kraeuter et al. (2003), Lee et al. (2001)
User control over information (Giving reasons / benefits for and control over captured personal information)	Reduction of risks (Riegelsberger et al., 2003a)	Nielsen (1999), IBM (2003), Egger (2001), Dayal et al. (2001)
Warranty Policy	Norms	Grabner-Kraeuter et al. (2003), Jarvenpaa et al. (1999) de Ruyter et al. (2001), Lee et al. (2001), Ratnasingam et al. (2004); Kim (1996)

Table 2. Elements of trustworthy interface design.

In summary, the research on trust in e-commerce vendors has resulted in a large number of guidelines detailing interface elements and constructs that have been named by users as signifiers of trustworthiness. Using the framework, these elements can be interpreted as signals for the underlying contextual and intrinsic properties. This approach abstracts from the specific technical implementations and thus provides guidelines that are transferable to other technologies.

5. TRUST IN VIRTUAL TEAMS

While many studies in social psychology looked at trust as one of several aspects of interpersonal perception in mediated communications, only a few specifically investigated trust. Most of the studies in the field of HCI that specifically investigated trust explored media effects on cooperation (i.e. on trust *and* trustworthy behaviour) in virtual teams with social dilemma games. They compared cooperation in representations such as video, audio, email, or text-chat. They thus focused on the effect of mediating interactions of the visibility of interpersonal cues (see Section 2.3.2). Due to the relatively narrow focus of these studies, the discussion in this section is mainly concerned with demonstrating how the framework can be used to incorporate further aspects of interpersonal trust in mediated interactions. First, however, the findings of these studies are briefly summarised.

5.1 Studies on Media Representations and Trust

Video. Studies on team cooperation found that video resulted in the highest rate of cooperation compared to the other media researched (Bos et al., 2002; Brosig et al., 2002). In the study by Brosig et al. (2002) video with audio, reached levels of cooperation that were similar to those reached in face-to-face communication. They are, however, reached after a longer time than in face-to-face interaction. Furthermore, cooperation was less stable without face-to-face communication (Bos et al., 2002).

Audio. The studies on cooperation in teams, yielded – in line with media richness models – that audio-only communication resulted in levels of cooperation that were lower than those for video (Bos et al., 2002), but higher than those found for text-only communications (Bos et al., 2002; Jensen et al., 2000; Davis et al., 2002; Olson et al., 2002). Even synthetic speech was found to reduce uncooperative behaviour compared to text chat (Davis et al., 2002; Jensen et al., 2000).

Photos. Out of the studies reported in Table 3, only Olson et al. (2002) looked specifically at the effect of exposure to a photo; they found a marginal positive effect on cooperation. Similarly, Bohnet & Frey (1999) found that silent mutual identification prior to making decisions in a social dilemma game with no communications increased cooperation, even though a photo or silent identification do not carry any information specific to the task at hand (e.g. intentions and strategies in a social dilemma game). These findings contradict those of a longitudinal study by Walther et al. (2001) on his earlier concept of *hyperpersonal interaction*: in the long run, groups communicating without seeing photos of each other rated their partners more positively than those that had been given photos of each other.

Text. Text-only communication was used by many of the studies discussed for base-line comparisons. Text-only communication led to lower cooperation than richer channels such as f-t-f or video (Bos et al., 2002; Jensen et al., 2000; Brosig et al., 2002). These findings are corroborated by Frohlich & Oppenheimer (1998), who compared text-only to f-t-f communications. In one of the few longitudinal studies in this field, Jarvenpaa et al. (1998) found that collaboration via email only resulted in fragile swift trust (Meyerson et al., 1996, see Table 1). However, even text-only communication increases cooperation and trust compared to no communication. This finding is strongly supported by a review of 37 social dilemma studies conducted by Sally (1995).

5.2 Applying the Framework

In this section, the framework for trust in mediated interactions is used to discuss the studies on trust in virtual teams, to show limits to their generalisation, and to outline further areas for research into trust in human actors.

Structure. The studies on virtual teams used symmetric and synchronous social dilemma games, in which all actors have the same role and where decisions have to be reached at exactly the same time. These games are good models of *public good problem*, where many individuals decide at the same time without knowing the others' decisions. However, they do not model many everyday trust-requiring situations, where we can identify a trustor and a trustee as actors with distinct roles. Public good models are characterized by *strategic insecurity* (Lahno, 2002a), which does not apply to conventional trust-requiring situations. In addition, symmetric games make it impossible to investigate the effect of a technology on trust and trustworthy behaviour individually.

Temporal embeddedness. Social dilemma studies clearly show the effect of temporal embeddedness in the form of deteriorating cooperation towards the end of the experimental games, when participants do not expect future interactions with other participants (Bos et al., 2002; Olson et al., 2002; Bohnet et al., 2003). One can also argue that the chosen media representation in effect determines the temporal embeddedness of a situation, as e.g. facial representations allow recognition of the experimental partner beyond the laboratory situation, whereas participants who are e.g. represented by text-only cease to be identifiable after the experiment. However, experimental studies – varying prior acquaintance of participants aside – cannot investigate temporal embeddedness beyond the duration of one experimental session. Hence, they need to be complemented with longitudinal surveys and ethnographic studies (e.g. Jarvenpaa et al., 1998; Walther et al., 2001).

Social Embeddedness. The studies on trust in teams did not investigate effects of reputation. As the Internet allows for the cheap dissemination of reputation information across a large but loosely knit network, reputation systems are increasingly receiving attention – in particular in experimental economics (e.g. at the MIT Reputation Systems Symposium: Dellarocas & Resnick, 2003; at the Symposium on 'Trust and Community on the Internet': Baurmann & Leist, 2004). However, these studies rarely compare the effect of different media representations of human trustees. Ideally, the approaches in these disciplines should be combined in future studies.

Institutional Embeddedness. As indicated in Section 2, this property is present in most everyday trust-requiring situations – often without the actors being aware of it. Institutional assurance, e.g. in the form of law enforcement agencies or a legal system, forms part of our template of situational normality (McKnight & Chervany, 2000). Most organisations provide incentives for their members to act in specific ways through job descriptions and hierarchies. The channel used in mediated interactions conveys much information about organisational embeddedness that will influence the perception of trust. Being contacted by someone on the company's Intranet will result in a different level of *a priori* trust than being contacted via an Internet Relay Chat (IRC). Modelling this important aspect of trust transfer is difficult in a laboratory setting, as the experiment itself is embedded in the context of a research institution. Nonetheless, this factor will have to be explored in future studies on online trust – e.g. by conducting field experiments or ethnographic studies.

Ability. Virtual team studies investigated willingness to fulfill – they researched motivation as one factor of trustworthiness. However, following Deutsch's (1958) classic

definition (see Section 2), trustworthiness also consists of ability to perform as expected. In many everyday situations, questions of trust do not arise from the risk of wilful deception, but because one is uncertain about the other's ability to perform as expected (Riegelsberger et al., 2003b): an individual might mean well, but lack the expertise to be truly helpful.

Internalized Norms and Benevolence. Since interpersonal cues have been identified (see Section 2.3.2) as important triggers of these intrinsic properties, the studies on trust in virtual team can be seen as primarily investigating the effect of internalized norms and benevolence, depending on the type and number of cues transmitted. A further way of investigating these properties for human trustees would be to observe how the evolution of norms and benevolence is affected by the design of the technical environment (see Cheng, Farnham, & Stone, 2002 for such an longitudinal analysis in the area of online gaming communities).

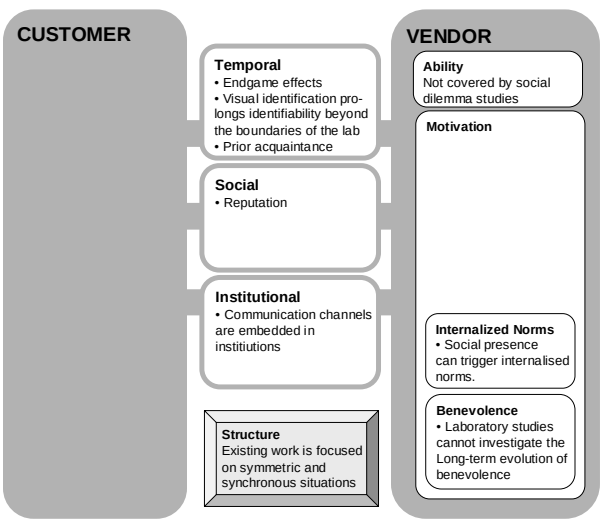

Figure 4. The framework applied to studies in virtual teams.

In summary, it is clear that further research on online trust in human trustees is needed that systematically varies the intrinsic and contextual properties. In particular, studies other than symmetric social dilemma games are required to investigate trust and trustworthy behaviour individually. Existing studies suggest a positive effect of media richness (i.e. the number of cues transmitted) on cooperation and trust in symmetric group settings.

6. SUMMARY

Trust is an integral part of coordinated action among humans. It allows actors to engage in exchanges that leave both parties better off. New technologies allow interactions between individuals who know little about each other prior to the encounter. Exchanges that have traditionally been conducted face-to-face are now mediated by technology or even executed with technology as a transaction partner. This situation has led to a surge of research in trust in e-commerce and virtual teams. We outlined a framework of trust in mediated interactions that accommodates both areas and incorporates trustor, trustee, and contextual factors. We identified two types of signals for

trustworthiness: symbols and symptoms. Symptoms are given as by-product of behaviour. They are preferable to symbols, which can be costly to emit, are less reliable, and subject to mimicry. We identified contextual (*temporal*, *social*, and *institutional embeddedness*) as well as intrinsic properties of the trustee (*ability, internalized norms*, and *benevolence*) as the basis of trustworthy behaviour and thus as the source of signals of trustworthiness. The framework was then used to discuss existing types of trust, guidelines for trust in e-commerce, and studies on trust in virtual teams.

For trust in e-commerce vendors, the framework allows identifying how individual interface cues work as signifiers of trustworthiness by tying them to underlying properties. *Temporal embeddedness* can be signalled by elements that signal interest in future business (e.g. investments in first purchases). For *social embeddedness*, various forms of reputation building and trust transfer were reviewed (e.g. affiliate programs). Institutional embeddedness covers regulatory approaches and trust seal programs. Intrinsic properties such as *ability* can be signalled by adherence to offline and online business standards. *Internalized norms* can be conveyed by mission statements, policy documents, or upfront disclosure of terms. *Benevolence*, finally, applies only with limitations to interactions between organisations and individual customers (e.g. in the form of loyalty schemes).

The discussion of HCI research on trust in virtual teams was more focused on using the framework to show how the present research agenda can be broadened to include further relevant aspects of interpersonal trust in mediated interactions. Existing studies mostly support media richness models, in the sense that the representations that conveyed the highest number of interpersonal cues resulted in the highest rate of cooperation.

While the framework discussed in this chapter can be helpful in the design of studies and for exploring design solution to the problem of trust in mediated interactions[6], it does not suggest that trust and trustworthy action can be 'designed into a system'. Designers can aim to create optimal environmental conditions for the emergence of trust, but they cannot fully determine users' behaviour. However, by designing technology with an awareness for the wider temporal, social, and institutional factors as well as trustor and trustee factors, researchers and designers can support trustworthy behaviour and well-placed trust – and the proverbial *lack of trust* needs not be accepted as an inherent consequence of mediated interactions

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[6] See (Riegelsberger et al., 2005) for examples of how the framework can be used to structure design approaches to trust in online gaming environments, and (Riegelsberger, Sasse, & McCarthy, 2004) for an application to trust in ambient technologies.

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