

EMBEDDED TRUST: CONTROL AND LEARNING

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ABSTRACT

*This paper discusses two mechanisms through which social embeddedness can affect trust among actors in cooperative relations. Trust can be based on past experiences with a partner or trust can be built on possibilities for sanctioning an untrustworthy trustee through own or third-party sanctions. These two mechanisms are labeled **learning** and **control**. The mechanisms are often left implicit or discussed in isolation in earlier research. Learning and control can operate at different levels: at the **dyadic** level and at the **network** level. We argue that for understanding trust the two mechanisms should be studied simultaneously, theoretically as well as empirically. We show that this is more easily said than done by addressing some of the theoretical as well as empirical issues. We offer preliminary evidence of the simultaneous working of the learning and control mechanisms at the dyadic level and the network level.*

1. INTRODUCTION

People encounter every day trust situations with persons they have never seen before or with others they already know for a considerable time, with complete strangers or with friends of their friends. For example, professors lend books to colleagues or students. Most people are more reluctant to lend their books

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to a complete stranger than to somebody they know or, at least, their friends know. Likewise, if somebody has ever returned your book with coffee spots on every other page, you might be more reluctant to lend him a book again. If nobody would be willing to lend books, everybody has to buy all books himself, which is more expensive compared to the situation that books can be shared among a group of people. Therefore, trust increases efficiency in human interactions (Arrow, 1974).

Lending books to colleagues or students resembles social exchange (Blau, 1964 [1996]). Trust also plays a crucial role in economic exchange, for example, in inter-firm relations. Buyers trust that suppliers will deliver good products without writing contracts that cover all possible contingencies (Macaulay, 1963). Negotiating and writing such contracts is costly and reduces the profits related to the transaction for both parties. Therefore, trust can make transactions more efficient but the problem remains that the supplier often has an incentive to abuse trust and obtain an extra profit in a transaction, for example, by selling an inferior product for the price of a high-quality one. If the buyer considers this risk to be too high, she will not trust the supplier.

Before we continue, we need to make explicit what we mean by trust. The definitions used in the literature vary considerably. We assume that actors are rational in the sense that trust is only possible if, for the trustor, the expected outcome of placing trust is preferred over the expected outcome of not placing trust. This is similar to Williamson's (1993) notion of "calculative trust." Trust can be problematic because the trustor is uncertain about the abilities and competencies of the partner. In the literature (e.g. Barber, 1983; see also Snijders, 1996, Chap. 1 for a discussion), this is sometimes labeled as a problem of "confidence." Here, we address trust problems due to incentives of the trustee rather than his abilities: The trustee has an incentive to abuse trust and the trusting actor has something to lose if trust is abused. Coleman (1990, pp. 97–99) distinguishes four elements that define a trust situation between a trustor and a trustee.

- (1) Placing trust by the trustor allows the trustee *to honor or abuse trust*. This action would not have been possible without placing trust by the trustor.
- (2) The trustor *regrets* placing trust *if trust is abused*, but *benefits from honored trust*.
- (3) The trustor *voluntarily* places resources in the hands of the trustee *without formal safeguards*.
- (4) There is a *time-lag* between placement of trust and the action of the trustee.

The Trust Game as shown in Fig. 1 is a game-theoretic representation of a transaction that closely resembles Coleman's definition of a trust situation

(see also: Camerer & Weigelt, 1988; Dasgupta, 1988; Kreps, 1990). The Trust Game starts with a move by the trustor, who chooses between placing trust and not placing trust. If the trustor does not place trust, the game is over and the trustor obtains a payoff P_1 , while the trustee receives P_2 . If the trustor places trust, the trustee chooses between honoring trust and abusing trust. If the trustee honors trust, the trustor and trustee receive, respectively, $R_1 > P_1$, $i = 1, 2$. If the trustee abuses trust, the trustor receives $S_1 < P_1$ and the trustee $T_2 > R_2$. We assume that these payoffs represent utilities for the actors.

Assume that the Trust Game with all payoffs is known to both actors in the game. The trustee will abuse trust if trust is placed, because the payoff for abusing trust is larger than the payoff for honoring trust ($T_2 > R_2$). The trustor realizes that the trustee will abuse trust if trust is placed. Thus, because the trustor is better off not placing trust than when she does place trust and trust is abused ($S_1 < P_1$), a rational trustor will not place trust. Bold lines indicate these moves of the trustee and the trustor in Fig. 1. Note that “abuse trust” is not observed if trust is not placed. The outcome constitutes a *social dilemma* because both actors are worse off in the situation that trust is not placed than in the case where trust is placed and honored ($R_i > P_i$). The Trust Game is a *one-sided* version of the *Prisoner’s Dilemma*, since in the Trust Game there is only one actor who can profit from being “nasty.”

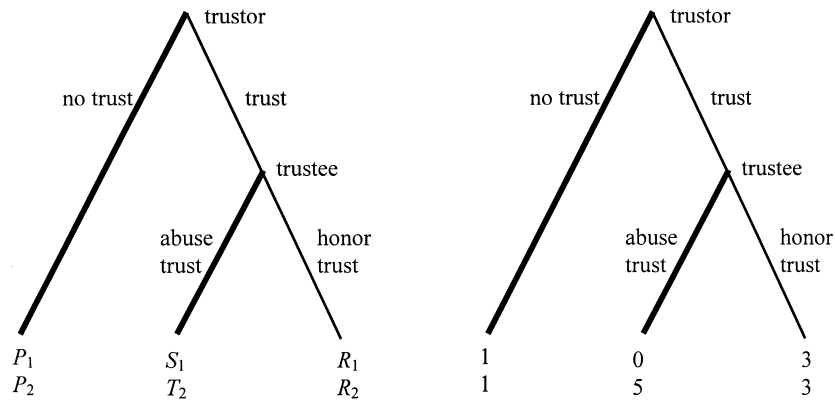


Fig. 1. Extensive Form of a Trust Game. $R_1 > P_1$, $R_2 > P_2$, $P_1 > S_1$, and $T_2 > R_2$.

Note: The right-hand Trust Game is a numerical example. Bold lines indicate the equilibrium path of play.

Definition of a trust situation. *A trust situation is a transaction between two actors that resembles a Trust Game.*

The discussion of the Trust Game highlights two issues. First, the *trustfulness* of the trustor, i.e. the extent to which the trustor places trust in the trustee. Second, the *trustworthiness* of the trustee, i.e. the extent to which the trustee honors trust if trust is placed. The analysis of the Trust Game suggests that the trustfulness of the trustor largely depends on her expectation of the trustworthiness of the trustee. If the trustor expects the trustee to abuse trust, she will not place trust. We will focus here on explaining the trustfulness of the trustor (who will be our “focal actor”), while the trustworthiness of the trustee is considered as one of the important predictors for trustfulness. We use the term *trust* to refer to the trustfulness of the trustor. It is important to note that trust is *not* something that is intrinsic to a particular person. Trust depends on the characteristics of both actors in a trust situation, on the relation between these two actors, and on the specific properties of the trust situation (Snijders, 1996).

Finally, we define the size of the trust problem in a trust situation. We define $T_2 - R_2$ as the (size of the) *trust problem*, which equals the incentive for the trustee to abuse trust in a given trust situation.¹ This gives us the opportunity to study the extent to which a trustor trusts a trustee. The extent to which a trustor trusts a trustee in a certain situation equals the maximum size of the trust problem for which the trustor still will trust the trustee.

As can be seen from the discussion of the Trust Game, trust is difficult in isolated encounters. Most trust situations, however, occur in a social context, where actors meet each other and each other’s acquaintances more often over time. This is often referred to as “embeddedness” in the social science literature (e.g. Granovetter, 1985). In this paper, we discuss two mechanisms through which embeddedness in a social context may affect trust, which we label *learning* and *control*.²

Learning refers to the possibility for actors to improve their choices in given interactions using experiences from *past* interactions. In contrast with assumptions in simple formal models of trust, actors are often uncertain about many aspects of an interaction with another actor, for example, the incentives of other actors or the properties of the social context. Both actors have certain beliefs about such parameters, for example, the trustor has some idea about the value of T_2 , but might not be completely certain about this value. Moreover, the trustee has a belief about the trustor’s belief about the value of T_2 . Actors obtain information from previous trust situations about the incentives, beliefs, and other characteristics of other actors. This information can be obtained from

the focal actor's past interactions with the trustee or from third parties who had interactions with the trustee. If a trustee has been trustworthy in past interactions, a trustor might become more convinced that the trustee will be trustworthy again in similar interactions in the future. Learning effects have been discussed frequently in the sociological literature (Granovetter, 1985, p. 400; Coleman, 1990; Burt & Knez, 1995a). Often, only the positive side of the emergence of trust as a result of positive experiences is emphasized, but Coleman as well as Burt and Knez show that trust can also decrease, or distrust can increase, if negative information about a trustee is revealed.

Past interactions can affect present interactions not only via information and learning. Past interactions can have implications in terms of relation specific investments that are made with respect to a given partner. For example, if one starts using a certain type of software, it becomes often costly to switch to another type of software. Moreover, as far as learning is concerned, we concentrate on learning about characteristics of a partner. Actors might also learn about suitable mechanisms for coping with trust problems. For example, after some experience, writing a suitable contract becomes easier compared to the first time one writes a contract. Such aspects of learning are largely neglected in this paper.

Control refers to the fact that trustors realize that trustees have short-term incentives for abusing trust, but that some long-term incentives for the trustee are under control of the trustor. The trustee has to take into account the threat that the trustor will not trust him in future transactions after he abuses trust and that the trustor might search for another partner. Moreover, a trustor can inform other trustors about untrustworthy behavior by the trustee, which might induce other potential partners of the trustee to refrain from trusting him. These sanction threats imply long-term losses for the trustee if they are executed. Therefore, trustors are expected to place trust if the trustee's long-term incentives of honoring trust are larger than the short-term incentives of abusing trust *and* if they do not have information that the trustee acted untrustworthy in the past. The mechanisms underlying control are also referred to as *reciprocity* (Gouldner, 1960; Blau, 1964 [1996]; Voss, 1982) or *conditional cooperation* (Taylor, 1987). Control through social networks can take rather extreme forms such as social ostracism by social groups if untrustworthy behavior is detected (see Wechsberg's, 1966, pp. 81–86 famous example of the diamond merchants).

Control through social networks might be problematic due to conflicting perceptions and motives of the potential actors who have to execute the sanctions. It is possible that a buyer has positive experiences with a dealer, but receives negative signals from others about this dealer. In such a situation, it

seems less probable that the buyer neglects her own experiences and implements sanctions against the dealer. The farther information travels through a network, the more actors will doubt the content of the information (for example, see: Lorenz, 1988; Williamson, 199 pp. 153–155; Blumberg, 1997, pp. 208–210; Buskens, 2002, pp. 18–20). This implies that third-party effects of control are smaller than one would expect if such issues are neglected. Consequently, a careful research design in which third-party effects of control and learning can be disentangled is crucial for a convincing argument that control through third parties actually occurs.

Two examples illustrate why learning as well as control is essential for understanding trust. In the first example learning is crucial. One prefers to hire a nanny with good references from a friend over a nanny without such references. Moreover, if one hires a nanny for a second child, one will first consider the nanny one had before. If she was trustworthy and seemed to treat your child well, she will probably be hired again. Clearly, in this example in which making the wrong choice might have dramatic consequences, learning about positive past behavior of the trustee is important. As a second example, consider long-term buyer-supplier relations. In such relations, control can be expected to play a key role in providing trust. Buyers often realize that the businesses of suppliers depend to a considerable extent on their reputation as trustworthy suppliers. If buyers can switch easily to other suppliers or if the supplier has many other customers in the neighborhood of the buyer, sanctions are relatively easy to implement for the buyer and, likewise, rather costly for the supplier. Therefore, if expected losses from abused trust are limited for the trustor and potential future losses for the trustee are obvious and can be expected to be sizeable, trustors will be able to base trust primarily on control. Table 1 summarizes the four embeddedness effects on trust studied in this paper.

Although learning and control matter, it is difficult to figure out how they are interrelated and how bilateral effects relate to network effects. To what extent do control opportunities matter if you do not know anything about a

Table 1. Summary of Four Effects on Trust Considered in this Paper.

Two Mechanisms	Two Levels	
	Dyad	Network
Learning	Information about the trustee from own past experiences.	Information from third parties about their past experiences with a trustee.
Control	Possibilities to sanction a trustee oneself after abuse of trust.	Possibilities to sanction a trustee through third parties after abuse of trust.

certain partner? Perhaps the partner is very short-sighted and does not care about any future sanctions. And, if someone has own experiences with a partner, to what extent are experiences of network contacts taken into account? Purely intuitive reasoning will not easily lead to clear conclusions about the combined effects of learning and control. Consequently, development of formal theory is inevitable to derive hypotheses on the combined effects of these two mechanisms. However, in this paper we will concentrate on arguing that both effects matter, that there is theory for both mechanisms separately, and that there is empirical evidence for both mechanisms. Theory in which both mechanisms co-occur is almost non-existent and available theory is not very satisfying in various respects. In addition, we think that up to now there has been hardly any empirical evidence in which both mechanisms are clearly disentangled. Therefore, this paper offers some evidence for the co-occurrence of learning and control and how both mechanisms interact. We hope that the empirical evidence presented in this paper proves useful in directing further theoretical research.

In the following section, we summarize theory concerning learning and control mechanisms related to trust. Section 3 offers evidence for learning and control from existing literature. Section 4 discusses in more detail two experiments in which evidence is found for the combination of learning and control. Finally, Section 5 presents ideas about how existing research on this topic can be extended and improved.

2. THEORIES

2.1. Learning Models

“Pure” learning models are models in which actors do not consider the payoffs of their opponents when making own decisions.³ These models assume only a minimal level of rationality for the actors. Actors adapt their behavior based on past experiences using a limited set of rules. Two main types of learning models can be distinguished: *belief-based* learning models and *choice-reinforcement* learning models.⁴ In belief-based learning models, an actor plays best-responses against his beliefs about the probabilities for certain moves of other actors. He does not take into account that other actors adapt behavior as a result of his behavioral changes. Updating of beliefs is based on experiences with and information about past behavior of the other actors. Simultaneously, actors change their behavior to play best-responses given the updated beliefs. In choice-reinforcement learning models, actors adapt their propensities for playing certain moves on the basis of the payoffs they received themselves in

the past. If they are satisfied with current play they continue their behavior, otherwise they change their behavior.

In economics, the development of learning models has been growing rapidly. Many studies are concerned with behavior “in the long run” and investigate the extent to which predictions of learning models are in the long run similar to predictions of more “rational” models in which the players take into account the incentives of other players (see, for example, Fudenberg & Levine, 1998). Another use of learning models in economics is to explain subjects’ behavior in experiments (Roth & Erev, 1995; Camerer & Ho, 1999; Erev & Roth, 1999). Since the actors in learning models act rather mechanically, learning models can straightforwardly be represented in computer simulations. Sociologists have used this opportunity to study what might happen in large groups of actors that have to cope with social dilemma situations (for some recent examples: Messick & Liebrand, 1995; Flache, 1996; Heckathorn, 1996; Lomborg, 1996; Buskens & Snijders, 1997; Macy & Skvoretz, 1998). Most of these studies provide conditions under which cooperation problems or collective good problems can be solved in societies of actors who adapt their behavior if they are not satisfied with the outcome of present behavior.⁵ For example, Flache (1996) demonstrates that, in a pure learning model, dense social networks can lead to very high as well as very low production of collective goods depending on the bilateral relations of the actors. The effect largely disappears if actors take into account that they can be controlled by others in future periods of play. This is just one example that learning models do not need to lead to the same conclusion as control models.

Formal learning models have not considered trust situations as defined here. However, there are some more informal studies on learning in trust situations. For example, Gulati (1995a) argues that strategic inter-firm alliances are less equity based if the alliance partners were partners before. Equity creates a joint ownership that “effectively deters opportunistic behavior” (p. 88). Gulati interprets this as an indication that trust grows with (positive) past experiences. Lawler and Yoon (1996) as well as Lawler et al. (2000), in their theory of relational cohesion, likewise argue that positive experiences in dyadic exchange relations as well as in triadic exchange induce more contributions of the actors in a joint venture which they conceptualize as a social dilemma. Their theory focuses on disentangling learning from earlier exchanges in the sense of uncertainty reduction and the emotional/affective consequences of earlier exchanges. Burt and Knez (1995a) show that dense networks amplify trust as well as distrust. Their argument is that due to the homogeneity of opinions in a dense network, actors become very convinced about some information because they receive the information disproportionately often. Clearly, these informal

analyses correspond with what we would expect from formal learning models about trust. Given that a trustor is not concerned about the payoffs of the trustee, the trustor's only consideration is whether the probability that she receives R_1 if she places trust is large enough (see also Coleman, 1990, Chap. 5). In a belief-based learning model, this implies that the percentage p of positive experiences in the past should be larger than $(P_1 - S_1)/(R_1 - S_1)$, since this is the condition for which $pR_1 + (1-p)S_1 > P_1$ so that the expected utility of placing trust exceeds the expected utility from no trust. In a choice-reinforcement learning model, the trustor should have obtained R_1 often enough after she placed trust to let her decide that placing trust leads to the most favorable outcome. And, although we will not elaborate on formal analysis of learning models for the Trust Game, it can generally be concluded that such models predict that if a trustor has more positive past experiences, the probability that she will trust a trustee is larger, while if she has more negative information, she will trust the trustee less. Buskens (2002, Chap. 4) shows how we can use this argument to derive hypotheses about the effects of structural properties of a trustor's network on the extent to which the trustor will trust a trustee under the assumption that information is either predominantly positive or negative. If information is mixed or ambiguous, this model does not provide predictions about effects on trust of learning through network embeddedness.

Learning models do not provide hypotheses about control effects because they assume that trustors do not consider the payoffs of the trustee but condition their behavior purely on past experiences. Therefore, by definition, we cannot derive effects of control, which would be based on arguments about future payoffs for the trustee, from learning models. "Control" elements might be included in strategies that are used in learning models. For example, a pre-programmed strategy might prescribe that the trustor does not place trust in an encounter after trust has been abused, and this might be a well-performing strategy. TIT-FOR-TAT would be an obvious example (see Axelrod, 1984). Still, this is something else than placing trust *because* of the anticipation that the trustee honors trust due to the fact that he would be worse off in the long run by abusing trust.

Based on the arguments and models mentioned above, we can derive five testable hypotheses, including three hypotheses about learning: (1) Trust increases with the potential gains for the trustor from honored trust ($R_1 - S_1$) and (2) decreases with the potential loss from abused trust ($P_1 - S_1$). Under the assumption that information about the trustee is positive, (3) trust increases with the number of past experiences the trustor has had with the trustee; (4) trust increases with the extent to which the trustor receives information about the

trustee from other trustors (indegree); and (5) trust increases with the density of the network of trustors.

2.2. Control Models

Models about control in trust situations are predominantly based on game-theoretic arguments. This is not surprising since trust based on control involves primarily considerations of the trustor about the trustee's incentives to abuse trust. The interdependence of two (or more) actors involved in trust situations is what drives the solutions of these models. First, it has to be noted that if the Trust Game is played only once between the same trustor and trustee, and there is no relation to any games with third parties that might be informed about the outcome of the Trust Game, there cannot be any control. Control is based on the fact that if the trustee abuses trust, a trustor who knows about this will not place trust, or at least will not place trust for some time after the abuse of trust. As a consequence, the trustee experiences a considerable loss because he will not receive more than P_2 if he is not trusted. Hence, the trustee is trustworthy and the trustor can be trustful.

We consider here "pure" control models. In these models it is assumed that players play rational *and* that all elements of the game are common knowledge (Rasmusen, 1994, p. 44). Then, by definition, hypotheses about learning cannot be derived from these models because all players are perfectly informed about the incentives and, implicitly, about the characteristics of the other players.⁶

The infinitely repeated Trust Game analyzed by Kreps (1990) is an example of such a control model. In this model, the Trust Game is repeated after each period with a continuation probability c . Kreps shows that always placing trust and always honoring trust is an equilibrium outcome if players value future payoffs high enough and the continuation probability is high enough. More precisely, assume players value the payoff X , in a Trust Game that is n periods away as $w^n X$, $0 < w < 1$. Then, $c \times w > (T_2 - R_2)/(T_2 - P_2)$ is a necessary and sufficient condition for always placing trust and always honoring trust to be an equilibrium outcome. Under this condition, the long-term losses for the trustee are larger than the short-term gains from abusing trust if the trustor does never place trust after any abuse of trust. In subsequent research, models for the repeated Trust Game have been extended to allow for a situation in which there is not one trustor but a network of trustors who can communicate about the behavior of the trustee (Raub & Weesie, 1993; Buskens, 1998; Weesie et al., 1998; Buskens & Weesie, 2000a; Buskens, 2002).⁷ Weesie et al. (1998) find that the denser the network of the trustors, the more these trustors can trust the trustee, but this model allows only for a homogeneous network of

trustors. Heterogeneous networks are introduced by Buskens (1998, 2002). The conclusion from these models is that not only network density has a positive effect on trust, but also the extent to which a trustor transmits information to other trustors (outdegree). The larger the outdegree of a trustor, the faster she transmits information about the trustee to other trustors in the network. Since these other trustors will not trust the trustee anymore, or at least will trust him less, if they receive negative information about the trustee, a trustor with a large outdegree has a large sanction potential against the trustee. This allows her to trust the trustee even if the temptation for the trustee to abuse trust is fairly large.

In pure control models, we do not find effects of past transactions of the trustors with the trustee or effects of the indegree of the trustors. In control models, trust is purely based on the potential sanctions of the trustor after an eventual abuse of trust. However, since the trustors perfectly know the incentives of the trustee, they will never place trust if the trustee would abuse trust. Therefore, trust will never be abused in equilibrium. Consequently, there is no relevant information to be communicated about the outcomes of past interactions under the condition that there are no deviations from equilibrium play. This is also the reason why, for example, the incentives of the trustors do not affect the equilibria either. As we have seen before, the threshold value for $c \times w$ is related only to payoffs of the trustee. This is a striking contrast with the learning models in which the trustor's payoffs determine trust.

We derive six testable hypotheses from the control models. Three of these hypotheses focus explicitly on control mechanisms: (1) Trust decreases with the trust problem, or the temptation for the trustee to abuse trust ($T_2 - R_2$); (2) trust increases with the loss for the trustee from not placing trust ($T_2 - P_2$) and (3) with the extent to which trustees value payoffs in the future (w); (4) trust increases with the probability that the same trustor and trustee have more interactions in the future (c). Moreover, trust increases with (5) the outdegree of the trustor and (6) the density of the trustor's network.

2.3. Combining Learning and Control

There are a few models integrating effects of learning and control. In these models, trustors are uncertain about the incentives of the trustee, but trustors know the distribution of incentives to abuse trust in the population of trustees. It is assumed that there exist some trustees who never have an incentive to abuse trust. Dasgupta (1988) and Camerer and Weigelt (1988) discuss such a (repeated) Trust Game with incomplete information. Also, Camerer and Weigelt test the model in an experiment, which we will discuss in the following section.

Technical details of this model have been provided by Bower et al. (1997). One conclusion is that the payoffs of the trustor are the main predictors for trust. This indicates that even in a setting in which there is only a limited amount of uncertainty for the trustors, the predictions of the “pure” control models about the payoffs of the players seem to lose much of their predictive power. Buskens (2000) extends the model with an exit option for the trustor and with a second trustor who communicates with the first about the behavior of the trustee. It is shown that an exit option does not have an effect on trust in this setting. Furthermore, communication between two trustors affects trust only if each trustor informs the other with a high probability about the trustee’s behavior, but not if only one of the trustors informs the other trustor with a high probability.⁸

Some of the results of these models are quite counterintuitive. In particular, note that in certain periods in the game, the probability that trustors trust increases (!) with the temptation for the trustee to abuse trust and decreases (!) with the probability that two trustors communicate about the trustee’s behavior. We will not elaborate here on the details behind these results. Explaining the model implications would require the introduction of too many technicalities. The important point is that the implications are not only counterintuitive but also inconsistent with some experimental findings. The complexity of the equilibria implies that there is hardly any reason to assume that actors actually (behave as if they) calculate the equilibria in such complicated situations. Still, Camerer and Weigelt (1988) claim that the equilibria have predictive power and can explain some features of the behavior of real actors. However, Neral and Ochs (1992) show that the actors do not act in accordance with the less intuitive prediction that trustfulness increases with temptation for the trustee in some periods of the game.

Consequently, we consider models in which learning and control are combined as very preliminary. The assumption that trustors know the distribution of incentives for the trustees might be too strong. Finding realistic information assumptions seems to be a more important problem than finding at least some assumptions for which game-theoretic solutions can be found, since outcomes of game-theoretic models tend to vary considerably depending on the information assumptions made (as we have seen from the different analyses related to the repeated Trust Game). We will not solve this problem in this paper (see Buskens, 2001, for some further discussion). We only want to show that to understand trust, we need a model in which learning and control are addressed simultaneously. Since the information assumptions seem to matter considerably for the predictions about behavior of the actors, it is important to obtain more knowledge about how trustors take into account their information in embedded trust situations with incomplete information.⁹

3. EMPIRICAL EVIDENCE FOR LEARNING AND CONTROL IN TRUST SITUATIONS

A typical feature of many empirical studies on trust in economic exchange as well as experimental settings is that they offer evidence for effects of dyadic embeddedness or network embeddedness, but it is hardly ever the case that we can determine whether the effects are due to learning, control, or a combination of the two mechanisms. It is often acknowledged, as we will see, that embeddedness is important for trust (Granovetter, 1985). Still, analysis of the mechanisms through which embeddedness works is often lacking.

For example, in a field study of four enterprises, Larson (1992) shows that relations between firms start with small transactions. Transactions become larger over time as trust emerges if the transactions progress smoothly. This is an example illustrating that trust evolves gradually and in a stepwise fashion (see: Blau, 1964 [1996]; Dasgupta, 1988; Coleman, 1990, p. 104). After the “trial period,” cooperative efforts can become more extensive, while the transactions are controlled through social relations only: “‘they trust us to pay and we trust them to give us a reasonable price’ ” (Larson, 1992). The trial period could be used to investigate the incentives of a partner, but also to obtain a better idea about the probability that more transactions will follow in the future. In an ethnographic study, Uzzi (1996, 1997) shows that failure rates of dress apparel firms are lower the stronger the relationship between partners. Uzzi explains this as a result of the comparative advantage of trust in strong relationships. The “black box” with unexplained mechanisms seems even larger here. It remains not only unexplained *how* strong relations affect trust, but also *why* trust increases performance.¹⁰ Uzzi (1996, p. 681) seems to prefer the learning explanation since he provides circumstantial evidence that trustors trust a trustee even in final transactions in embedded ties.

Gulati (1995a, b) finds that the probability that firms form alliances is larger if they have been involved in alliances with the same partner before. Gulati interprets this finding as an indication that previous, probably positive, experiences enlarge trust among partners. Moreover, the probability that partners in alliances use equity as a formal governance mechanism decreases with the number of previous alliances between the partners. Complementary experimental findings are due to Lawler and Yoon (1996) who present evidence showing that positive experiences in repetitive exchanges positively affect cooperation in the Prisoner’s Dilemma (see Lawler et al., 2000, for similar evidence for N-person Prisoner’s Dilemmas). Similarly, Baker et al. (1998) find that interorganizational ties between advertising agencies and their clients have a smaller probability of being dissolved if they have already existed for a longer

period. Although these findings are clearly explained in terms of learning – positive past experience increases trust, while trust enlarges the probability to stay together – a control interpretation seems likewise plausible. The increased probability to stay together improves control opportunities, which is also a reason to trust each other better.

Some studies on trust in economic exchange are noteworthy for addressing the effects of embeddedness at the dyadic level on the investment in formal arrangements such as investments in contracting. We consider the lack of investment in formal arrangements as an indication for trust among partners since such arrangements provide, for example, compensation for the trustor in case of untrustworthy behavior by the trustee. In a study on 72 subcontracting relationships, Lyons (1994) finds that the probability for arranging the relationship with a formal contract decreases with the number of years subcontractors have been trading with their most important customers. Blumberg (1997, Section 4.2) uses a complex measure for the investment in formal arrangements (comprising both time and money invested in formal arrangements and negotiations, and the extensiveness of the contract). He finds that both measures decrease and, thus, that trust increases with the extent to which the partners had transactions in the past. These results support the learning hypothesis that positive experiences increase trust. Blumberg actually distinguishes between the effect of past transactions and transactions expected with the partner in the future, but he does not find an effect of the transactions partners expect in the future.

Batenburg et al. (2002) study relations between buyers and suppliers of IT products. Their dependent variable is a combination of time and money spent in searching for a partner, negotiating with the partner, and the extensiveness of the contract. Such a dependent variable represents investments in the ex ante planning of transactions. They find that these investments decrease if the partners had transactions in the past. Furthermore, they find that the investments decrease even more if the partners already had past transactions *and* expect more transactions in the future. They do not find an effect of expected future transactions if the partners had no previous transactions. Their explanation employs two arguments. First, costly investments in ex ante planning are less necessary if more future transactions are expected because of the sanction opportunities from subsequent transactions. This is a control effect based on the expectation of future transactions. Second, however, it is worthwhile to invest more in formal arrangements if more future transactions are expected, because these investments can be used again in subsequent transactions. This is an investment effect due to the expectation of future transactions. The driving force of this effect is that relation specific investments associated with a focal

transaction affect the incentive structure of future transactions. Such effects have been ignored above in our theoretical discussion of learning and control. Combining the arguments on control and on the investment effect, it is unclear what the total effect of future transactions will be. However, a negative interaction effect between past and future on ex ante planning is indeed expected, since the investment effect will be larger in initial transactions compared to later transactions (see: Raub, 1996; Raub & Snijders, 2001). Another explanation for such an interaction effect could be that control only plays a role if the partners have sufficient information about each other and that uncertainties about an unknown partner are simply too large to allow for reliance on the effectivity of future sanctions already in the first transaction.

Buskens et al. (2000) use the same data, but their dependent variable is the number of issues addressed in the contract that was written for a transaction. They find that less items are included in the contract after positive transactions in the past, but no effect of transactions expected in the future is found for this dependent variable. Buskens et al. (2000) also address the effects of network embeddedness on trust. They find that there are less issues addressed in the contract if the buyer and supplier are located closer to each other. Their explanation is that buyers and suppliers who are located closer to each other are probably embedded in a denser network. Although alternative explanations might be possible, this is an indication that network embeddedness increases trust. Obviously, being located close to one another improves learning as well as sanction opportunities, so it is unclear whether this effect is due to learning or control.

In *experimental research*, cooperative relations are extensively studied using repeated Prisoner's Dilemmas (see Colman, 1982, Chap. 7 for an overview). Findings suggest that subjects often end up in cooperative play, but also might run into mutually defective choices. One explanation for this is that subjects try to learn and test whether another subject is trustworthy. This can lead to mutually cooperative choices. However, defective choices of untrustworthy partners probably result in implementing sanctions associated with control strategies, implying defective choices with partners who are untrustworthy.

More directly related to the issues discussed here are the experiments by Camerer and Weigelt (1988) and Neral and Ochs (1992). In these experiments, games are played that consist of eight or six times repeated Trust Games with incomplete information. Incomplete information in these games implies that trustors are not sure whether the trustee has an incentive to abuse trust. Thus, there is a positive probability that a trustor meets a trustee for whom $T_2 < R_2$, which implies that such a trustee will never abuse trust. All other elements of the Trust Game are the same. These experiments show empirically that trustees

care more about their reputation in the initial periods of play than at the end of the eight or six periods to be played. Moreover, trustors test whether the trustee is trustworthy, especially in the earlier periods. The more positive experiences a trustor has, the more she is convinced that she is playing with a trustee who does not have any incentive to abuse trust. However, the observed probability of placing trust by the trustor does not increase as the end of the game comes nearer. This is consistent with the theory, since the trustor has to realize that also the trustee has an incentive to make her believe that he does not have an incentive to abuse trust, but he will abuse trust toward the end of the game. Of course, in real-life situations, actors hardly ever know in advance which transaction with the partner will be the last one. The outcomes in the experiment clearly show learning in early periods, but simultaneously a concern about decreasing control opportunities if the end of the game approaches. In the absence of learning, a backward induction argument would cause that no trust can be placed in any of the rounds in a finitely repeated Trust Game.¹¹ In the absence of control, trust can never decrease after positive experiences.

Kollock (1994) studies trust experimentally in situations in which buyers are uncertain about the quality of a seller's products. Two groups of four subjects ("buyers" and "sellers") can trade with each other for twenty rounds. In each round, buyers and sellers are given five minutes to make offers about prices, while the sellers advertise the quality of their goods. The sellers can choose from three levels of quality at which they want to produce. The advertisement about quality does not need to be trustworthy. After each round the buyers are informed about the quality of the product they bought. Profit margins are largest for low-quality products sold for high prices. But selling high-quality products for high prices is preferred by all parties over selling low-quality products for low prices. In these experiments, most sellers seek to obtain a reputation for selling high-quality products and in the meantime obtaining high prices for their products. Sellers who start to sell low-quality products for high prices eventually end up with mutually sub-optimal outcomes, namely, selling low-quality products for low prices. A major difference between Kollock's experiments and the repeated Trust Games experiments of Camerer and Weigelt (1988) is that in Kollock's experiment the game with twenty rounds was played *only once*, while Camerer and Weigelt let the subjects play the eight times repeated Trust Games *75–100 times* with changing partners. Camerer and Weigelt show that subjects need some time to experience what the better strategies are. In the initial games in their experiments, a considerable number of subjects end up in sub-optimal outcomes, but this number decreases with experience in playing the repeated games. Summarizing, both experiments show that trustors test the trustees and try to learn about them in the course of the game. Moreover, trustors

execute control strategies if it is necessary to do so. Finally, it takes trustors and trustees some experience before they are able to figure out how to combine learning and control opportunities in an optimal way.

Most evidence discussed above is related to embeddedness at the level of the dyad. It is more difficult to find clear empirical evidence unambiguously supporting a causal relationship between social networks and trust. In the sociological literature, cohesive social structures and trust are often seen as being almost equivalent. For example, Gellner (1988, p. 143) states this explicitly and repeatedly. In these studies, trust is treated as being either present or absent in a society. Actors know each other and have similar norms leading to trustworthy behavior. Diamond merchants (Wechsberg, 1966) and the stock exchange market (Weber, 1921, pp. 191–193) form cohesive societies where trust reaches high levels. Ellickson (1991) describes an example of “high trust” among farmers in Shasta County, California. Disputes between the farmers arise when trespassing cattle damage neighboring fields or when there are collisions between cattle and vehicles. However, as long as the disputes are not too serious, neighbors are able to settle them informally, thereby saving the cost of law-suits. Formal law is used to settle conflicts only in exceptional cases. Anthropological studies likewise provide examples where reciprocal behavior without formal arrangements is the rule rather than the exception in close communities (see Sahlins, 1972, Chap. 5).

Although these studies provide evidence that trust can be extensive in cohesive networks, they do not explain why trust emerged and continues to exist. Learning could be part of the explanation, because newcomers will not receive negative information about actors in the network. Moreover, imitation will lead to trustful behavior after some positive experiences. However, if trust is exclusively based on learning, the situation does not seem to be very stable. One untrustworthy actor could easily invade a society where trust is omnipresent and exploit the trustful actors. Therefore, control is important in maintaining a stable level of trust. Actors who are untrustworthy must be expelled or punished severely enough for other actors to see that untrustworthy behavior is only worthwhile in the very short term.¹²

Some evidence suggests that control alone is not sufficient for the emergence and maintenance of trust. Burt and Knez (1995a, b) show that not only trust emerges in dense social networks, but trust and distrust may occur simultaneously in the same group of actors. Moreover, strong trust as well as strong distrust are especially prevalent in dense parts of the network. Control effects, in principle, explain strong trust rather than strong distrust. The reason is that in a dense network control is effective and, therefore, no untrustworthy behavior will occur. However, the fact that distrust might increase with the

density of the network is a strong indication that trustors adjust their beliefs about the trustworthiness of a trustor on the basis of information they obtain from network contacts and that untrustworthy behavior occurs in spite of the existence of a dense network.

In recent years, several studies into the relations between organizations with respect to *network governance* have provided evidence for learning and control (Nohria & Eccles, 1992; Swedberg, 1993; Smelser & Swedberg, 1994; Kramer & Tyler, 1996). "Network governance" is used as a label for a group of firms that engage in exchange relationships and the exact meaning of the label varies considerably between the studies (see Jones et al., 1997). Most of the research has a descriptive focus describing which kinds of networks emerge and which firms are more likely to be in the center of a network (see Barley et al., 1992). Kogut et al. (1992) show that biotechnology firms tend to search for partners within a cluster of firms with whom they can work cooperatively. However, the causes and consequences of the choices made by these firms are mostly ignored. Gerlach (1992) goes one step further, showing that Japanese firms are more tightly connected in organizational networks than American firms. Therefore, Japanese firms can rely more on inter-firm networks of supply and distribution than American firms. As a result, Japanese firms are smaller than American firms because the latter incorporate more frequently production processes within the firms. Finally, Gulati (1995b) finds that social networks help firms to obtain information about facilities and the abilities of potential partners. The result is that alliances occur more often among partners who have more common ties with third parties. Gulati and Gargiulo (1999) is one of the recent studies in which more specific network properties such as centrality are used to explain, in this case, alliance formation. Stuart and Robinson (Robinson & Stuart, 2001; Stuart & Robinson, 2001) also distinguish between different network mechanisms expressing the importance of having a good reputation based on past transactions and having sanctioning opportunities. Their core independent variables are the alliance experience of the trustor ("client") and trustee ("agent" or "target"), the centrality of the trustor and trustee in the network, and the status of previous partners of the trustee. They also include a variable representing past alliances among the two partners. These studies provide strong evidence for effects of dyadic embeddedness and network embeddedness on trust by explaining the use of informal network management mechanisms rather than more formal and contractual management. Again, however, it is impossible to distinguish clearly between learning and control because Stuart and Robinson use centrality measures such that the ties considered are symmetric and can be used for sending as well as receiving information. Moreover, the evidence in these network studies is based on the

assumption that the network structure for alliance formation corresponds largely with the network structure of communication among the relevant firms. If this assumption does not hold, learning and control can be the result of ties other than the alliance ties.

The evidence for learning and control through social networks discussed above is still far from conclusive. While there is evidence that trust can emerge in dense social networks, it remains unclear what drives the emergence of trust. Is it learning or is control through the threat of sanctions more important? Probably, the empirical evidence is limited because theoretical explanations guiding the search for empirical evidence are scarce. Researchers have primarily focused on establishing the relationship between embeddedness and trust considering at most one mechanism that drives this relationship. The proposed interdependence between learning and control, however, asks for an integrated approach that allows for disentangling these two mechanisms. We will return to this issue later in the conclusions. Before, we discuss some more specific evidence for the co-occurrence of learning and control in trust situations.

4. TWO VIGNETTE STUDIES

Available survey data do not offer more than circumstantial evidence to support that control and learning mechanisms play a role in durable relations. Most research has not been designed to distinguish learning and control effects explicitly and, consequently, although effects of social embeddedness are found, the precise nature of the mechanisms producing the effects remains unclear. Even if one would aim beforehand at distinguishing learning and control, it is a complex task to develop an appropriate research design, since convincing theory about the two mechanisms is still in the early stages of development. Experiments are useful to provide more control over the variation of key variables and experiments can be designed explicitly to resemble more closely assumptions made in theoretical models. In this way, experimental research cannot only provide us with evidence on hypotheses derived from theoretical models, but they can also shed light on the extent to which certain assumptions in existing models actually are problematic. Thus, experimental evidence can often guide further development of theoretical models more accurately than survey research.

We discuss two experiments in which subjects are presented with hypothetical transactions. The subjects are asked to imagine that these “vignettes” are actual transactions and they answer questions about their behavior related to these transactions (see, for example: Rossi, 1979; Rossi & Nock, 1982 on vignette experiments). The two experiments are rather different as far as the

design is concerned, but they are both designed specifically to test effects of different dimensions of dyadic embeddedness and network embeddedness on trust.

In the first experiment, purchase managers of Dutch companies are asked to answer questions about hypothetical transactions. The description of the transactions incorporates information about characteristics such as price and importance, but also about the relationship of the buyer with the supplier. Questions that had to be answered by the purchase managers included questions about the extent to which buyers would negotiate about the terms of the transactions and questions about arrangements they want to include in a formal contract for the given transaction. In the second experiment, students are asked to compare pairs of situations for buying a used car, while properties of the relation between the buyer and the car dealer are varied. There are a number of important differences between these two experiments. The type of transaction is clearly different. In the first experiment, subjects *rate* vignettes by indicating the level of investments in negotiations and contracting, while in the second experiment subjects *compare* different vignettes rather than providing ratings. In the first experiment, subjects are purchase managers with considerable experience in the type of transactions discussed in the experiment, while in the second experiment the subjects are students. In the first experiment, transaction characteristics are varied while they are kept constant in the second experiment. In the first experiment, learning and control through third parties are not explicitly distinguished, while the second experiment provides a first attempt to do so. An overview of the dependent and independent variables as well as other core features of both experiments is presented in Table 2. The table also indicates how the variables that represent social embeddedness are related to learning and control.

In this paper, we cannot go into all details about the design of the experiments. Additional information about the experiment on transactions in buyer-supplier relations can be found in Rooks et al. (2000). Further details on the experiment on buying a used car are provided in Buskens and Weesie (2000b).

4.1. Vignettes on Transactions in Buyer-Supplier Relations

In this experiment, respondents were requested to consider transactions from their daily business practice as purchase managers of medium-sized and large Dutch firms. A vignette consists of a description of a transaction for which eight variables are varied. The formulations for the different values of the variables are given in Table 3. The first three variables are related to transaction

Table 2. Summary of the Empirical Evidence on Trust from Two Vignette Studies Considered in this Paper.

	Experiment 1	Experiment 2
Type of transaction	Transactions in buyer-supplier relations	Buying a used car
Subjects	Purchase managers	Students
Number of subjects	40	125
Number of transactions	348	1249
Dependent variable	Effort invested in management	Choice between two dealers
Independent variables		
Transaction characteristics	Volume of transaction Specific investments Uncertainty	Volume of transaction – –
Dyadic embeddedness	Past (learning) Future (control)	Past (learning) Future (control)
Network embeddedness	– Degree (learning and control)	Density (learning and control) Third-party information (learning) Outdegree (control)
Institutional embeddedness	Exit opportunities (control) Country	–

characteristics, namely, the volume of the transactions, the extent to which the buyer needs to make specific investments for implementation of the transaction, and the extent to which the buyer is able to judge the quality of the product at the time of the transaction (uncertainty). Transaction cost arguments suggest that all three variables should have positive effects on the extent to which the buyer is concerned about obtaining a low-quality product, because of the supplier’s opportunities and incentives for abusing trust as well as the potential damage for the buyer (see, for example, Williamson, 1985). Hence, these variables are expected to affect trust negatively.

The fourth and fifth variable describe the bilateral relation between the buyer and the supplier. The past variable indicates whether the buyer and supplier have done business before with one another. Thus, the past variable represents learning. The future variable indicates whether buyer and supplier expect to do more business in the future. Clearly, this variable represents control.

The sixth and the seventh variable are related to the network of the buyer. The degree variable is an indicator for the extent to which the buyer knows

Table 3. Description of the Variables in the First Vignette Experiment.

Variable	Value	Text
Volume	0	A transaction with a small volume, namely less than US\$ 5000 on a yearly basis.
	1	A transaction with a reasonable volume, namely, about 5% of the total purchase volume of your firm.
	2	A transaction with a very large volume, namely, about 18% of the total purchase volume of your firm.
Specific investments	0	A transaction for which extra investments by your firm are not necessary.
	1	A transaction for which your firm has to make small investments, such as investments in specific machines and equipment.
	2	A transaction for which your firm has to make considerable investments, such as investments in specific machines and equipment.
Uncertainty	0	A known product about which your firm has the required expertise.
	1	A known product but one about which your firm has only limited expertise.
	2	A brand new product about which your firm has only very limited expertise.
Past	0	A supplier with whom your firm has never done business before.
	1	A supplier with whom your firm has a relationship in which minor problems occurred.
	2	A supplier with whom your firm has a long and successful relationship.
Future	0	It is uncertain how long your firm will continue with the supplier.
	1	Your firm expects to do business for a long period with the supplier.
Degree	0	You do not know any business partners of the supplier.
	1	You know some business partners of your supplier, but your firm does not do business with them.
	2	You do business with other business partners of the supplier.
Exit opportunities	0	A product for which there are no alternative suppliers on the market.
	1	A product for which there are some alternative suppliers on the market.
	2	A product for which there are many alternative suppliers on the market.
Country	0	A supplier from Eastern Europe.
	1	A supplier from Japan.
	2	A supplier from the United States.
	3	A supplier from Germany.
	4	A supplier from the Netherlands.

other business partners of the supplier. This variable represents learning as well as control. The exit variable describes the extent to which the buyer has alternatives for buying a similar product. Therefore, this variable represents control. An additional variable indicates in which country the supplier is located. This is an indicator for “institutional embeddedness.” The idea is that trust is more difficult if the supplier comes from a different institutional setting. We do not discuss this variable any further in this paper. A more detailed

discussion can be found, for example, in Weesie and Raub (1996). The precise formulation of the variables is given in Table 3.

Trust can be measured in different ways in this experiment. The subjects were asked how much time they would invest in negotiations and contracting for the transaction, and which departments would be involved in these negotiations. We assume that purchase managers want to invest more time in negotiations if they trust the supplier less. The subjects also answered whether or not they wanted to include a legal item (from a list of fourteen items) in a contract for the given transaction. Again, the assumption is that trust is smaller if a purchase manager wants to incorporate more safeguards in the contract. We discuss in detail the analyses for a dependent variable that is the product of the time invested in negotiations and the number of departments that would participate in these negotiations. Regression analysis is used with Huber standard errors modified for clustering. This is necessary since each purchase manager answered all questions for up to ten vignettes (Huber, 1967; Rogers, 1993).

The analyses in Table 4 demonstrate the importance of the transaction characteristics to explain trust in a given transaction. Purchase managers take more precautions for larger transactions for which they have to invest more and about which they have less information. These variables define in fact the trust problem in terms of the payoffs in a Trust Game. The trust problem can be

Table 4. Regression Analysis of Effort Invested in Management.

Independent variable	Hypothesis	Model 1	Model 2
Volume	+	0.63**	0.64**
Specific investments	+	0.16**	0.14*
Uncertainty	+	0.16*	0.17**
Past	-	-0.14*	-0.13*
Future	?	-0.02	-0.02
Degree	-	-0.08~	-0.09*
Exit opportunities	-	-0.04	-0.04
Institutional embeddedness	-	-0.10**	-0.10**
Past × future	-		-0.32**
Constant		-1.27	-1.26
Explained variance		0.49	0.51
Number of subjects		40	40
Number of observations		348	348

** , * , and ~ represent two-sided significance at respectively $p < 0.01$, $p < 0.05$, and $p < 0.10$ based on Huber standard errors modified for clustering.

alleviated by learning and control based on embeddedness as we see through the main effects of past and degree, and the interaction effect of past and future. Trust increases with transactions in the past and with the extent to which the buyer knows business partners of the supplier. Moreover, given that the buyer and supplier have done business in the past, the trust problem decreases considerably if the buyer and supplier expect to do more business in the future. The effect of exit opportunities is in the expected direction, but not significant. The effects for degree and exit opportunities are both somewhat unstable depending on the exact specifications of the model. If we estimate random-effect models with two random components, one on the level of the vignettes and one on the level of the subjects, both effects are close to significance but not very strong. The effects of the different countries turned out to be nicely ordered and, therefore, we added a one-dimensional variable for institutional embeddedness. Germany was clearly closest to the Netherlands on this scale followed by the United States and Japan. Purchase managers wanted to invest the most time in negotiating with suppliers from Eastern Europe.

We did similar analyses with the extent to which the purchase managers wanted each of fourteen items in a contract for a given vignette as the dependent variable. It turns out that volume, specific investments, and uncertainty are the predominant predictors, although the standard errors of the effects vary considerably with the exact specification of the models. Remarkably, however, is a strong negative effect of exit opportunities on the extensiveness of the contract. Moreover, though purchase managers tend to write more extensive contracts with suppliers from Germany, the United States, and Japan, they do not do so in the case of Eastern Europe. This analysis does not show any other effects of embeddedness. It seems that the two different management mechanisms “contracting” and “negotiating” are, at least to some extent, complementary mechanisms to overcome a trust problem. Probably, contracting seems of limited value in Eastern Europe due to the problem of enforceability, but this is compensated with more negotiating. On the other hand, exit opportunities can be used in negotiations to obtain a better deal, which might lengthen negotiations, but the supplier should stick to the verbal agreements since the exit threats remain available for the buyer.

We conclude that this experiment confirms the existence of a strong effect of embeddedness on trust due to learning within a dyadic relation. Moreover, the interaction effect of past and future indicates not only the existence of a control mechanism, but also that the occurrence of control is contingent on some previous learning opportunities or the importance of the investment effect of contracting that has been discussed in Section 3 above. This finding is in correspondence with the results of the survey on IT transactions of Batenburg

et al. (2002). Concerning third-party effects, we find that knowing other business partners of the supplier increases trust. It is unclear whether this effect is due to learning or control, since these third parties can be used to obtain information, but they also can be informed in case of untrustworthy behavior of the supplier to extend control opportunities. The effect of exit opportunities on contracting indicates that the purchase managers realize that this provides them with alternative sanction opportunities implying that the supplier is less likely to act untrustworthy if he has more competitors.

In the light of our previous discussion, two aspects of this first experiment are problematic. First, there is considerable variation in transaction characteristics and although we reach a considerable level of explained variance in the statistical models, we think that this variation creates likewise a considerable amount of noise. This noise might cause that the network effects, which are considerably smaller than the effects of the transaction characteristics, are partly obscured by the unexplained variance in the trust problem due to these transaction characteristics. Second, the experiment does not distinguish between learning and control due to the exchange of information with other buyers of the supplier. Both problems are addressed in the following experiment.

4.2. Vignettes on Buying a Used Car

In the second experiment, we asked students to compare situations for buying a used car. We presented students with pairs of vignettes describing such a transaction and asked them which one they preferred. The experiment was held in the U.S. (Chicago) and the Netherlands (Utrecht and Tilburg). Six variables are varied at the vignettes. The first variable indicates the price of the car (U.S.\$1000 or U.S.\$4000). Within each pair of vignettes between which subjects had to choose, the price of the car is held constant. Consequently, the price does not have a direct effect on the choices made by the subjects, but it might be the case that some embeddedness variables are more important for cheap cars than for expensive cars. In other words, the volume variable is added only to test for interaction effects of the size of the trust problem and embeddedness variables.

Five other variables represent embeddedness: past, future, density, third-party information, and outdegree. The precise formulations are given in Table 5.

Past, indicating learning at the dyadic level, is operationalized as whether the buyer has bought a car from the dealer before and was satisfied, or did never buy a car from the dealer. We only study the difference between *no* information and *positive* information from past experiences with the dealer, disregarding negative or mixed information. We expect that a vignette in which the buyer

Table 5. Description of the Variables in the Second Vignette Experiment.

Variable	Value	Text
Volume	0	You can buy a car for about US\$1000.
	1	You can buy a car for about US\$4000.
Past	0	You never bought a car from The Autoshop before.
	1	You bought a car from The Autoshop before and you were satisfied.
Future	0	You will move to the other side of the country in a few weeks.
	1	You do not expect to move out of town soon.
Density	0	The Autoshop is an unknown garage in your neighborhood.
	1	The Autoshop is a well-known garage and has many customers in your neighborhood.
Third-party information	0	As far as you know, none of your friends have bought a car from The Autoshop
	1	You have friends who bought a car from The Autoshop and they were satisfied.
Outdegree	0	You do not have a close link with the owner of The Autoshop.
	1	The owner of the garage and you are members of the same football team.

had positive experiences with the dealer is more attractive than a vignette in which the buyer had no positive experiences with the dealer.

Future, indicating control at the dyadic level, is operationalized as whether or not the buyer expects to move to the other side of the country soon. Control is more difficult for a buyer if she moves to the other side of the country. Moreover, the probability that the buyer has future transactions with the dealer is smaller if the buyer moves. Therefore, it is expected that a vignette is more attractive if the buyer does not expect to move than if the buyer expects to move. One problem with the operationalization is that, theoretically, the effect of future is based on the sanctions of the buyer *anticipated by the dealer*. Therefore, strictly speaking, future can be expected to affect the behavior of the buyer only if the dealer is informed about the buyer's plans to move. Another problem is that if a buyer moves, the possibilities of control through the network also become smaller. We will come back to this issue in the discussion of outdegree.

Density differentiates between a dealer whose garage is or is not well-known in the neighborhood of the buyer. If more potential customers in the neighborhood know the dealer, the buyer probably knows more other customers and it is likely that there are more ties among these other customers. Therefore, learning as well as control of a well-known garage through the network of customers can be more effective than learning about or control of a garage that is not well-known. Although we cannot distinguish learning and control for this

variable, density is added because it is a global network characteristics that is not directly linked to the specific individual network position of the buyer and the dealer.

Third-party information is operationalized as whether or not the buyer has information from friends about transactions of these friends with the garage. Again, only positive information is included, because we focus on the difference between *no* and *positive* information rather than the effect of negative or mixed information. Therefore, third-party information is expected to have a positive learning effect on the attractiveness of a vignette.

Outdegree is operationalized as whether or not both the buyer and the dealer are members of the same sports team. This is a measure for outdegree, because the number of acquaintances the buyer and dealer have in common is expected to be larger if the buyer and dealer are members of the same sports team. Common membership provides the buyer with possibilities of controlling the dealer through reputational sanctions both in his business and as a team member. These sanctions can include discouraging others to buy from the dealer, but also social sanctions during activities at the sports team. A rational dealer should be concerned about these sanction opportunities of the buyer. Therefore, outdegree is expected to have a positive control effect on the attractiveness of a vignette. Note that this effect of common membership may be smaller if the buyer expects to move to the other side of the country (future). In the formulation for outdegree, we did not mention anything about past behavior of the dealer to prevent the effect being interpreted as learning. Of course, the buyer has also a better potential for learning about the dealer's behavior, but given that the social setting allows for very extensive social sanctions and the fact that there is no indication whether information would be positive or negative, the control interpretation seems predominant for this variable. An advantage of this formulation of outdegree is that the theoretical assumption of "common knowledge about the network" is unlikely to be violated because the buyer and the dealer both know that they are members of the sports team. DiMaggio and Louch (1998) demonstrate that many buyers prefer a relative as a dealer for a used car rather than a dealer with whom they have no social relationship. A problem with this operationalization is that there may also be a group of buyers who are reluctant to buy a car from a team member. The relationship between the team members may be spoiled if the car happens to have a defect. Moreover, if it is not very obvious that an acquaintance has acted untrustworthy, it is questionable whether a buyer will actually execute sanctions against this acquaintance because the costs of sanctions for the buyer herself are probably relatively high. Obviously, this alternative interpretation of outdegree would

Table 6. Probit Analyses of the Choice of Vignettes.^a

Independent variable	Hypothesis	All	Chicago	Utrecht	Tilburg
Past	+	1.09**	0.99**	1.19**	1.39**
Future	+	0.57**	0.61**	0.61**	0.30
Density	+	0.71**	0.67**	0.73**	0.73**
Third-party information	+	0.83**	0.77**	0.89**	0.86**
Outdegree	+	0.26**	0.18	0.28*	0.51*
Number of subjects		125	40	72	13
Number of observations		1249	400	720	129

^a The effect sizes are proportional to the parameter estimates and, hence, not reported.

** and * represent two-sided significance at respectively $p < 0.01$ and $p < 0.05$ based on Huber standard error modified for clustering.

make a dealer *less* attractive if he is a team member, and would therefore reduce the theoretically predicted outdegree effect.

The choices in this experiment can be analyzed using a random utility model for multiple choice situations (McFadden, 1973) if we assume that subjects assign to each vignette a certain utility that depends in a linear manner on the attributes of the vignette. This statistical model implies that we estimate a probit model in which the differences in the values for the variables within a pair of vignettes are the independent variables, and whether a certain vignette is chosen is the dependent variable. The coefficients resulting from this model are interpretable straightforwardly as regression coefficients such that a positive coefficient implies that a certain embeddedness variable contributes positively to the utility of a vignette. Standard errors in the analyses are modified for clustering of observations within subjects.

The outcomes for the analyses are presented in Table 6 for all sessions together and for the sessions in the different cities separately. Note the remarkable resemblance of the results for the different sessions. No statistically significant differences occur between the sessions. Therefore, we focus now on the aggregated results. All embeddedness variables have positive effects on the utility of a vignette, which we interpret as having a positive effect on the probability that the subject expects to obtain a car that is worth the money paid for it. Thus, all types of embeddedness have a positive effect on trust. The largest and most significant effects are those of the learning variables: past and third-party information.¹³ Positive information clearly enhances trust. Future, density, and outdegree have likewise positive effects on trust, which implies that control is important at the dyadic as well as at the network level. Remember that this evidence for a control mechanism is somewhat problematic since these

variables are subject to alternative explanations. There might be other disadvantages for buying a car just before you move, for example, because you need to find another garage if there is any problem with the car in the future. The alternative interpretation of the outdegree variable would imply that the effect should be in the other direction. This is not the case and, consequently, the result is in correspondence with the arguments and results of DiMaggio and Louch (1998). However, we cannot exclude that actors prefer to trust well-known others over unknown others for other reasons than the control reasons advocated in this paper.

From the theory in Buskens and Weesie (2000a), we expected that the effects of embeddedness at the level of the dyad would become smaller compared to the effects of network embeddedness for larger transactions. Unfortunately, we did not find any interaction effects in this experiment. A reason for this might be due to the design of the experiments in which the corresponding variables were row-wise presented next to each other. This might cause that subjects concentrate on differences to simplify their decision task and disregard variables having the same values within a pair of vignettes. As a consequence, interaction effects can only be found by comparing pairs of vignettes that differ in both interacting variables with pairs of vignettes that do not differ in both variables. This decreases the number of cases considerably that can be used for testing the interaction effects.

5. CONCLUSION

In this paper we have outlined two mechanisms that foster trust in cooperative relations. One of these mechanisms is learning from previous behavior of a trustee, the other being control of the trustee through possibilities for future sanctioning of untrustworthy behavior. Both mechanisms work at a dyadic as well as at a network level. Two vignette experiments have shown evidence for learning as well as control. The first experiment on transactions in buyer-supplier relations demonstrates that learning through past transactions with the same partner and control through expected future transactions with the partner facilitate trust between business partners. In addition, we find evidence that these two effects of dyadic embeddedness are interrelated. Network effects exist in addition to the dyadic embeddedness effects, although we cannot disentangle learning and control in the degree variable that represented network embeddedness in the first experiment. In the second experiment, we are able to distinguish between learning and control through social networks. Again, learning and control affect trust through embeddedness at the dyadic level and at the level of the network. Learning at the dyadic level is represented through

previous experiences of the buyer with the dealer, while control at the dyadic level is represented through a variable specifying whether or not the buyer is about to move. In addition to these embeddedness effects at the dyadic level, trust is facilitated in this experiment through learning at the network level due to third-party information from common friends as well as through control at the network level via common membership of a sports club. We find additional support for the effect of network embeddedness from a variable for density, where network density represents learning as well as control. Consequently, we find consistent support for the positive effects of learning and control on trust at the dyadic as well as the network level in this experiment.

The empirical evidence accumulated in this paper has not only shown that trust prevails in embedded settings, but also that explaining trust requires to consider different mechanisms. Four effects have been distinguished, resulting from two mechanisms that operate at two levels. Trust can be based on bilateral learning and control mechanisms as well as on network learning and control mechanisms. While all four effects are found in the literature, there is hardly any knowledge about the relative importance of the four effects and the interplay between the two mechanisms and the two levels at which they occur.

Existing theoretical research provides underpinning for all four effects, but a satisfactory model that incorporates all four simultaneously does not yet exist. New modeling efforts face the difficulty of finding a fruitful combination of analytic tractability and realistic assumptions about what information actors have and how they use relevant sources of information. On the one hand, models with more realistic informational assumptions are often difficult to analyze. On the other hand, knowledge about what realistic informational assumptions would be is limited, because most empirical research has not succeeded in clearly disentangling the effects of learning and control mechanisms. Disentangling the effects could provide some evidence on the relative importance of these mechanisms and evidence about changes in the importance of different effects related to different circumstances.

To overcome these limitations, we propose a two-step empirical and theoretical approach. More experimental research is necessary to obtain better insights in the relative importance of the different mechanisms. Experiments should be designed such that subjects are involved in abstract trust situations embedded in a social context that allows for communication among trustors between transactions with trustees. The experiments should explicitly provide insights in how subjects use information they obtain from other subjects in the networks and whether or not they try to sanction untrustworthy behavior by informing other subjects in the network. In this way, the experiments enable the development of new models built on assumptions, for example, about

information exchange, that have an empirical basis rather than on assumptions chosen exclusively on the basis of introspection of researchers and mathematical tractability. Moreover, the experiments can be used to obtain initial insights in circumstances that affect the importance of learning vs. control in trust situations. Some of the arguments in this paper support that learning becomes more important compared to control if the trust situations presents more uncertainties. Specific uncertainties, for instance, about the incentives of the trustee, can be varied in order to study variations in the use of learning or control mechanisms depending on these kinds of uncertainties. Results of such experiments can inspire new theoretical models on the relative effects of learning vs. control, depending on circumstances that affect trust situations. Based on these new theories, survey designs can be developed that allow for variations in learning and control variables such that the predicted effects can be distinguished.

NOTES

1. Alternatively, one could define the temptation $(T_2 - R_2)/(T_2 - P_2)$ as the size of the trust problem if one wants to incorporate the potential loss for the trustee if the trustor refuses to place trust (see Snijders, 1996).

2. The distinction we make here resembles one made by Lewicki and Bunker (1995) between calculus-based trust and knowledge-based trust. The major difference, however, is that we do not consider different types of trust, but argue that the *extent* of trust depends on learning and control simultaneously. Moreover, we do not believe that earlier on in a relation trust is more based on control (calculus-based) and only later becomes knowledge-based. On the contrary, there is evidence that control becomes more important if actors already have information about each other (Batenburg et al., 2002). Note that trust based on learning is possible before actors actually meet, because social networks can provide learning opportunities as will be explained below. Note also that Burt (e.g. 1992, 2000) discusses a related distinction between “information benefits” and “control benefits” associated with social capital and “structural holes.” A major difference with our analysis here is that Burt focuses on information and control benefits for individual performance in competitive situations, while we address how learning and control can be beneficial for both trustor and trustee in mitigating a social dilemma such as the Trust Game. Trustor *and* trustee are better off if trust is placed and honored due to learning and control.

3. Game-theoretic models with incomplete information, which combine learning and control and assume that actors take incentives of their opponents into account are discussed later in this paper.

4. See Camerer and Ho (1999) for a comparison and an attempt for unification of these models.

5. An alternative interpretation of these models is that actors using strategies that lead to lower payoffs obtain less off-spring, which causes that they become less numerous in subsequent periods.

6. One might argue that learning is still possible in these models, since there are often many equilibria and it is not clear why players should choose the same equilibrium to start with. We disregard this issue, assuming that players coordinate instantly on the same equilibrium (see, for example, Fudenberg & Levine, 1998, p. 20).

7. See Raub and Weesie (1990) for an earlier analysis of a similar scenario for the Prisoner's Dilemma.

8. The model indicates that whether or not a probability can be considered high depends on the temptation of the trustee to abuse trust. The higher the temptation, the higher the communication probability should be.

9. An interesting question that we owe to the editors is whether trust should be based on both mechanisms, control and learning. Or, alternatively, is it possible that trust is produced and stabilized only as a consequence of one of the two mechanisms? It follows from the theory outlined here that if the learning mechanism is strong enough in the sense that the probability p of meeting a trustworthy trustee has become high enough, the trustor places trust even without opportunities for control. However, in this case trust will be occasionally abused, namely, when the trustee is in fact untrustworthy. Conversely, the theory implies that given sufficient control opportunities, trust will be placed and honored even without learning.

10. From the description of the Trust Game, it is clear why trust increases performance since trusting partners earn more than partners who do not trust each other.

11. The backward induction argument states that since trust will be abused in the last period, trust cannot be placed in the last period. Consequently, trust will be abused in the last but one period, so no trust will be placed in this period either. This argument continues up to the first period (see, for example, Rasmusen, 1994, pp. 122–123, for the same argument about the Prisoner's Dilemma).

12. In game-theoretic terms, a combination of strategies in which abuse of trust is not sanctioned cannot be a subgame-perfect Nash equilibrium. A similar situation can be found in Axelrod's (1984) computer experiments, in which naive cooperators in Prisoner's Dilemmas are exploited by strategies that initiate defection.

13. We do not have any strong evidence for which effects are larger than others since the scales of the variables cannot be compared and the strength of effects depends largely on the specifics of the formulations of the variables.

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REFERENCES

- Arrow, K. J. (1974). *The Limits of Organization*. New York: W. W. Norton & Company.
- Axelrod, R. (1984). *The Evolution of Cooperation*. New York: Basic Books.
- Baker, W. E., Faulkner, R. R., & Fisher, G. A. (1998). Hazards of the Market: The Continuity and Dissolution of Interorganizational Market Relationships. *American Sociological Review*, *63*, 147–177.
- Barber, B. (1983). *The Logic and Limits of Trust*. New Brunswick: Rutgers University Press.
- Barley, S. R., Freeman, J., & Hybels, R. C. (1992). Strategic Alliances in Commercial Biotechnology. In: N. Nohria & R. G. Eccles (Eds), *Networks and Organizations: Structure, Form, and Action* (pp. 311–347). Boston: Harvard Business School Press.
- Batenburg, R. S., Raub, W., & Snijders, C. (2002). Contacts and Contracts: Temporal Embeddedness and the Contractual Behavior of Firms. *Research in the Sociology of Organizations* (forthcoming).
- Blau, P. M. (1964 [1996]). *Exchange and Power in Social Life*. New Brunswick, NJ: Transaction Publishers.
- Blumberg, B. F. (1997). *Das Management von Technologiekooperationen: Partnersuche und Verhandlungen mit dem Partner aus empirisch-theoretischer Perspektive*. Amsterdam: Thesis Publishers.
- Bower, A. G., Garber, S., & Watson, J. C. (1997). Learning about a Population of Agents and the Evolution of Trust and Cooperation. *International Journal of Industrial Organization*, *15*, 165–190.
- Burt, R. S. (1992). *Structural Holes: The Social Structure of Competition*. Cambridge, MA: Harvard University Press.
- Burt, R. S. (2000). The Network Structure of Social Capital. *Research in Organizational Behavior*, *22*, 345–423.
- Burt, R. S., & Knez, M. (1995a). Kinds of Third-Party Effects on Trust. *Rationality and Society*, *7*, 255–292.
- Burt, R. S., & Knez, M. (1995b). *Trust and Third Parties*. Working paper, Graduate School of Business, University of Chicago.
- Buskens, V. (1998). The Social Structure of Trust. *Social Networks*, *20*, 265–289.
- Buskens, V. (2000). Trust in Triads: Effect of Exit, Control, and Learning. *Games and Economic Behavior* (forthcoming).
- Buskens, V. (2001). Third-Party Effects in Cooperation Problems: An Integrated Approach. *ISCORE Paper 195*. Utrecht University.
- Buskens, V. (2002). *Social Networks and Trust*. Dordrecht, Boston: Kluwer Academic Publishers.
- Buskens, V., Raub, W., & Weesie, J. (2000). Networks and Contracting in Information Technology Transactions. In: J. Weesie & W. Raub (Eds), *The Management of Durable Relations: Theoretical and Empirical Models for Organizations and Households* (pp. 77–81). Amsterdam: Thela Thesis.
- Buskens, V., & Snijders, C. (1997). 'Individual Heuristics and the Dynamics of Cooperation in Large Groups': Additional Results Using Analytical Methods. *Psychological Review*, *104*, 792–800.
- Buskens, V., & Weesie, J. (2000a). Cooperation via Networks. *Analyse und Kritik*, *22*, 44–74.

- Buskens, V., & Weesie, J. (2000b). An Experiment on the Effects of Embeddedness in Trust Situations: Buying a Used Car. *Rationality and Society*, 12, 227–253.
- Camerer, C., & Ho, T.-H. (1999). Experience-Weighted Attraction Learning in Games: Estimates from Weak-Link Games. In: D. V. Budescu, I. Erev & R. Zwick (Eds), *Games and Human Behavior* (pp. 31–51). Mahwah, NJ: Lawrence Erlbaum.
- Camerer, C., & Weigelt, K. (1988). Experimental Tests of a Sequential Equilibrium Reputation Model. *Econometrica*, 56, 1–36.
- Coleman, J. S. (1990). *Foundations of Social Theory*. Cambridge, MA: The Belknap Press of Harvard University Press.
- Colman, A. (1982). *Game Theory and Experimental Games: The Study of Strategic Interactions*. Oxford: Pergamon Press.
- Dasgupta, P. (1988). Trust as a Commodity. In D. Gambetta (Ed.), *Trust: Making and Breaking Cooperative Relations* (pp. 49–72). Oxford: Blackwell.
- DiMaggio, P., & Louch, H. (1998). Socially Embedded Consumer Transactions: For What Kinds of Purchases Do People Most Often Use Networks? *American Sociological Review*, 63, 619–637.
- Ellickson, R. C. (1991). *Order Without Law: How Neighbors Settle Disputes*. Cambridge, MA: Harvard University Press.
- Erev, I., & Roth, A. E. (1999). On the Role of Reinforcement Learning in Experimental Games: The Cognitive Game-Theoretic Approach. In: D. V. Budescu, I. Erev & R. Zwick (Eds), *Games and Human Behavior* (pp. 53–77). Mahwah, NJ: Lawrence Erlbaum.
- Flache, A. (1996). *The Double Edge of Networks: An Analysis of the Effect of Informal Networks on Cooperation in Social Dilemmas*. Amsterdam: Thesis Publishers.
- Fudenberg, D., & Levine, D. K. (1998). *The Theory of Learning in Games*. Cambridge, MA: MIT Press.
- Gellner, E. (1988). Trust, Cohesion, and Social Order. In: D. Gambetta (Ed.), *Trust: Making and Breaking Cooperative Relations* (pp. 142–157). Oxford: Blackwell.
- Gerlach, M. L. (1992). The Japanese Corporate Network: A Blockmodel Analysis. *Annual Review of Sociology*, 16, 435–463.
- Gouldner, A. W. (1960). The Norm of Reciprocity: A Preliminary Statement. *American Sociological Review*, 25, 161–178.
- Granovetter, M. S. (1985). Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91, 481–510.
- Gulati, R. (1995a). Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances. *Academy of Management Journal*, 38, 85–112.
- Gulati, R. (1995b). Social Structure and Alliance Formation Patterns: A Longitudinal Study. *Administrative Science Quarterly*, 40, 619–652.
- Gulati, R., & Gargiulo, M. (1999). Where Do Interorganizational Networks Come From? *American Journal of Sociology*, 104, 1439–1493.
- Heckathorn, D. D. (1996). The Dynamics and Dilemmas of Collective Action. *American Sociological Review*, 61, 250–277.
- Huber, P. J. (1967). The Behavior of Maximum Likelihood Estimates under Non-Standard Conditions. *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*, 1, 221–233.
- Jones, C., Hesterly, W. S., & Borgatti, S. P. (1997). A General Theory of Network Governance: Exchange Conditions and Social Mechanisms. *Academy of Management Review*, 22, 911–945.
- Kogut, B., Shan, W., & Walker, G. (1992). The Make-or-Cooperate Decision in the Context of an Industry Network. In: N. Nohria & R. G. Eccles (Eds), *Networks and Organizations: Structure, Form, and Action* (pp. 348–365). Boston: Harvard Business School Press.

- Kollock, P. (1994). The Emergence of Exchange Structures: An Experimental Study of Uncertainty, Commitment, and Trust. *American Journal of Sociology*, 100, 313–345.
- Krackhardt, D. (1992). The Strength of Strong Ties: The Importance of Philos in Organizations. In: N. Nohria & R. G. Eccles (Eds), *Networks and Organizations: Structure, Form, and Action* (pp. 216–239). Boston: Harvard Business School Press.
- Kramer, R. M., & Tyler, T. R. (Eds) (1996). *Trust in Organizations: Frontiers of Theory and Research*. Thousand Oaks, CA: Sage.
- Kreps, D. M. (1990). Corporate Culture and Economic Theory. In: J. E. Alt & K. A. Shepsle (Eds), *Perspectives on Positive Political Economy* (pp. 90–143). Cambridge: Cambridge University Press.
- Larson, A. (1992). Network Dyads in Entrepreneurial Settings: A Study of the Governance of Exchange Relationships. *Administrative Science Quarterly*, 37, 76–114.
- Lawler, E. J., Thye, S. R., & Yoon, J. (2000). Emotion and Group Cohesion in Productive Exchange. *American Journal of Sociology*, 106, 616–657.
- Lawler, E. J., & Yoon, J. (1996). Commitment in Exchange Relations: Test of a Theory of Relational Cohesion. *American Sociological Review*, 61, 89–108.
- Lewicki, R. J., & Bunker, B. B. (1995). Trust in Relationships: A Model of Development and Decline. In: B. B. Bunker & J. Z. Rubin (Eds), *Conflict, Cooperation, and Justice: Essays Inspired by the Work of Morton Deutsch* (pp. 133–173). San Francisco: Jossey Bass Publishers.
- Lomborg, B. (1996). The Evolution of Social Structure in the Iterated Prisoner's Dilemma. *American Sociological Review*, 61, 278–307.
- Lorenz, E. H. (1988). Neither Friends nor Strangers: Informal Networks of Subcontracting in French Industry. In: D. Gambetta (Ed.), *Trust: Making and Breaking Cooperative Relations* (pp. 94–107). Oxford: Blackwell.
- Lyons, B. R. (1994). Contracts and Specific Investments: An Empirical Test of Transaction Cost Theory. *Journal of Economics and Management Strategy*, 3, 257–278.
- Macaulay, S. (1963). Non-Contractual Relations in Business: A Preliminary Study. *American Sociological Review*, 28, 55–67.
- Macy, M. W., & Skvoretz, J. (1998). The Evolution of Trust and Cooperation between Strangers: A Computational Model. *American Sociological Review*, 63, 638–660.
- McFadden, D. (1973). Conditional Logit Analysis of Qualitative Choice Behavior. In: P. Zarembka (Ed.), *Frontiers in Econometrics* (pp. 105–142). New York: Academic Press.
- Messick, D. D., & Liebrand, W. B. G. (1995). Individual Heuristics and the Dynamics of Cooperation in Large Groups. *Psychological Review*, 102, 131–145.
- Neral, J., & Ochs, J. (1992). The Sequential Equilibrium Theory of Reputation Building: A Further Test. *Econometrica*, 60, 1151–1169.
- Nohria, N. & Eccles, R. G. (Eds) (1992). *Networks and Organizations: Structure, Form, and Action*. Boston: Harvard Business School Press.
- Rasmusen, E. (1994). *Games and Information: An Introduction to Game Theory*. Oxford: Blackwell.
- Raub, W. (1996). *Effects of Temporal Embeddedness on Ex Ante Planning under Incomplete Information*.
- Raub, W., & Snijders, C. (2001). A Reluctant Match: Models for the Analysis of Trust in Durable Two Party Relations. In: Y.-H. Tan & C. Castelfranchi (Eds), *Trust and Deception in Virtual Societies* (pp. 195–200). Dordrecht, Boston: Kluwer Academic Publishers.
- Raub, W., & Weesie, J. (1990). Reputation and Efficiency in Social Interactions: An Example of Network Effects. *American Journal of Sociology*, 96, 626–654.

- Raub, W., & Weesie, J. (1993). Symbiotic Arrangements: A Sociological Perspective. *Journal of Institutional and Theoretical Economics*, 149, 716–724.
- Robinson, D. T., & Stuart, T. E. (2001). *Just How Incomplete Are Incomplete Contracts: Evidence from Biotech Strategic Alliances*. Working paper, Graduate School of Business, University of Chicago.
- Rogers, W. M. (1993). Regression Standard Errors in Clustered Samples. *Stata Technical Bulletin*, 13, 19–23.
- Rooks, G., Raub, W., Selten, R., & Tazelaar, F. (2000). Cooperation between Buyer and Supplier: Effects of Social Embeddedness on Negotiation Effort. *Acta Sociologica*, 43, 123–137.
- Rossi, P. H. (1979). Vignette Analysis: Uncovering the Normative Structure of Complexity. In: R. K. Merton, J. S. Coleman & P. H. Rossi (Eds), *Qualitative and Quantitative Social Research: Papers in Honor of Paul F. Lazarsfeld* (pp. 176–186). New York: The Free Press.
- Rossi, P. H., & Nock, S. L. (Eds) (1982). *Measuring Social Judgments: The Factorial Survey Approach*. Beverly Hills, CA: Sage.
- Roth, A. E., & Erev, I. (1995). Learning in Extensive-Form Games: Experimental Data and Simple Dynamic Models in the Intermediate Term. *Games and Economic Behavior*, 8, 164–212.
- Sahlins, M. (1972). *Stone Age Economics*. Chicago: Aldine.
- Smelser, N. J., & Swedberg, R. (Eds) (1994). *The Handbook of Economic Sociology*. New York: Russell Sage.
- Snijders, C. (1996). *Trust and Commitments*. Amsterdam: Thesis Publishers.
- Stuart, T. E., & Robinson, D. T. (2001). *The Origins of Interorganizational Networks: Probation Until Reputation*. Working paper, Graduate School of Business, University of Chicago.
- Swedberg, R. (Ed.) (1993). *Explorations in Economic Sociology*. New York: Russell Sage.
- Taylor, M. (1987). *The Possibility of Cooperation*. Cambridge: Cambridge University Press (Revised edition of it *Anarchy and Cooperation*, London: Wiley 1976).
- Uzzi, B. (1996). The Sources and Consequences of Embeddedness for the Economic Performance of Organizations: The Network Effect. *American Sociological Review*, 61, 674–698.
- Uzzi, B. (1997). Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. *Administrative Science Quarterly*, 42, 35–67.
- Voss, T. (1982). Rational Actors and Social Institutions: The Case of the Organic Emergence of Norms. In: W. Raub (Ed.), *Theoretical Models and Empirical Analyses: Contributions to the Explanation of Individual Actions and Collective Phenomena* (pp. 101–128). Utrecht: Explanatory Sociology Publications.
- Weber, M. (1921). *Wirtschaft und Gesellschaft*. Tübingen: Mohr 1976.
- Wechsberg, J. (1966). *The Merchant Bankers*. New York: Bedminster Press.
- Weesie, J., Buskens, V., & Raub, W. (1998). The Management of Trust Relations via Institutional and Structural Embeddedness. In: P. Doreian & T. Fararo (Eds), *The Problem of Solidarity: Theories and Models* (pp. 113–138). Amsterdam: Gordon and Breach.
- Weesie, J., & Raub, W. (1996). Private Ordering: A Comparative Institutional Analysis of Hostage Games. *Journal of Mathematical Sociology*, 21, 201–240.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: The Free Press.
- Williamson, O. E. (1993). Calculativeness, Trust, and Economic Organization. *Journal of Law and Economics*, 36, 453–486.
- Williamson, O. E. (1996). *The Mechanisms of Governance*. Oxford: Oxford University Press.