Trust in Embedded Settings

Trust in Embedded Settings

Vertrouwen in situaties met netwerkinbedding
(met een samenvatting in het Nederlands)

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Puzzles of Embedded Trust

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Example 1

Imagine Ego is driving her car in an unfamiliar neighborhood of the city where she lives when she suddenly hears a strange noise coming from the engine of the car. Ego is not a mechanic nor is she an expert in car repairing, but, as far as she can tell, it sounds as if something serious has happened to the engine. The car continues running, but Ego does not know how far she can drive before it stops. Ego remembers having seen a garage sign a few hundreds meters back. She could turn around and drive to the mechanic. Compare this scenario with a similar situation, but this time Ego is driving in a familiar neighborhood. Moreover, this time the problem concerning the engine of Ego's car occurs only a few hundred meters away from the garage of Ego's regular mechanic, who has repaired her car several other times in the past. In which of the two situations would Ego trust the mechanic most?

Example 2

Alpha and Beta are two companies in the automobile industry. Beta produces cars, while Alpha is one of Beta's components supplier. The two companies have had a number of transactions with each other in the past; Beta has been buying components from Alpha to install on its cars. Imagine Ego is the manager of Alpha. One day, Alter, the manager of Beta, suggests that the two companies form an R&D alliance and together develop a new technology which would be profitable for them both. However, Ego is afraid that Beta might use this opportunity to "steal" know-how from Alpha's best engineers and start producing the components by itself. Ego knows Alter because Alpha has been Beta's client for some time. However, previous transactions did not imply any such "risk" for either of the two companies. Would Ego trust Alter and join the project? Now, assume Ego does not know Alter and has had no previous transactions with him, would Ego's decision be the same?

Example 3

Although some people are still afraid to buy goods via Internet – because they do not trust that the sellers will eventually ship an item of adequate quality – online transactions have become very common nowadays. Imagine Ego is one of these old-fashioned people who do not like to buy things if they do not see the seller in person, and that she is desperately looking for a specific book. Furthermore, imagine that this book seems to be out of store in all shops, and the only way Ego can have it is to buy it second-hand from an online bookseller. Ego goes onto secondhandbooks.com and finds out that a few second-hand bookshops do have this book. Secondhandbooks.com uses a reputation system that allows all customers to rate the sellers with whom they have had transactions. The average ratings of each seller and the number of transactions on which this average is computed are available to the buyers. Ego can see that these sellers vary slightly with respect to price, but also with respect to their rating. Since Ego really wants this book, she resolves to set aside her doubts and buys it. How would Ego decide from which seller to purchase the book? Would the ratings help her to make a choice?

Example 4

In the 1990s, there was a big parking lot in front of the main building of the University of Turin, which was – and probably still is – always completely full. There were two guys who looked after the parking lot every day from early in the morning until late in the afternoon. They were neither authorized, nor paid by the town council, but they received tips from the students to optimize the space in the parking lot and keep an eye on their cars. These guys did not look very reliable, they wore shabby and dirty clothes and they were covered by self-made aggressive-looking tattoos. However, it was not unusual to see one of these guys sitting in an expensive sports car, smoking stinky cigarettes and listening to loud music from the car-stereo. In fact, when the parking lot was completely full, students used to leave their cars to the guys, who parked them as soon as a place was available. Imagine Ego is a first-year student who goes to the university by car for the first time, enters the parking-lot and finds out that there is no place available to park her car. Then, one of the unauthorized “attendants” offers to take her car, park it as soon as a place is available, and then leave the key on it. Judging from his appearance, the guy certainly does not look trustworthy. However, it seems that many other students indeed trust him, since there is a long queue of cars waiting to be parked, including some expensive looking ones. Would Ego leave her car to the attendant?

Would Ego take the number of other cars waiting to be parked as a signal that the attendant is trustworthy?

Example 5

Imagine once again that Ego is an old-fashioned type who does not like making online transactions. Imagine again that Ego is desperately looking for a book that is out of store in all the shops, but this time imagine that the only online seller who has the book Ego wants has no rating, because it is a new book-shop. Other sellers have ratings based on thousands of transactions, indicating that many more people than Ego initially thought buy second-hand books online. However, these other online sellers do not have the book Ego wants. What would Ego do in this case? Does the information that so many other people regularly buy from other online sellers matter at all to Ego?

Example 6

Imagine Ego is sitting in a pub together with a friend, when Alter, a former schoolmate of Ego's friend, whom Ego does not know, walks into the pub and comes along to greet Ego's friend. The friend introduces Alter to Ego, they speak with each other for a couple of minutes and then Alter leaves. Some days later, Ego is shopping in a supermarket when she meets Alter again. This time, he approaches Ego and asks her to lend him some money to pay for his grocery because he just realized he forgot his wallet at home. He is not a perfect stranger to Ego, but Ego cannot say she knows him either. Particularly, Ego only knows Alter went to school with her friend, but she has no idea whether he can be trusted. Would Ego lend him the money or would she refuse?

The situations described in the examples above are similar in one respect. They represent *trust problems* between two actors. By "trust problem", we indicate a situation with an incentive structure that we specify in the next two sections. Moreover, all trust problems described in these examples occur in *embedded* settings. We refer to these situations as "embedded" because they do not represent simple isolated encounters between two actors. On the contrary, in all of the examples, either the actors know each other, they share relations to some third parties (a specific actor in such a role will be indicated by Tertius), or they have experienced the same or a similar situation before. Consequently, a certain amount of information concerning the actor to be trusted (Alter) or the specific trust problem is available to the focal actor (Ego) who has to decide whether to trust. The ways in which actors are embedded in

these examples are varied. Consequently, the information available to Ego also varies considerably. Furthermore, Ego is confronted with uncertainty. Uncertainty in trust problems can relate to different aspects: uncertainty about Alter's trustworthiness and uncertainty about other possible contingencies. For example, if Ego decides to buy a second-hand item online, as in example 5 or 6, she may be uncertain about whether the item will actually be delivered due to a mistake in the shipment independent from the will of the seller.[1]

As the examples above suggest, this book focuses on:

1. *The effects of information available to actors in embedded settings on the choices made in trust situations*;
2. *The extent to which Ego's uncertainty affects the importance of the information available to her*.

In this chapter, we introduce the essential features of the types of problems that this book addresses and formulate explicit research questions which are treated in the subsequent empirical chapters. In section 1.2, we introduce trust. In section 1.3, we specify which embedded settings are examined and offer a typology of embedded situations where different types of information are available to Ego. In section 1.4, we discuss uncertainty. Research questions are formulated explicitly in section 1.5, which concludes with an overview of the book.

1.2 Trust

1.2.1 What is trust?

Since trust has been extensively studied, several different conceptions can be found in the literature. A first distinction could be made between studies focusing on the function of trust for the social system and those that look at trust at the individual level. Examples of the first type of approach are Parsons' conception of trust in the normative system as a source of social order (e.g., Parsons, 1937) and Luhmann's argument that trust serves the purpose of reducing the complexity which characterizes modern societies (Luhmann, 1988; see Misztal, 1996: ch. 3 on the different functions of trust). We are interested in the emergence of trust between interdependent actors, and hence this book approaches trust at the individual level. Among

[1] For reader friendliness, we refer throughout this book to the focal actor facing the trust problem (Ego) using female personal pronouns, and to her partner, the actor who is to be trusted (Alter), using male personal pronouns.

scholars who studied trust at the micro level, one can find definitions of trust that focus on psychological and cognitive elements on the one hand (e.g., Barber, 1983; Lewis and Weigert, 1985; Robinson, 1996) and definitions that stress strategic and calculative elements on the other (e.g., Arrow, 1974; Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990; Williamson, 1993). All of these definitions more or less uniformly identify an element of risk due to the fact that, as far as the trust problem is concerned, Ego's welfare *depends* on Alter's action. However, insofar as they fail to take the incentives of the actors involved into account, most definitions that treat trust as a psychological state apply also to situations that, in our view, are not trust problems. For example, Robinson (1996: 576) defines trust as a person's "expectations, assumptions, or beliefs about the likelihood that another's future action will be beneficial, favorable, or at least not detrimental to one's interests." According to this definition, we can say that, if we are in a hospital, for example, we trust that the doctors' actions "will be beneficial, favorable, or at least not detrimental to our interests." However, if we are considering the doctors' capability to make the right diagnosis and choose appropriate treatments, we should rather say that we *confide* that their actions will be beneficial, and not that we *trust* them, because – as stated by Snijders (1996: 10) using a similar example – we rely on their competence, not on their preferences. Conversely, if we consider the possibility that the doctors do not apply perfect care-intensity to our problem, for example, because they want to dedicate more of their time to other cases, it is appropriate to say that we trust them, because the source of our concern lies in their preferences.

In the literature on trust, another important distinction can be found between studies that treat trust as an explanans and others that treat it as an explanandum (Craswell, 1993). In the first case, trust is offered as an explanation for certain behavior, typically seemingly non-calculative behavior, such as cooperation in the one-shot Prisoner's Dilemma. Trust is used as an explanans when it is invoked as an alternative justification for Ego's risk-taking behavior, namely a justification that excludes the possibility that such a risk is in Ego's calculated interest (e.g., Lewis and Weigert, 1985). Trust is typically conceived as an explanans by scholars who study trust at the level of the system (e.g., Parsons, 1937; Luhmann, 1988). Conversely, in the second case, the term trust indicates risk-taking behavior in situations that are described as a subclass of risky situations, namely those in which the risk to which Ego exposes himself depends on the performance of another actor (Coleman, 1990: ch. 5). However, when trust is seen as an explanandum, the term trust is used only to *describe* Ego's risk-taking behavior, rather than to *explain* it. The explanation of Ego's trusting behavior requires that some theory is provided, which may very well include a calculative explanation

(e.g., Gambetta, 1988; Coleman, 1990). In Craswell's (1993) terms, this book deals with trust as an explanandum. We provide explanations of Ego's trusting behavior by investigating the role of information about Alter and about the trust problem that is available to Ego before her trusting choice is made.

Gambetta (1988: 217) defines trust as "a particular level of the subjective probability with which an agent assesses that another agent or group of agents will perform a particular action [an action that is beneficial or at least not detrimental], both *before* he can monitor such action, ... *and* in a context in which it affects *his own* action" (emphasis in the original). Although this definition still includes both "trust in the intentions of others not to cheat us and in their knowledge and skill to perform adequately over and above their intentions" (ibidem: 218), Gambetta adds two important elements. First, he restricts trust to situations in which Ego's *action* depends on such subjective probability, and second, he introduces time asymmetry by specifying that such subjective probability is assessed *before* Alter's action can be monitored. In other words, trust is conceptualized as a strategic decision made by Ego based on the subjective probability that a certain event – dependent on the will of Alter – will occur, and not just as a psychological state.

Although his definition is merely cognitive, and trust as behavior is explicitly excluded, Hardin (1996, 2002) adds another important element in his definition of trust: Alter's trustworthiness. If Ego's trust in Alter depends on her assessment of Alter's trustworthiness, then it is essential to understand trustworthiness in order to explain trust. Thus, a congruent definition of trust must take Alter's incentive to be trustworthy into account. According to Hardin (2002: 4), trust is *encapsulated interest*: "I trust you because I think ... [that] you have an interest in attending to *my* interest because, typically, you want our relation to continue" (emphasis in the original). Subsequently, Hardin explores a number of possible arguments supporting Alter's trustworthiness. These arguments include internal motivations, such as dispositions, moral rules, and internalized norms, as well as external motivations, such as institutional devices and commitments (cf. Raub, 2004).

The major features of a trust problem are summarized by Coleman (1990: ch. 5), who identifies four essential characteristics:

- Ego has the possibility to place some resources at the disposal of Alter who has the possibility to either honor or abuse trust.
- Ego prefers to place trust if Alter honors trust, but regrets placing trust if Alter abuses it.

- There is no binding agreement that protects Ego from the possibility that Alter will abuse trust.
- There is a time lag between the decision of Ego and that of Alter.

The first point stresses the dependency of Ego's welfare on Alter's action. The second point specifies that a trust problem is characterized by "mixed motives", in the sense that Ego and Alter's interests are partly common and partly conflicting. Consequently, a trust problem implies the risk that Alter's action will harm Ego's interests. The third point emphasizes that this element of risk cannot be eliminated exogenously, and the fourth point restricts the definition to situations with a sequential structure, excluding situations in which Ego and Alter's decisions take place simultaneously. It follows from this definition that Ego's trust in Alter is Ego's *decision* to place some resources at Alter's disposal when confronted with a situation resembling the description above. According to Coleman this decision depends on Ego's subjective probability that Alter will honor trust and on the possible gains and losses depending on Alter's decision. The subjective probability that Alter will honor trust represents Ego's assessment of Alter's trustworthiness. Coleman discusses possible reasons for Alter to be trustworthy throughout the chapter. However, he does not explicitly model Alter's incentives. Formal definitions of a trust problem that also incorporate this aspect can be found in game-theoretic models. Such models are discussed in the next subsection.

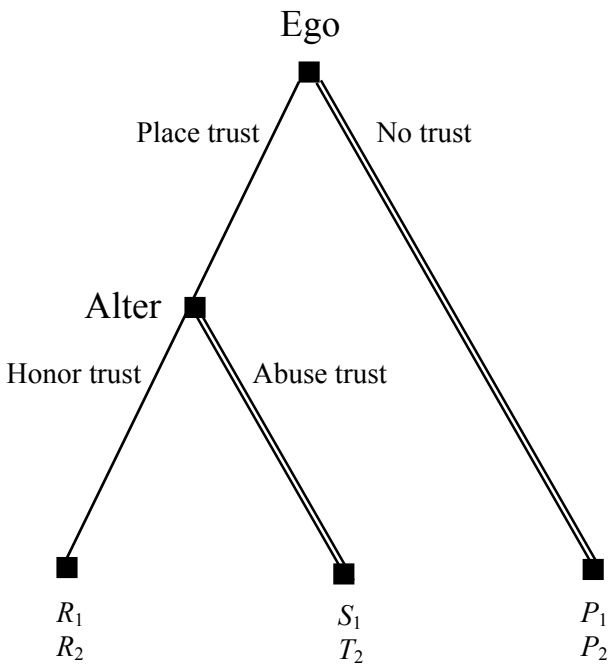
1.2.2 Modeling trust problems

Coleman's definition of trust is consistent with the game-theoretic formalizations of the *Trust Game* (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990) and the *Investment Game* (Berg et al., 1995; Ortmann et al., 2000).

The Trust Game (figure 1.1) begins with a move by Ego, who has a choice between trusting and not trusting Alter. If Ego withholds trust, the game ends. In this case, Ego receives P_1 and Alter receives P_2.[2] If Ego chooses to place trust, Alter has the possibility to honor or abuse trust. If Alter honors trust, he obtains $R_2 > P_2$ and Ego obtains $R_1 > P_1$, while if he abuses trust Alter receives $T_2 > R_2$ and Ego is left with $S_1 < P_1$. This game can be seen as a one-sided version of the well-known Prisoner's Dilemma. For this reason, payoffs are indicated with the conventional letters used in the literature on the Prisoner's Dilemma: T for

[2] We use subscript 1 to indicate payoffs obtained by Ego and subscript 2 to indicate payoffs obtained by Alter, throughout the book. In figures, the payoffs earned by Ego and Alter are displayed one above the other next to the end nodes of the game.

Figure 1.1 Trust Game ($R_1 > P_1 > S_1$; $T_2 > R_2 > P_2$)

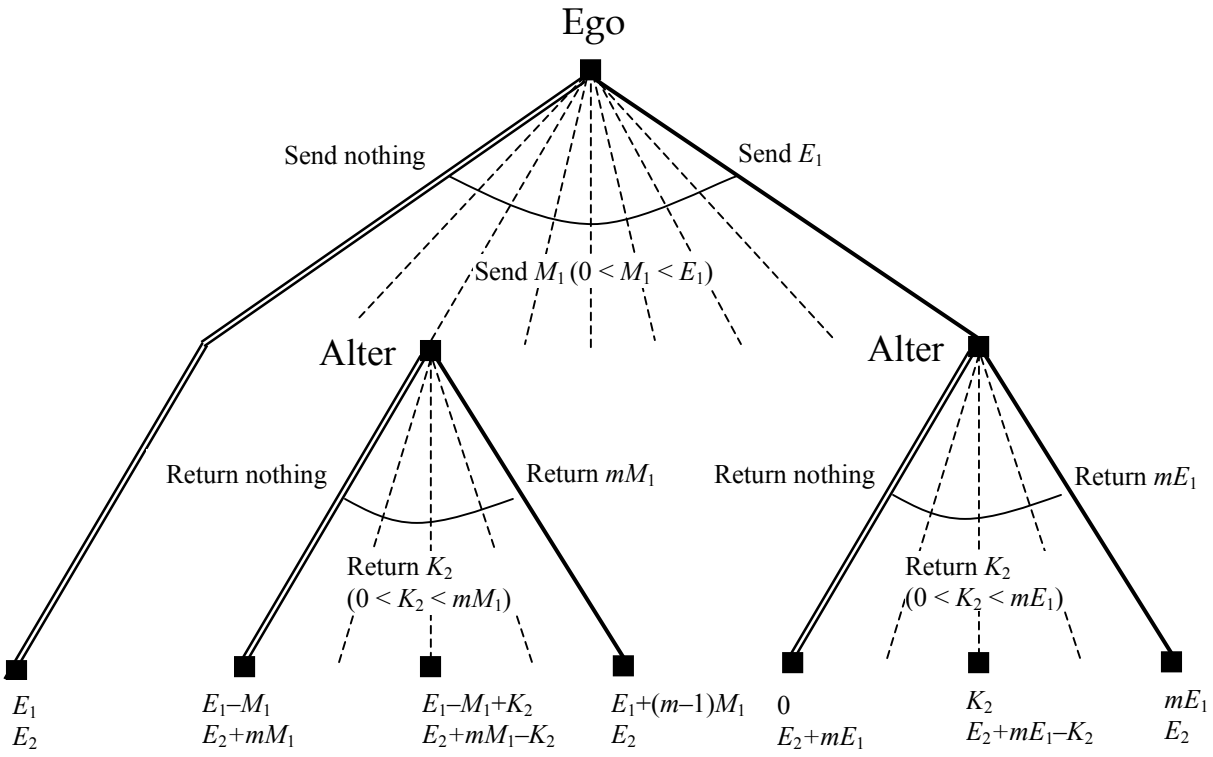


temptation, *R* for *reward, P* for *punishment,* and *S* for *sucker*. Assuming that payoffs equal utility, and that the game is played only once, non-cooperative game theory predicts that Ego will not place trust.[3] If Ego placed trust, Alter would abuse it because $T_2 > R_2$. Consequently, Ego – knowing the payoff structure – should withhold trust because $P_1 > S_1$. "No trust" and "Abuse trust" are equilibrium choices (in figure 1.1 this is represented by double lines). Therefore, the payoffs in equilibrium are P_1 and P_2. This outcome is Pareto sub-optimal, because both actors would prefer the payoffs yielded in the situation in which trust is placed and honored, R_1 and R_2.

The Investment Game (figure 1.2) models a situation in which Ego's choice whether to trust Alter and Alter's choice whether to honor trust are not dichotomous choices as in the Trust Game. On the contrary, in the Investment Game, Ego and Alter choose a value corresponding to the *extent* to which Ego trusts Alter, and the *extent* to which Alter honors trust, respectively. The two players start with an initial endowment, E_1 and E_2. Ego then has the possibility to send all, some, or none of her endowment to Alter. The amount of money

[3] Assuming that payoffs are utilities implies that any sort of moral, emotional, or psychological concern – such as envy, guilt, regret, fairness, etc. – induced by the outcomes of the game does not alter the rank order of the payoffs or, in other terms, all possible moral, emotional, or psychological concerns are already incorporated in the payoffs so that the preference order of the players is $T > R > P > S$. For examples of theoretical models of Trust Games explicitly incorporating such psychological aspects see Snijders (1996).

Figure 1.2 Investment Game



that she decides to send, denoted M_1, is then multiplied by a factor m (with $m > 1$). Alter receives an amount equal to m times the amount sent by Ego. The parameter m can be interpreted as the returns Alter makes due to Ego's investment. Then Alter can decide to send back to Ego all, some, or none of the money he has received. The amount returned by Alter – denoted K_2, satisfying $0 \le K_2 \le mM_1$ – is not multiplied. After players have chosen their actions, the game ends and the players receive their payoffs. The payoff earned by Ego (V_1) is:

$$V_1 = E_1 - M_1 + K_2,$$

while the payoff earned by Alter (V_2) is:

$$V_2 = E_2 + mM_1 - K_2.$$

The amount that Ego is willing to send to Alter indicates the extent to which Ego trusts Alter. Therefore, we refer to Ego's choice M_1 as (degree of) *trust.* Conversely, the amount that Alter is willing to return to Ego represents the extent to which Alter is trustworthy. Therefore, we

refer to Alter's choice K_2 as (degree of) *trustworthiness*.[4] Assuming a one-shot non-cooperative game in which payoffs equal utility, Alter maximizes his revenues by keeping everything Ego has sent to him. Thus, Alter should choose $K_2 = 0$. Consequently, knowing the structure of the game and anticipating Alter's behavior, Ego maximizes her revenues by choosing $M_1 = 0$, since $E_1 - M_1 < E_1$ if $M_1 > 0$. Therefore, "Send nothing" and "Return nothing" are the equilibrium choices (in figure 1.2, this is represented by double lines) and the payoffs in equilibrium are E_1 and E_2. As in the Trust Game, this outcome is Pareto-suboptimal, because both actors would prefer the payoffs yielded in the situation in which trust is placed and honored, $E_1 - M_1 + K_2$ and $E_2 + mM_1 - K_2$, with $M_1 > 0$ and $K_2 > M_1$. For the Investment Game, Pareto improvements are always possible if $M_1 < E_1$. The pie that the actors are dividing reaches its maximum when Ego sends everything ($M_1 = E_1$). Ego gains from trusting Alter only if Alter returns more than what Ego sent ($K_2 > M_1$), but, given $M_1 = E_1$, all possible K_2 chosen by Alter induce outcomes that are Pareto non-comparable.

The Trust Game and the Investment Game differ, because in the Trust Game "trust" and "trustworthiness" are represented by dichotomous choices – trust vs. no trust, honor trust vs. abuse trust –, while the Investment Game exhibits some "continuity" both in the choice of placing trust and in the choice of honoring or abusing trust. The Trust Game presented above can be seen as a "special case" of the Investment Game in which Ego has to decide whether to send everything or nothing to Alter, $M_1 = E_1$ or $M_1 = 0$, and Alter – if Ego chooses to send everything – can choose to keep everything ($K_2 = 0$), or split the amount received in such a way that both actors end the game earning the same payoff ($K_2 = ½mE_1 + ½E_2$). Both games represent social dilemmas characterized by a conflict between individual and collective rationality (Rapoport, 1974). The situation in which trust is placed and honored is collectively rational because in such a situation both actors obtain a better payoff in comparison with the situation in which trust is not placed. Nevertheless, it is individually rational for Alter to abuse trust if Ego places trust. Consequently, it is individually rational for Ego to withhold trust. Thus, if the actors are individually rational and expect their partner to be individually rational, trust situations yield a collectively suboptimal outcome.

Throughout the book, we define trust as a decision corresponding to Ego's choice to place trust in the Trust Game or to send a positive amount to Alter ($M_1 > 0$) in the Investment

[4] In the economic literature, K_2 is often labeled *reciprocity* (e.g., Berg et al., 1995; Ortmann et al., 2000). The term reciprocity is used because if Ego chooses a small M_1, Alter might choose a small K_2 as well in order to punish Ego for not trusting him. Thus a small K_2 does not necessarily mean that Alter is not trustworthy. However, the term reciprocity implies a certain degree of psychological speculation about the cause of Alter's choice K_2. Therefore, we prefer the term *trustworthiness*.

Game. We apply the Trust Game in chapter 2 and the Investment Game in chapters 3 and 4. The choice of the theoretical model depends on the design of the experiments that are discussed in these chapters. Chapter 2 presents a vignette experiment (Rossi and Nock, 1982) in which subjects are requested to express a preference between two alternatives.[5] This dichotomous choice is better captured by the Trust Game. Therefore, the theoretical analyses in chapter 2 are based on the Trust Game. In the two laboratory experiments in chapters 3 and 4, we observe variations of the level of trust on a continuous scale as a function of our experimental variables. Therefore, we adopted the Investment Game as our "constituent game." Chapter 5 differs from the previous three empirical chapters, because we present analyses based on survey data instead of experimental data. Since these data do not include information on the behavior of the subjects, but only on their attitude towards each other, we adopt a different definition of trust in chapter 5.

1.3 Trust in embedded settings

1.3.1 Types of embeddedness

In the previous section, we reviewed definitions of trust and described the two formal representations of a trust problem that are most widely applied in experimental research on decision making in strategic interactions. Generally, we maintain that Ego's trusting decision depends on her subjective probability that Alter is trustworthy (Gambetta, 1988; Coleman, 1990: ch. 5). The assessment of this probability is based on what Ego knows about Alter's preferences and about the structure of the strategic interaction. In a one-shot Trust Game or Investment Game, Ego only knows the possible moves of the game and the payoffs that can be obtained. If it is assumed that Ego and Alter are only interested in their own welfare, Ego has no reason to expect Alter to be trustworthy. Thus, trust is never placed in equilibrium in the Trust Game and $M_1 = 0$ in the Investment Game. Does this imply that, according to standard game theory, trust cannot emerge? No, it only implies that, according to standard game theory, trust cannot emerge in situations in which all the assumptions specified above are met. More specifically, it implies that trust cannot emerge in isolated encounters between perfect strangers who meet only once and have that specific preference order for the payoffs of the game. However, this is clearly a rather extreme situation. In real life, most trust

[5] Rossi and Nock (1982) call this research method a *factorial survey.* We call it a vignette experiment, because our vignette was not included in a survey, but it was administered to a group of students recruited specifically for this purpose.

problems do not occur in isolated encounters, but in a context of *social embeddedness* (Granovetter, 1985; Raub, 1997; Raub and Weesie, 2000).

Two dimensions of embeddedness can be distinguished: first, Ego and Alter can have repeated interactions with each other, and, second, Ego can have relations with other actors. We refer to the first dimension as *dyadic* embeddedness and to the second as *network* embeddedness (Raub, 1997; Buskens, 2002; Buskens and Raub, 2002). Dyadic embeddedness refers to situations in which a relation between Ego and Alter pre-exists the specific trust problem, or to situations in which Ego and Alter are likely to be facing each other again after the trust problem is solved. Conversely, network embeddedness refers to situations in which there exists at least one third party (Tertius) who is connected to Ego by means of a relation allowing Tertius to provide Ego with information about Alter or about the kind of trust problem Ego is facing (hereafter, we refer to this as the focal trust problem), as well as to receive similar information about Alter or about the focal trust problem from Ego. Thus, in situations with dyadic or network embeddedness, more information is available to Ego to assess the probability that Alter is trustworthy. This additional information makes trust possible also in equilibrium in interactions resembling the Trust Game or the Investment Game.

There is considerable evidence that trust emerges more easily, or is more easily sustained in situations with dyadic (Larson, 1992; Gulati, 1995a, 1995b) and network embeddedness (Wechsberg, 1966; Lorenz, 1988; Uzzi, 1996, 1997; Gulati and Gargiulo, 1999). Thus, network embeddedness constitutes social capital for the actors, who, since social relations need to be created and maintained, have an incentive to invest in embedded relations (Flap, 2004). In general, existing research shows that trust increases with positive experience, but the mechanism through which social embeddedness promotes trust is often left unspecified. Raub and Buskens identify two types of mechanisms that account for the effects of dyadic and network embeddedness in trust situations: *control* and *learning* (Raub, 1997: 4-5; Buskens, 2002; Buskens and Raub, 2002; see also Yamagishi and Yamagishi, 1994: 138-139). Learning indicates the mechanism through which information about Alter's behavior in the past reaches Ego, either through dyadic embeddedness, because Ego herself has had previous interactions with Alter, or through network embeddedness, because Alter has had previous interactions with Tertius, who, in turn, can now inform Ego about his behavior. Control, on the other hand, refers to the possibility for Ego to sanction or reward Alter depending on his behavior. Through dyadic embeddedness, Ego can punish Alter for abusing trust by withholding trust in future interactions or reward Alter for honoring trust in the past

by placing trust in the future. Through network embeddedness, Ego can affect Alter's reputation by informing third parties of Alter's past behavior. The sanction potential through dyadic embeddedness depends on the likelihood of future encounters between Ego and Alter. The sanction potential through network embeddedness depends on the extent to which Ego is able to inform third parties about previous behavior of Alter, and on the likelihood of future trust problem occurring between Alter and third parties. If third parties are informed about Alter's behavior in a previous interaction with Ego, they can sanction or reward Alter by placing or withholding trust when a subsequent trust problem occurs between them and Alter (see Buskens and Weesie 2000a for a game-theoretic model about control effects through social networks and Buskens and Yamaguchi 1999, for a model of information diffusion in social networks). However, these models make rather restrictive assumptions on the content of the information that is available to Ego in embedded settings. For example, they typically assume that information concerning abuse of trust by Alter is transmitted to or from third parties. By contrast, this book also investigates trust problems in which information available to Ego is less specific. We now offer a typology describing the kinds of information that are covered in the following chapters.

1.3.2 Types of information available in embedded settings

A trust situation consists of three essential elements: the focal actor, *Ego*, who has to decide whether to place trust, a second actor, *Alter*, who – if trust is placed – can honor or abuse trust, and *the focal trust problem*, what Ego can trust Alter to do, which is formally defined by the incentive structure of the interaction between the two, e.g., Trust Game and Investment Game, (cf. Hardin, 2002: 9 on "trust as a three-part relation"). In embedded situations, relevant information for Ego to solve her trust problem can refer to the second and third element. It is useful for Ego to know more about Alter or about the focal trust problem that she has with him. However, this information can be more or less specific. For example, company Alpha in example 2 has information about company Beta through dyadic embeddedness, but this information does not refer to trust problems, but rather to other types of interaction, characterized by a different set of possible outcomes and relative preferences for these outcomes held by the actors involved. Conversely, in example 5 on online purchasing, Ego knows that this type of transaction is very common and usually successful, and she knows that other sellers have been trustworthy in interactions with other customers, but has no information about the seller from whom she wants to make a purchase.

The information Ego can have, through dyadic or network embeddedness, can vary on two dimensions (see table 1.1). First, concerning Ego's *partner* in the interaction, information can be either *Alter-specific* or *Alter-unspecific*. Alter-specific information refers to information about *Alter* himself, the very same actor with whom Ego is involved in the focal trust problem. Alter-specific information is available to Ego through dyadic embeddedness, for example, when Ego and Alter had trust problems in the past, or through network embeddedness, for example, when she has relations with other actors who have had a trust problem with Alter in the past. Conversely, if the information available to Ego is Alter-unspecific, it refers to a *different* trustee and not to Alter, Ego's partner in the focal trust problem. Ego could have Alter-unspecific information about trust problems involving a different trustee through dyadic embeddedness, for example, because she herself has had a trust problem with a different trustee in the past, or through network embeddedness, for example, because she has relations to other actors who have had a trust problem with another trustee in the past. Second, concerning the *type* of interaction in which Ego and Alter are involved, the information available to Ego through social embeddedness can be either *transaction-specific*, or *transaction-unspecific.* Transaction-specific information refers to information about a *similar* trust problem, whereas if information is transaction-unspecific, it refers to other interactions *different* from the focal trust problem. By a "similar" trust problem, we mean an interaction resembling a Trust Game or an Investment Game, and involving a risk of similar magnitude as the focal trust problem that Ego is having. Conversely, a "different" interaction could be an interaction that cannot be represented by the Trust Game or the Investment Game, or a trust problem with inverse roles, e.g., a trust problem in which Ego played in the role of Alter, or simply a trust problem with very different payoffs, e.g. a trust problem with a much larger or smaller risk for Ego. Therefore, looking simultaneously at the available information concerning both Ego's partner and the type of interaction, four situations are possible, as illustrated in table 1.1. The typology of information in socially embedded trust problems which we offer here is not intended to be exhaustive of all possible types of information that could be available to Ego. However, we present this classification in order to systematically describe the embedded settings that are discussed and analyzed in chapters 2 through 5.

Since information can originate either from dyadic or from network embeddedness, we discuss the content of the four cells of table 1.1 separately for the two types of embeddedness. Dyadic embeddedness refers to situations in which Ego and Alter have a common past or a common future. Therefore, we only discuss cells 1 and 3 for dyadic embeddedness. In

Table 1.1 Typology of information available to Ego in embedded settings

		Information about the transaction	
		Specific	Unspecific
Information about Alter	Specific	1	3
	Unspecific	2	4

principle, Ego's experience from previous trust problems involving a different trustee would fit in cell 2, and Ego's experience from previous interactions different from the focal trust problem and involving a different trustee would fit in cell 4. However, we consider situations with dyadic embeddedness only those interactions in which the information available to Ego originates from a common past or a common future between Ego and Alter. Cell 1 refers to the situations in which information available to Ego is both Alter-specific and transaction-specific. Therefore, cell 1 includes situations in which Ego had similar trust problems with Alter in the past, and situations in which Ego is likely to have similar trust problems with Alter in the future. A trust problem between Ego and her regular mechanic, as described in example 1, fits in this cell too. More precisely, in example 1, the situation in which Ego's car has a problem and Ego can go to a nearby (unknown) mechanic is compared to the situation in which Ego's car has a problem and Ego can go to her regular mechanic, who has already repaired Ego's car in the past and probably will do so again in the future. Thus, in the second situation in example 1, Ego faces an (embedded) trust problem in which she has both Alter-specific and transaction-specific information, like in the situation represented by cell 1 of table 1.1. Conversely, Ego has no information from dyadic embeddedness in the first situation described in example 1, and the trust problem resembles an isolated encounter.

Cell 3 refers to situations in which the information available to Ego is Alter-specific, but transaction-unspecific. This information refers to what Ego knows from other interactions, that are different from the trust problem that she has had with Alter in the past, or might have in the future.[6] In example 2, Alpha and Beta are two companies who have had repeated transactions in the past and are currently about to form an R&D alliance. Ego, the manager of Alpha, is afraid that company Beta might exploit the R&D alliance to acquire know-how from Alpha. Although no similar trust problem occurred between them in the past, the managers of

[6] In principle, cell 2 includes potential future interactions between Ego and Alter that differ from a trust problem. However, a systematic analysis of all situations in which this information could matter exceeds the aim of this book. Thus, we only analyze one case in which Ego and Alter have had previous interactions different from a trust problem. This is done in chapter 4.

Alpha and Beta know each other, because Beta has repeatedly bought components from Alpha. In the example, we maintain that these previous transactions do not involve any trust problems. We know that in real life such transactions typically do involve a certain degree of trust, because legal contracts hardly ever cover all possible contingencies in which a trust problem could actually arise (see Macaulay, 1963). However, an R&D cooperation involves disproportionally larger risks for the firm that has the most know-how, compared to a simple market transaction. Thus, in example 2, transaction-unspecific information is available to Ego through dyadic embeddedness. Such information could facilitate Alpha's decision to join Beta in an R&D alliance, helping her to solve the trust problem.

Now, we turn to network embeddedness and discuss again the four cells of figure 1.1, but focusing on information originating from Ego's social network. Cell 1 refers to Alter-specific and transaction-specific information. For network embeddedness, this cell concerns information about trust problems between third parties and Alter that occurred in the past, or potential trust problems between third parties and Alter that could occur in the future. The situation described in example 3, in which the ratings of all previous transactions completed by online sellers are available to Ego, fits in this cell. Thus, in example 3, the other customers who rated the dealer from whom Ego wants to buy a second-hand book provide Ego with information specifically about Alter, and probably about a similar trust problem. Similarly, in example 4, the number of cars left by other students to the parking-lot attendant suggests to Ego that many others trust Alter. Thus, also in this example Ego receives Alter-specific and transaction-specific information. However, examples 3 and 4 differ in one respect. While in example 3, previous customers explicitly rated Alter's trustworthiness, in example 4, Ego might assume that all students trust the parking-lot attendants, but she has no way to find out whether the parking-lot attendants ever abused trust. For example, Ego does not know whether any car was ever stolen from the parking lot because of the attendants' carelessness. This difference bears on the *content* of the information that Ego can access through social networks, namely whether Ego is informed about Alter's trustworthiness or only about the fact that others have trusted Alter. We postpone the discussion of this point to chapters 2 and 3, in which we discuss and test hypotheses based on this distinction.

In cell 2, the information available to Ego is transaction-specific, but Alter-unspecific. This cell captures the situation described in example 5. Particularly, in this example, Ego wants to buy a second-hand book through an online trader, but Alter, the only seller who has the book in store, is not rated. Therefore, in this situation, Ego only knows that many people buy second-hand books through online sellers; in fact some sellers have thousands of rated

transactions. However, Ego does not have any information about Alter, the seller who has the book Ego wants to buy.

In cell 3 Alter-specific, transaction-unspecific information is available to Ego through network embeddedness. This type of information is available to Ego in example 6 where Alter asks her to lend him some money to pay for his grocery. Ego knows that Alter is an old school mate of a good friend of hers. However, in the example, Ego does not know whether trust problems occurred between Alter and her friend in the past, nor does Ego know about the likelihood of future trust problems occurring between these two actors. The type of information represented by cell 3 of table 1.1 for network embeddedness could perhaps influence Ego's decision to trust Alter. However, this type of situation is treated only marginally in the empirical part of this book.

Finally, cell 4 concerns situations in which the information available to Ego is both Alter-unspecific and transaction-unspecific. In principle, Ego could possess a lot of information matching these characteristics. However, if this information does not relate to Alter, or to the transaction between Ego and Alter, it would presumably be mostly irrelevant to Ego's trust problem. Therefore, we do not discuss any examples for this type of information and neither do we analyze this type of information in the remainder of the book.

1.4 Uncertainty

In the technical literature on decision making, the term *uncertainty* has been used differently by different scholars. For example, according to Knight (1921), uncertainty refers to situations in which probabilities of alternative outcomes are unknown to the decision maker. In Harsanyi's (1977) terminology, if the *objective* probabilities associated with at least some of the possible outcomes resulting from the decision of an actor are not known to him, the actor faces a *decision under uncertainty* (Harsanyi, 1977: ch. 3). However, Harsanyi maintains that, in situations of decision under uncertainty, the actors can assess *subjective* probabilities for those events of which they do not know the objective probabilities. Furthermore, uncertainty can have different sources. Decisions under uncertainty can occur when the outcomes depend on natural events with unknown objective probabilities, such as an earthquake, or on the decisions of other agents, or on a combination of both. Hammond (1990: 281) refers to the first as *exogenous* uncertainty, and to the second as *endogenous* uncertainty. An example in which both exogenous and endogenous sources are present is a potential flood caused by extensive woodcutting and urbanization (endogenous decisions of economic agents) combined with extreme rainstorm (exogenous contingency).

In this book, we use the term uncertainty in a broad sense, including situations in which objective probabilities associated with some events are not known to the players, as well as situations in which some objective probabilities are known and covering both endogenous and exogenous sources of uncertainty. The settings characterized by decisions under uncertainty are of three different kinds:

1. Ego is uncertain about Alter's capabilities. Consider example 6 in which Ego is asked to lend money to someone who is practically a stranger. Lending this money will depend on Ego's subjective probability that this person is able to pay back the money. In chapter 2, we consider this type of subjective and endogenous uncertainty with respect to the extent to which a trusted stockbroker will be able to make a profit on the stock market with Ego's money.
2. Ego is uncertain about whether a negative outcome of a trust problem is caused by Alter's untrustworthy behavior or by possible external contingencies. In example 3, this corresponds to uncertainty about the possibility that a shipping company may lose a parcel sent by an online bookseller. Ego cannot observe whether the parcel was indeed lost by the shipping company or whether the parcel was not sent at all. In chapter 2, this type of exogenous uncertainty is considered in terms of external shocks of the stock market, independent of the behavior of a stockbroker. The probabilities of such uncertain shocks are subjective estimations made by Ego. In chapter 3, this type of uncertainty is implemented in an abstract experiment with the Investment Game, by choosing a *stochastic* multiplier m that is unknown to Ego and determines the amount of points Alter can divide between himself and Ego. In this experiment, objective probabilities for this multiplier are provided in the instructions.
3. Ego can be uncertain about Alter's preferences for specific outcomes, e.g., because Alter might have preferences for more equal outcomes (see Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). This creates endogenous uncertainty about the probability that Alters will behave trustworthily. Considering example 2, Ego, the manager of a car component supplier, might have obtained indications about the preferences of Alter, the manager of a car producer, from previous transactions with Alter that were not necessarily trust situations. This information could influence her behavior in subsequent trust problems, because her estimation of Alter's preferences for equal outcomes might have changed. In general, we assume that Ego has a subjective estimation of how likely it is that Alter has specific preferences. This

estimation is potentially important in chapters 2 through 5. However, as indicated above, we focus on other types of uncertainty in chapters 2 and 3 and do not address this type of uncertainty in these chapters. In chapter 4, we address this type of uncertainty specifically in a similar setting as in example 2: with transaction-unspecific information.

In chapter 5, a survey is discussed in which Ego and Alter are two employees of the same department in a hospital. Uncertainty is not measured directly in this survey, but the time two people have been working together in the department is used as an indicator for uncertainty. Clearly, we cannot distinguish between different types of endogenous uncertainty using this indicator, particularly not between the first and third type of uncertainty mentioned above.

We develop new hypotheses related to uncertainty and test them empirically. These new hypotheses will typically have the form of interaction effects between the extent to which Ego is uncertain and the information available to her. In order to test these hypotheses, we investigate empirically how different sources of uncertainty affect the relative importance that actors attach to information that is available to them through dyadic and network embeddedness.

1.5 Research questions and overview of the book

Having characterized the core features of the social situations we analyze in this book, the research questions can now be addressed specifically. As anticipated in the introduction, we focus on two research problems:

1. The effects of different types of information stemming from network embeddedness on the decision whether to place trust in a trust problem,
2. The extent to which these effects vary depending on uncertainty.

Each of the chapters 2 through 5 takes a different view on these two problems, focusing on different types of information and different forms of uncertainty, or adopting a different methodological approach. Therefore, in figure 1.3, we organize our research questions per chapter. Italics are used in order to underline the kinds of information that are treated in every chapter.

Figure 1.3 Research questions

Chapter 2:

2.1. What are the effects of *transaction-specific* and *Alter-specific* information from network embeddedness on Ego's decision whether to trust Alter?

2.2. What are the effects of *transaction-specific* and *Alter-unspecific* information from network embeddedness on Ego's decision whether to trust Alter?

2.3. How do the effects of *Alter-specific* and *Alter-unspecific* information from network embeddedness vary *under different uncertainty conditions*?

Chapter 3:

3.1. What are the effects of *transaction-specific* and *Alter-specific* information from both dyadic and network embeddedness on Ego's decision whether to trust Alter?

3.2. What are the effects of *transaction-specific* and *Alter-unspecific* information from both dyadic and network embeddedness on Ego's decision whether to trust Alter?

3.3. How do the effects of *Alter-specific* and *Alter-unspecific* information from both dyadic and network embeddedness vary *under different uncertainty conditions*?

Chapter 4:

4.1. What are the effects of *Alter-specific* and *transaction-unspecific* information from both dyadic and network embeddedness on Ego's decision whether to trust Alter?

Chapter 5:

5.1. What are the effects of *transaction-specific* and *Alter-specific* information from both dyadic and network embeddedness on Ego's decision whether to trust Alter in a setting in which networks are endogenous?

5.2. How do the effects of *Alter-specific* and *transaction-specific* information from network embeddedness on Ego's decision whether to trust Alter vary *under different uncertainty conditions*?

Chapters 2 and 3 deal with transaction-specific information stemming from network embeddedness. In chapter 2, the effects of Alter-specific and Alter-unspecific information are compared using a vignette experiment. In chapter 3, these effects are investigated using a laboratory experiment. Chapter 4 studies transaction-unspecific information originating from both dyadic and network embeddedness using a laboratory experiment. Concerning information about Alter, chapter 4 deals with Alter-specific information only. Finally, chapter 5 focuses on transaction-specific and Alter-specific information, while empirical analyses are conducted using longitudinal survey data. Table 1.2 summarizes which topics are treated in these four chapters.

Table 1.2 Overview of the topics of the empirical chapters

	Dyadic embeddedness		Network embeddedness				
	Information about the transaction		Information about the transaction		Information about Alter		
	Specific	Unspecific	Specific	Unspecific	Specific	Unspecific	Uncertainty
Chapter 2			X		X	X	X
Chapter 3	X		X		X	X	X
Chapter 4		X		X	X		
Chapter 5	X		X		X		X

"X" indicates that a particular effect is studied in a given chapter.

This book improves on existing literature studying the effects of social embeddedness on trust problems in several respects. First, previous literature focuses on Alter-specific and transaction-specific information. In fact, the information available to the actors in embedded situations generally refers to previous (similar) trust problems involving the same actor in the role of Alter (e.g., Camerer and Weigelt, 1988; Neral and Ochs, 1992; Gulati, 1995a, 1995b; Buskens, 2002; Bolton et al., 2004). By contrast, we also investigate situations in which Alter-unspecific and transaction-unspecific information is available to Ego, i.e. situations in which available information concerns different types of transactions or different actors in the role of Alter. Second, we identify relatively new types of information effects, such as the effects of imitation, and disentangle them both theoretically and empirically from other effects that have already been studied more extensively, such as learning effects. Third, while existing research focuses mostly on only one type of embeddedness, we also analyze the effects of information in situations characterized by both dyadic and network embeddedness.

In addition to the substantive points discussed above, we improve on existing research from a methodological point of view, because we apply three different but complementary research methods and use different types of data to test the same hypotheses. In fact, the data used for our empirical analyses were collected using a vignette experiment, two laboratory experiments, and a survey. Laboratory experiments are particularly suitable to test hypotheses about the effects of social mechanisms, because the relevant variables are controlled directly by the experimenter, leading to high internal validity. However, in laboratory experiments, the behavior of the subjects is observed in rather artificial settings. Therefore, it is often arguable to what extent empirical evidence from laboratory experiments generalizes to the real world. Conversely, evidence from survey data can be more easily generalized, but it is prone to other types of problems bearing on internal validity, such as measurement problems. Vignette

experiments using hypothetical choices in a contextualized setting lie somewhere in between laboratory experiments and surveys in terms of internal and external validity. By testing the same hypotheses using different methods, we improve both internal and external validity, and obtain information on the robustness of the results (Raub and Buskens, 2004).

In this chapter we do not discuss theories and hypotheses, because the empirical analyses that are presented in the following four chapters are based on different theories about the effects of information stemming from social embeddedness in trust problems and these are discussed separately in each of the following chapters. These four chapters differ with respect to the theories that are used to derive hypotheses, as well as with respect to the methodology applied both in data collection and in data analyses. In this book, no new theoretical model is developed, but we present and test new hypotheses based on existing models. We adopt an actor-oriented approach, in which trust is conceived broadly as incentive-guided behavior and we test hypotheses using complementary empirical methods such as a vignette experiment (in chapter 2), laboratory experiments (in chapters 3 and 4), and a survey (in chapter 5).

In chapter 2 we present a vignette experiment in which network parameters referring to the type of information available are varied, together with uncertainty about Alter and about possible contingencies affecting the payoffs of the trust problem. We introduce a distinction between the effects of *learning* and *imitation,* based on the information available to Ego from network embeddedness and we test hypotheses for these types of effects. Due to the framing of the vignette, this experiment focuses on the effects of network embeddedness and not on the effects of dyadic embeddedness.

Chapter 3 also addresses the effects of network embeddedness, but using a different methodological approach, namely a laboratory experiment in which small networks of Egos play a finitely repeated Investment Game with Alters and exchange information about the behavior of Alters in previous play. Moreover, the effects of information from dyadic embeddedness are also analyzed in this experiment. Thus, we study a situation in which various types of information are simultaneously available to the actors in a controlled environment.

Chapter 4 presents another laboratory experiment focusing on the effects of transaction-unspecific – but Alter-specific – information stemming from both dyadic and network embeddedness. In this experiment, subjects first negotiate the division of a resource pool under different network exchange conditions and subsequently play an Investment Game with one of the actors who were in the same exchange network in the first part of the experiment. In the first part of the experiment, the subject's bargaining power is varied by

manipulating the number of exchange partners available to every subject. Thus, the subjects participating in the experiment earn different amounts of points at the end of the first part of the experiment. In the second part of the experiment, the Investment Game is played twice by every actor, first in the role of Ego and then in the role of Alter. Moreover, this chapter does not focus only on Ego's behavior in the Investment Game but, unlike the other chapters, also contains an analysis of the effects of transaction-unspecific information on the behavior of Alter.

Chapter 5 differs substantially from the other chapters in two important respects. First, in order to gain insight in the robustness of our findings, we investigate some of the information effects analyzed in previous chapters using survey data instead of experimental data. Since our subjects answered a questionnaire but did not play any game, we do not analyze actual behavior in trust problems, as in the previous three chapters, but rather we focus on subjective reports about interpersonal trust relations at the dyadic level. Second, in all other chapters, the network of information exchanged is treated as exogenous. Available empirical evidence shows that, generally, embeddedness has positive effects (e.g., Wechsberg, 1966; Lorenz, 1988; Larson, 1992; Gulati, 1995a, 1995b; Uzzi, 1996, 1997; Gulati and Gargiulo, 1999). Therefore, since actors have incentives to form social networks (Flap, 2004), settings in which social networks are endogenous should be studied as well. In chapter 5, we make a step in this direction, releasing the assumption of exogenous networks. The data analyzed in chapter 5 are longitudinal data from a survey in a particular department of an organization, in which all relations of trust and communication between the actors are measured four different times, with intervals of three months between the measurements. Using these data, we analyze how trust relations are formed or dissolved depending on the information available to the actors through their relations with colleagues.

Finally, we summarize and discuss the results of our empirical analyses and their implications in chapter 6. Since chapters 2, 3, 4, and 5 have been written as independent articles, a certain extent of overlap between them as well as between chapter 1 and the remainder of the book could not be avoided.

Chapter 2

Imitation and Learning under Uncertainty: A Vignette Experiment*

Abstract

Existing theories regarding the effects of communication on trust problems stress the influence of information about the behavior of potential partners. The effects of *imitation* are less extensively elaborated in the literature. In this chapter, we develop a theory about imitation in combination with other network effects on trust. We propose a distinction between imitation and other types of learning, contrasting trustors who only know that other trustors have placed trust in a particular trustee in the past with trustors who also know that this trustee was in fact trustworthy. The theory predicts that both imitation and learning have an effect in trust situations and that these effects depend on trustors' uncertainties. We have designed a vignette experiment that enables us to distinguish between the effects of imitation and learning for different levels of uncertainty. The effects of learning *and* imitation on trust are empirically supported by the results of the experiment. However, there is only limited evidence that the effects depend on uncertainty.

* This chapter is co-authored with Vincent Buskens. A slightly different version is currently under review (Barrera and Buskens, 2005a).

2.1 Introduction

Imagine that you are relatively new in a firm in which projects are often carried out in small groups or pairs. You have recently been assigned to a project. You are responsible for the initial part of this project and you are dependent on a colleague's performance for the reward you will receive for the end product. If you suspect that your colleague may not do his fair share of the work for this project, you will prefer not to put too much effort into it yourself, because you will not get the credit you deserve for this effort anyway. If you trust that your colleague will work hard, you will be prepared to work hard yourself as well. The problem described above has the structure of a trust problem, as defined in chapter 1. Trust is clearly important for the focal actor's performance and, if this type of trust problem occurs regularly, for the performance of the firm as a whole. Costa et al. (2001; see also Costa, 2000) have already shown empirically that trust is related to team performances. Dirks (1999) provides experimental evidence for the relation between trust and performance, if at least team members are motivated to perform their tasks well.

Trusting colleagues is especially difficult for an employee who is new in a firm and is uncertain about what to expect from her colleagues. Such a person might be inclined to use additional control measures to make sure that the colleagues do their jobs properly. Alternatively, he or she might look at how other colleagues solve their trust problems and adapt her behavior accordingly, even if it is unclear whether the behavior of others is effective in terms of reaching mutually cooperative behavior. This brings us to the sociological angle on this topic, namely, how social networks affect trust in situations as described above.

The idea that social embeddedness promotes trust is well known and accepted in sociology (Granovetter, 1985). Existing theories address the importance of social networks and hypothesize effects of reputation (Raub and Weesie, 1990), learning, and control (Raub, 1997; Buskens, 2002; Buskens and Raub, 2002), and gossip (Burt and Knez, 1995; Burt, 2001). Nevertheless, these theories do not account for all network mechanisms that affect individual decisions in trust problems. Particularly, we believe that the effects of *imitation* on trust problems are largely neglected. With the term "imitation" we refer to situations in which actors facing a trust problem base their decision upon the behavior of other trustors in similar conditions. If several other trustors trust a certain trustee, their behavior can be perceived as a signal that trust can be placed safely, even though it is unknown whether this trustee honors trust. In other words, individuals sometimes decide to trust somebody just because they see others doing so. Imitative behavior is traditionally considered a form of social learning that plays an important role in the socialization process (see, for example, Bandura and Walters,

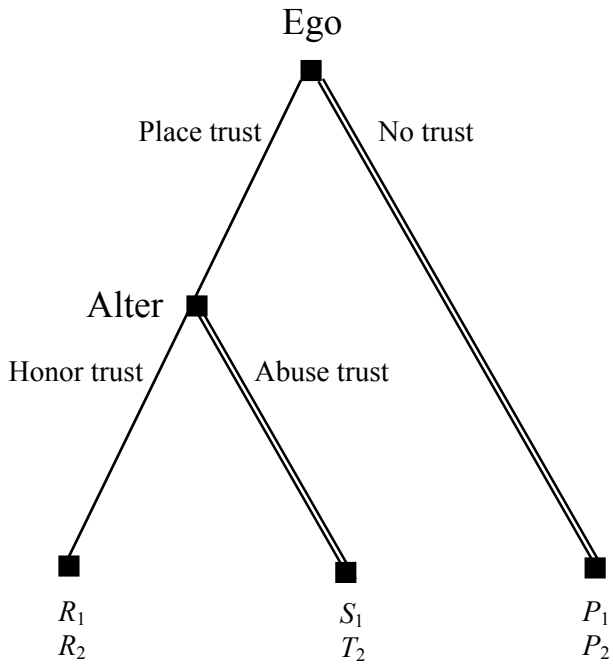
1963: ch. 2). Imitation might be chosen if it is seen as the most convenient way to arrive at a better decision, especially when accurate information is not readily available, and, in this specific sense, imitation can be viewed as a sensible and even rational type of behavior (see Hedström, 1998 on "rational imitation"). This does not exclude the possibility of imitation having perverse effects. If actors realize that their partners' best option is to base their decision on the behavior of similar others, without knowing the outcomes of these actors' behavior, there will be more room for opportunistic behavior than in situations where outcomes are observable. This chapter studies imitation and other types of learning in trust problems. Empirical evidence for the importance of imitation is provided by means of a vignette experiment that tests hypotheses about imitation and other types of learning under various conditions.

A more precise definition of trust problems from our point of view is given below. In line with Coleman (1990: ch. 5), we regard trust problems as interactions involving two interdependent actors with the following properties:

1. The opportunity for one actor (*Ego*) to place some resources at the disposal of another actor (*Alter*) who has the option to either honor or abuse trust.
2. A structure of preferences in which Ego prefers to place trust if Alter is trustworthy, but regrets placing trust if Alter is untrustworthy; while for Alter abusing trust is preferred over honoring it, but honoring trust is preferred over a situation in which trust is not placed at all.
3. There is no formal guarantee that protects Ego from the possibility of Alter abusing trust.
4. There is a time lag between Egos' decision and Alters' action. The strategic risk is caused either by these "time asymmetries" (Coleman, 1990: 91) between Ego and Alter's decisions, by information asymmetries concerning the object of the transaction (Kollock, 1994), or more generally, by the actors' interdependence (Raub and Weesie, 2000).

In game-theoretic terms, a simple trust problem between a pair of actors can be represented in the extensive form displayed in figure 2.1, which is also known as the *Trust Game* (TG; Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990). This formalization captures the essential features of the problem. The game begins with a move by Ego who has a choice between trusting and not trusting Alter. If Ego withholds trust, the game ends. In this

Figure 2.1 Trust Game ($R_1 > P_1 > S_1$; $T_2 > R_2 > P_2$)



case, Ego receives P_1 and Alter receives P_2. If Ego chooses to place trust, Alter has the possibility to honor or abuse trust. If Alter honors trust, he obtains $R_2 > P_2$ and Ego obtains $R_1 > P_1$, while if he abuses trust Alter receives $T_2 > R_2$ and Ego is left with $S_1 < P_1$. This game can be viewed as a one-sided version of the well-known prisoner's dilemma. The standard game-theoretic prediction is that Ego will not place trust in a one-shot TG. If Ego were to place trust, Alter would abuse it because $T_2 > R_2$. Consequently, Ego, knowing the payoff structure, should withhold trust because $P_1 > S_1$. "No trust" and "abuse" are equilibrium choices (in figure 2.1 this is represented by double lines). The payoffs in equilibrium are therefore P_1 and P_2. This outcome is sub-optimal, because both actors would prefer the payoffs yielded in the situation in which trust is placed and honored, R_1 and R_2.

This formalization of the TG resembles an isolated encounter between two isolated actors. But a single encounter between two actors is insufficient to account for the complexity of human transactions. Transactions between pairs of actors are often embedded in a complex system of social relations (Granovetter, 1985), which promotes trust by reducing the risk derived from interdependence (Raub and Weesie, 2000). In addition, actors are seldom perfectly informed about the incentives of the other actor. There might be uncertainty on, for example, whether or not the other actor is actually able to perform his or her part of the job well enough, even when he or she genuinely tries.

In section 2.2, we elaborate on the distinction between imitation and learning. We present theoretical arguments about mechanisms through which embeddedness affects trust under uncertainty. From section 2.3 on, this chapter presents a vignette experiment that provides evidence of network effects in a specific trust problem. The experiment is designed to define specific conditions, such as uncertainty, that could facilitate imitative behavior. Section 2.3 describes the experimental setup and the methods of analysis. Section 2.4 presents the results of the empirical analysis. Section 2.5 concludes and identifies possibilities for future research.

2.2 Theory and hypotheses

First, we introduce another example of a trust problem. This example provides a frame for the theoretical model as well as a suitable scenario for the experiment (see appendix A). Imagine a student (Ego) who has an idea for starting an e-business. The investment requires an initial capital of about €5000, but Ego only has €3000. Within her year group there is a student (Alter) who is a stockbroker. Alter is known for making money by investing small amounts on the stock market. Alter suggests to Ego that she invest her money in the stock market in order to obtain the capital for the e-business. In exchange, Alter asks for 10% of the profit, but he will not share the losses if the investment fails. Since Ego does not have the competence to invest alone, Alter has the possibility to lie about the outcome of the investment and keep (part of) the profit he made for himself. This scenario displays all essential features of a trust problem as defined in section 2.1. Ego prefers to invest her money if Alter is trustworthy, but to keep the money and renounce the idea of an e-business if Alter is untrustworthy. Alter, on the other hand, realizes he has a greater chance of gaining a profit by abusing trust, but prefers honoring trust to the situation in which trust is not placed. The scenario has two additional desirable characteristics. First, the stock market accounts for the type of uncertainty that we are trying to model and, second, it is realistic enough to use as a frame for the experiment.

Now, we elaborate on the importance of embeddedness for trust. Note that these theoretical arguments are not restricted to trust problems in teams within organizations, but generalize to a variety of trust problems including, e.g., alliance formation among firms and buyer-supplier relations (cf. Buskens et al., 2003). We elaborate on the validity of the experimental test for different applications in section 2.5.

We distinguish two dimensions of embeddedness: first, Ego and Alter can face similar trust problems repeatedly, and, second, Ego can have relations with other actors who have had or who have similar trust problems involving Alter (for a more general discussion of this issue

see also Raub and Weesie, 2000). We refer to the first dimension as *dyadic* embeddedness and to the second as *network* embeddedness. Dyadic embeddedness can enforce cooperation, casting a shadow on the future that discourages opportunistic behavior (Axelrod, 1984), or it can lead to actors trusting each other more easily, if they have a history of past cooperative relations (Gautschi, 2000). Network embeddedness represents the possibility that actors are not only involved in bilateral transactions, but also have contacts with third parties. Information about actors' trustworthiness circulates in the network, determining the emergence of reputation (Raub and Weesie, 1990). Buskens and Raub (2002) distinguish two mechanisms through which dyadic and network embeddedness induce cooperation: *learning* and *control*. Learning refers to changes in Ego's trust in Alter depending on information about Alter's past performances, either from Ego's own experiences or from third-party experiences. Learning effects are stronger for networks where information circulates faster (see Buskens and Yamaguchi, 1999; Buskens, 2002, ch. 4). Clearly, Ego's trust increases if the information about Alter is positive, and decreases if this information is negative. Control is based on Alter's anticipation of future sanctions for the abuse of trust (see Buskens and Weesie, 2000a for a game-theoretic model about control effects through social networks).[1] The larger the potential sanctions for Alter if Ego no longer trusts Alter or if Ego damages Alter's reputation by informing third parties about an abuse of trust, the less likely Alter will abuse trust. As a result of this control mechanism, Ego is better able to trust Alter if her sanction potential is larger after a possible abuse of trust by Alter.

In this chapter we elaborate on the framework mentioned above by adding imitation as a third mechanism. In order to study the role of imitation in supporting trust and compare this with learning, we first elaborate on some existing theories with respect to learning. Learning mechanisms have been studied and modeled by several scholars. Actors adapt their choices depending on the information they receive that is relevant for the decision they have to make. This information can either be obtained through one's own experience or from the experiences of others who have had to make similar decisions. In such models, actors look to past experiences and repeat choices that proved to be successful (Macy, 1990), or they update their behavior after observing the (or a sample of) choices made by others and the outcomes they obtained (e.g., Ellison and Fudenberg, 1995; Erev and Roth, 1998).

Some of the economics scholars who developed these learning models (Pingle, 1995;

[1] We use a rather restrictive definition of control here, namely, the extent to which the long-term relation between Ego and Alter can be expected to affect Alter's behavior. Control is often defined more generally in terms of processes through which Ego can affect Alter's behavior (e.g., Das and Teng, 1998).

Pingle and Day, 1996; Schlag, 1998) use the label "imitation" for models in which individuals make decisions after having received information about the outcomes obtained by others and comparing them by employing some efficiency criteria. Yet, there are situations in which these learning models do not apply. For instance, if actors are able to observe other people's behavior, but not their payoffs, the existing models cannot predict the effects this kind of information has on Ego's behavior. This type of decision problem has been largely neglected in the literature.

It is precisely this type of decision with respect to trust problems that we focus on here. As in chapter 1, we use the label "learning" for any decision based on information that *includes* the outcomes of a given transaction. The term "imitation" is restricted to situations in which individuals base their decisions on the behavior of others who are in a similar position as Ego – e.g., they are also trustors – *without* having any information about the outcomes obtained by these others. This definition is inspired by psychological definitions of imitation (see Byrne and Russon, 1998, on some of the definitional controversies within psychology) that focus on copying behavior, but explicitly exclude a reinforcement argument, namely, that the behavior is copied *because* it leads to desirable results.

Moreover, Ego might observe the behavior of third parties in relation with other third parties and base her decision on this information. To distinguish clearly between these different types of third parties, we introduce the label "Other Egos" for third parties who have had transactions in a similar role as Ego, i.e., they have also needed to decide whether or not to trust another actor. We use the label "Other Alters" to refer to third parties that have played a similar role as Alter and in whom Other Egos have had to decide whether to place their trust or not.

Situations in which actors observe the behavior of others and then choose a strategy are not difficult to imagine, but neither are situations in which information regarding choices made by other individuals is not sufficient. When deciding whether to trust a colleague on a collaborative effort, actors can take into account how many other people have trusted this particular colleague. When deciding whether to confide in somebody about personal problems, actors presumably consider the number of other people that have confided in him irrelevant, especially in cases where it cannot be observed whether the confidant was faithful. Hence, it is plausible that certain *conditions* facilitate imitation in trust problems and others hinder it. Generally speaking, we might expect imitation to preferably take place in relatively unfamiliar situations (cf. Podolny, 1993, 2001; Pingle, 1995) and in situations in which an eventual abuse of trust is not "life-threatening."

More precisely, we expect imitation as well as learning to be associated with uncertainty (cf. Podolny, 2001). We claim that individuals facing trust problems in which they are uncertain about the possible outcomes will imitate others, especially when adaptive learning is difficult and no better information is available (cf. Nooteboom, 2002: 5-8). In the example of the student who lets a fellow student invest her money in the stock market, we distinguish two types of uncertainty:

> **Partner uncertainty** is Ego's uncertainty about Alter's capability to obtain a good outcome for Ego even if Alter tries to act trustworthy.

> **Market uncertainty** is Egos' uncertainty that Alter will reach a good profit even if Alter tries to act trustworthy *and* he is able to do so.

The first type of uncertainty refers to Alter's competence as a stockbroker. The second type of uncertainty refers to the situation in which Alter is losing Ego's money due to unforeseeable market circumstances. Even if Alter is competent, the investment can still go wrong and Ego can still end up loosing her money. If her investment ends up falling through, Ego will not know the cause of her misfortune, because she is unable to distinguish between actual untrustworthy behavior, unintended sub-optimal investments, or unforeseeable circumstances.

Given that Ego is uncertain about Alter's competence as a stockbroker, but also about the functioning of the market as a whole, it is not only important for her to have had good experiences with Alter herself, but also to know that Other Egos have good experiences with Alter, and even to know that Other Alters are doing well because this indicates that it is possible to make a good profit with stock market investments. Even if there is no information about the actual outcomes of investments made by other people, it is reassuring to know that Other Egos are involved in similar types of transactions. This leads to the following set of testable hypotheses about the effects of learning and imitation.

> **Hypothesis 2.1 (dyadic learning)** The more positive experiences Ego has had with Alter or Other Alters, the more trustful Ego is.

> **Hypothesis 2.2 (partner uncertainty)** The more positive information Ego has about Alter's competence, the more trustful Ego is.

Hypothesis 2.3 (network learning) The more information Ego has received from Other Egos that Alter or Other Alters were trustworthy in past transactions , the more trustful Ego is.

Hypothesis 2.4 (imitation) The more Ego knows that Other Egos trusted Alter or Other Alters, the more trustful Ego is.

Clearly, we expect negative effects on trust if Ego has negative experiences or receives negative information, but we do not test these hypotheses in the vignette experiment discussed below.

Other studies have examined variables for dyadic embeddedness (Buskens, 2002; Gautschi, 2000). These variables represented the history of the relation between the two focal actors and the effects of these variables were as expected. However, in this experiment we do not examine the case in which Ego and Alter have a common past. We expect that, consistent with the earlier findings, Ego's own common past with Alter has such a strong effect that it obscures the network effects on which this chapter focuses. For example, if Ego has already made stock market investments with Alter, it is not necessary for her to learn from the network or to imitate Other Egos, as her own experience is basis enough for grounded choices. In an experiment as the one described below, it is always preferable to restrict the number of variables that are manipulated. Therefore, we do not test hypothesis 1 here. In addition to the decision to focus mainly on network effects we consequently do not test the hypothesis on dyadic learning about Other Alters either.

Network learning involves more complete information about Alter's transactions than imitation does, thus we expect learning effects to be larger than imitation effects both when information regards Alter and when it regards Other Alters.

Hypothesis 2.5 (learning versus imitation) The effect of learning about the trustworthiness of Alter (or Other Alters) is stronger than the effect of imitating trust in Alter (or Other Alters).

As explained in the theory, we expect information to be of more importance if uncertainty is larger, i.e., (1) if the uncertainty about Alter's competence is larger, information about Alter is more important and (2) if Ego has less knowledge about the market, all information about Other Ego's interactions with Alter as well as with Other Alters is more important.

Hypothesis 2.6 The effects of information about Alter's trustworthiness and Other Egos' trust in Alter are larger if the uncertainty about Alter's competence is larger.

Hypothesis 2.7 All effects of network learning and imitation are larger if Ego has less knowledge about the market.

Furthermore, we provide a test for control effects in this experiment. As indicated above, the existence of a common future creates sanction possibilities for Ego after an abuse of trust. Moreover, the faster Ego can inform third parties about an abuse of trust by Alter, the larger Alter's loss will be after an abuse of trust, and thus the less likely it is that Alter will abuse trust. Hypotheses on control effects have been tested in another vignette experiment (Buskens and Weesie, 2000b), but the framing of this experiment exposed the results to some criticism concerning the interpretation of the variables operationalizing control effects. In the present design we try to avoid similar criticism by using a frame in which the effective social network is better defined. The student's year group provides a specific network in which each member presumably knows all other members. Therefore, the following two hypotheses on control effects closely resemble the analogous hypotheses presented in the Buskens and Weesie (2000b) experiment, but the operationalizations adopted here give less room to alternative interpretations of the effects.

Hypothesis 2.8 (dyadic control) The more transactions Ego and Alter expect to have in the future, the more trustful Ego is.

Hypothesis 2.9 (network control) The more Ego is able to inform Other Egos and the denser the network among Egos, the more trustful Ego is.

2.3 Method

Imitation as a mechanism for actors to solve trust problems is not easily observable in real life, because it relies on mental processes that are intrinsically difficult to observe. Although there is some empirical evidence of *mimetic trust* from "real life" data (Wittek, 2001), experimental data are more suitable, because they reproduce simple situations in which actors are required to make choices given little – but well specified – information about a choice

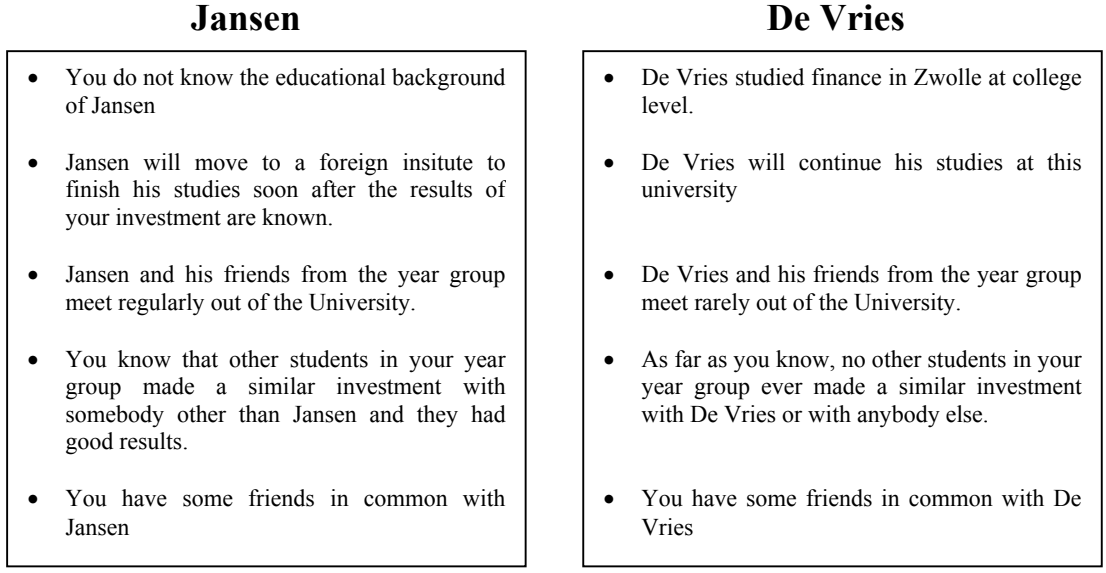
situation. Precisely for this reason we realize a vignette experiment in which we vary the kinds of information that distinguish imitation from other types of learning. Vignettes are simple descriptions that sketch hypothetical situations reproducing real-life problems. Respondents are selected voluntarily and are asked to imagine how they would solve the dilemma that is depicted in the vignette. Rossi and his colleagues introduced vignette experiments in sociology in the 70s (for an overview of their research see Rossi and Nock, 1982). Recently, vignette experiments have been applied to study economic transactions (Buskens and Weesie, 2000b; Rooks et al., 2000). We opted for a design similar to that applied by Buskens and Weesie. In their experiments they presented pairs of vignettes with different characteristics to respondents and asked them to give a simple preference for one vignette out of each pair. This is known as the method of paired comparison. Assuming that subjects find it easier to express a preference for a vignette when presented with a choice of two rather than to rate several vignettes according to their preferences, we expect choices with paired comparison to be easier for the subjects and to provide more realistic results, especially when differences between options are rather subtle.

2.3.1 The scenario

A vignette experiment typically begins with a scenario that provides the "frame" for the actor's decision. Subsequently, the actor evaluates a series of vignettes in which crucial information is varied. The scenario is intended to reproduce a trust situation in which actors make choices under uncertainty. The independent variables of the vignettes are intended to include information, providing room for learning and imitative behavior. In our scenario, Ego is a student and Egos' year group provides network embeddedness. The experimental network is imaginary, but it refers to an existing group to which Ego belongs, which provides her with a realistic and effective network of informants. It should be relatively easy for subjects to imagine themselves in the hypothetical situation, because the subjects are students of a Dutch university and members of a year group.

In the experiment, it is hypothesized that Ego needs money to set up an e-business and it is important that she realizes this investment quickly so that she does not miss the opportunity. Alter is a schoolmate of Ego and is a stockbroker. Alter is willing to help Ego invest her savings on the stock market in exchange for 10% of the potential profits. The trust problem arises from asymmetry in the information available to Ego and Alter: Alter knows the probability of realizing the profit. Moreover, assuming that Ego is unable to monitor the profits, Alter has an incentive to claim that the investment was unsuccessful while it actually

Figure 2.2 A pair of vignettes.



was successful, making more profit for himself, since he does not have to share the potential losses. Some details are emphasized in the instructions to make the story more concrete: Ego wants to conclude the business as quickly as possible; she needs €5000 as initial capital and she only has €3000; a loan from her parents or from a bank is not an available option. We decided to use the example of the stock market in the experiment for two reasons. First, the stock market accounts in a credible way for the possibility that the transaction will yield a negative outcome for Ego, even if Alter intends to perform well. Second, the scenario was particularly realistic for the students who participated in the experiment because they were studying IT management and economics. According to their professor, they were expected to have a certain familiarity with the type of problems described in the experiment, because the students had had to think about initiating an IT investment for one of the assignments given in the course in which this experiment was done. Note also that investments on the stock market were still very fashionable at the time this experiment was done, in the spring of 2001. The English translation of the text that was presented to the students as the "scenario" and the "task" can be found in appendix A.

Vignettes are presented to the subjects in pairs and vary with respect to key characteristics of embeddedness and uncertainty. In order to make the comparison easier, the

vignettes are presented as referring to two different Alters with different characteristics.[2] The subjects are furthermore told that there are two fellow students in their year group that are known as expert stock brokers (Jansen and De Vries).[3] This expedient only serves the purpose of facilitating the imaginary choice for the subjects associating the characteristics to two different persons.[4] Figure 2.2 presents an example of a pair of vignettes between which the actors had to choose.

2.3.2 Independent variables

The independent variables are the characteristics that are listed in the vignettes. We assume that the subjects choose according to the utility they associate with each vignette. The characteristics that are varied in the vignettes should refer to those aspects of a trust problem that are indeed relevant for an actor's decision in similar situations. Six characteristics are varied: three for network embeddedness, (information available to Ego, OUTDEGREE, and DENSITY), one for dyadic embeddedness (FUTURE), one for uncertainty (PARTNER UNCERTAINTY), and one for the city where Alter studied finance (CITY). Table 2.1 shows the specific formulations of all vignette variables.

PARTNER UNCERTAINTY represents uncertainty about Alter's ability to honor trust. Assuming that education in finance increases one's competence regarding the stock market, this variable is operationalized as previous formal education in finance, with two categories: previous education in finance versus no information about previous education. The temptation for Alter to abuse trust decreases if his competence increases. In addition, Ego will be more uncertain about Alter if she has no information about his competence, and less uncertain if she knows that Alter has had an education in finance. PARTNER UNCERTAINTY takes the value 1 when no information is provided about Alter's previous education, and 0 when Alter has had a formal education in finance. The category 0 is split into two sub-categories that vary with respect to the city where Alter got his degree. This supplementary variation refers to a different variable, CITY, that is discussed next. We decided to incorporate the variable CITY into PARTNER UNCERTAINTY in order to reduce the total number of character descriptions in

[2] This setting does not allow for an "exit" option. We are only interested in which Alter the subjects prefers; we do not know whether the subjects consider either of the two subjects a reasonable option for such a transaction at all.

[3] Jansen and De Vries are two of the most common Dutch surnames; we expect no preference for one or the other name.

[4] Some of the characteristics (such as the variables concerning the type of information available to Ego) do not refer specifically to a person, but more generally to a situation, nonetheless we have no reason to expect subjects to evaluate this information incorrectly.

Table 2.1 Description of the variables in the vignette experiment

Variable	Value	Text
PARTNER UNCERTAINTY	0	Jansen (De Vries) studied finance in Zwolle (or Den Bosch) at college level.
	1	You do not know the educational background of Jansen (De Vries).
CITY	0	Jansen (De Vries) studied finance in Zwolle at college level.
	1	Jansen (De Vries) studied finance in Den Bosch at college level.
FUTURE	0	Jansen (De Vries) will move to a foreign institute to finish his studies soon after the results of your investment are known.
	1	Jansen (De Vries) will continue his studies at this university.
DENSITY	0	Jansen (De Vries) and his friends from the year group meet rarely out of the University.
	1	Jansen (De Vries) and his friends from the year group meet regularly out of the University.
NO INFORMATION	0	As far as you know, no other students in your year group ever made similar investment with Jansen (De Vries) or with anybody else.
OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	1	You know that other students in your year group made a similar investment with somebody else than Jansen (De Vries) but you do not know the outcome.
TRUSTWORTHINESS OF OTHER ALTERS	2	You know that other students in your year group made a similar investment with somebody other than Jansen (De Vries) and they had good results.
OTHER EGOS' TRUSTFULNESS VS. ALTER	3	You know that other students in your year group made a similar investment with Jansen (De Vries) but you do not know the outcome.
TRUSTWORTHINESS OF ALTER	4	You know that other students in your year group made similar investment with Jansen (De Vries) and they had good results.
OUTDEGREE	0	You do not have any friends in common with Jansen (De Vries).
	1	You have some friends in common with Jansen (De Vries).

the vignettes.

CITY varies with respect to the city where Alter obtained his degree in finance. One objection to an experimental set-up as the one we propose here is that variation in any variable produces significant effects on the dependent variable, because subjects react in some way consistent with the variations implemented by the experimenter. In order to challenge this criticism, we decided to include an "irrelevant" variable in the design to test whether this variable produces any effect on the subjects' choices. We opted for the city where the partner attended high school, because it seems reasonable to assume that such a variable should not have any effect. The two towns (Zwolle and Den Bosch) are two middle-size, relatively anonymous Dutch towns and we are not aware of any significant difference in the quality of their programs; hence we do not expect any preference for one or the other.

FUTURE indicates whether Ego and Alter have a common future. It takes the value 0 if Alter is going to be leaving the university soon after his transaction with Ego and 1 if Alter is not planning to leave in the near future. FUTURE is a variable of dyadic embeddedness that induces control effects (Buskens, 2002). The "shadow of the future" (Axelrod, 1984) provides

Ego with opportunities to sanction Alter in case her trust is abused. Even if it is less plausible that Alter and Ego will have more similar transactions in the future, other forms of control, for example, through social sanctions are plausible in the given context. In the Buskens and Weesie (2000b) experiment, this variable took the value 0 if *Ego* was going to leave soon. This formulation, however, was somewhat more problematic; the assumption that Alter knows that Ego is about to leave, for instance, is not realistic in this scenario. Nevertheless this assumption is necessary for potential sanctions to be effective.

DENSITY indicates the closure of the common network. DENSITY takes the value 1 if Alter and the other members of the year group meet regularly outside the university, while DENSITY equals 0 if they seldom meet. DENSITY induces both control and learning effects, because information spreads quicker in a denser network, allowing actors to learn about each other and also to sanction abuse of trust.

Other Egos provide Ego with information about Alter's competence or about the population of potential Alters. The actors that can provide this information to Ego are Other Egos who have been involved in similar trust problems with Alter or with Other Alters. This information allows Ego to learn or imitate. The related variable has five categories, in accordance with the different types of information provided (table 2.1). The categories are transformed into four dummy variables in the analysis, with "no information" as the reference category. Category 4 provides Ego with information about Alter's trustworthiness (TRUSTWORTHINESS OF ALTER): Ego knows that Other Egos made the same type of investment with Alter and were successful. In this case, the information is specifically about the behavior of Ego's partner. The formulation is very similar to the one used in previous experiments (Buskens and Weesie, 2000b). Category 3 regards Alter, but the information is less specific. Category 3 provides Ego with information about the trustfulness of Other Egos versus Alter (OTHER EGOS' TRUSTFULNESS VS. ALTER): Ego knows Other Egos made the same type of investment with Alter, but she does not know whether these investments were successful or not. The information provided here informs Ego about the extent to which Other Egos trusted Alter in similar trust problems. A decision based on this type of information leads Ego to imitate Other Egos. In category 2 and 1, the information regards the same type of trust problem, but involving Other Alters. Category 2 provides Ego with information about the trustworthiness of Other Alters (TRUSTWORTHINESS OF OTHER ALTERS): Ego knows that Other Egos made the same deal with a third party other than Alter and that the investment was successful. There is a different partner involved, but the trust problem is exactly the same. Ego can learn, from this information, how often this type of transaction had been successful,

in general. Category 1 provides Ego with information about the trustfulness of Other Egos versus Other Alters (OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS): Ego knows that Other Egos made the same type of investments with other partners, but she does not know whether these investments were successful. In other words, Ego is informed about the extent to which other people make this type of investments through a partner. As for category 3, the effect of this type of information on Ego's decision is an effect of imitation. Category 0 refers to the situation in which Ego has no available information from the network about this trust problem with the same or a different partner. In summary, the information available to Ego presented in the four descriptions in the vignettes varies along two dimensions: first, Ego receives information about transactions involving the same partner or different partners; second, information includes or does not include the outcomes of these transactions.

OUTDEGREE refers to common acquaintances in the network. This variable takes value 1 if Ego has a number of mutual friends in common with Alter and value 0 if Ego has no friend in common with Alter. As for FUTURE, OUTDEGREE mainly induces control effects; in fact Ego has the opportunity to sanction Alter by damaging his reputation with their common friends. As for FUTURE, this operationalization is more satisfactory than the one proposed by Buskens and Weesie (2000b). It refers to friends within a well-defined network, which makes it plausible to assume that Alter is concerned about the consequences of his behavior in the transaction with Ego for his reputation in the year group.

2.3.3 Individual characteristics

Although there is extensive evidence in the literature of how actors' characteristics correlate with trust (see Snijders, 1996, for a review), in isolated trust problems, payoffs are more important than individual characteristics. Because we apply paired comparison, subject characteristics do not vary within these choices, and there is no reason to expect subjects to prefer "De Vries" to "Jansen" or the other way round. Therefore, individual characteristics can only matter in the sense that some subjects find it more important to know that Alter performed well in the past with Other Egos, while other subjects find it more important that Alter is not planning to leave the country soon after the transaction. This implies that subject characteristic can only have an effect in interactions with the independent variables in the vignettes. The only subject characteristic for which we derive such hypotheses in the theory section is *stock market knowledge*. Nevertheless, to exclude other possible differences between subjects, we included a small questionnaire at the end of the experiment to make sure that choices were not influenced by these individual characteristics.

If Ego has some knowledge about the stock market, she can reasonably estimate the risk connected with the described investment, and uncertainty will then mainly be related to Alter's ability to succeed in the stock market. In order to estimate Ego's knowledge, subjects were asked how familiar they were with the stock market and whether they were able to operate on the stock market themselves. Answers were given on a four-point scale (0 = not familiar at all; 1 = some basic knowledge, but not familiar; 2 = some information but do not know how to operate; 3 = familiar enough to invest on the stock market). Other questions about expertise on economic issues regard frequency of reading economic newspapers and economics pages and educational background in economics (Yes / No). As the subjects' expertise on economic issues is crucial for our hypotheses, it seemed preferable to also have some more "objective" measures for this expertise. Therefore, subjects were asked to estimate the value of the AEX (Amsterdam Exchange Index), the Dow Jones, and the exchange rate of US Dollar/Dutch Guilder on the day before the experiment, and the highest value during the last 12 months for all three indices. In addition, they were asked how sure they were about each of these estimates). Subjects were also asked to rank the following types of economic investment by "risk": shares, options, bonds, and stock options. On average, subjects were not very knowledgeable about most of the issues mentioned above. However, we tried to construct an index for stock market knowledge using different combinations of these variables, and eventually we opted for the solution that seemed to summarize this information most accurately. We ran a factor analysis, using principal axis factoring, of the following variables: self-assessment of familiarity with the stock market, self-confidence with the answers about estimates of indices such as the AEX and the Dow Jones, actual errors in these estimates, and the correctness of the answers to the rank of investments by risk. The results indicate that the answers to this set of questions are better explained by a one-factor solution, the eigenvalues of the first two factors being 3.405 and 0.541, respectively. Therefore, the standardized score of the first factor obtained with this analysis was used as an index of stock market knowledge (KNOWLEDGE).[5]

We now describe the other subject characteristics in the questionnaire. The *Personal characteristics* are age, sex, and size of the place of residence. *Birthplace* and *place of residence* are included because the preference for the city in which Alter studied finance might be affected by Ego's birthplace or place of residence. *Religious affiliation* was included

[5] In order to have all cases included in our analysis, missing values of the factor score were imputed with the best possible prediction from the data available for the variables that were used to construct the factor score by using the command impute in Stata 8.2 (Stata Corporation, 2003a: 120-125).

Table 2.2 Hypotheses on attractiveness of a vignette

Hyp.	Independent variable	Expected sign of the coefficient
2.2	PARTNER UNCERTAINTY	−
2.3	TRUSTWORTHINESS OF ALTER	+
2.3	TRUSTWORTHINESS OF OTHER ALTERS	+
2.4	OTHER EGOS' TRUSTFULNESS VS. ALTER	+
2.4	OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	+
2.5	TRUSTWORTHINESS OF ALTER > OTHER EGOS' TRUSTFULNESS VS. ALTER	
2.5	TRUSTWORTHINESS OF OTHER ALTERS > OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	
2.6	PARTNER UNCERTAINTY x TRUSTWORTHINESS OF ALTER	+
2.6	PARTNER UNCERTAINTY x OTHER EGOS' TRUSTFULNESS VS. ALTER	+
2.7	KNOWLEDGE x TRUSTWORTHINESS OF ALTER	−
2.7	KNOWLEDGE x TRUSTWORTHINESS OF OTHER ALTERS	−
2.7	KNOWLEDGE x OTHER EGOS' TRUSTFULNESS VS. ALTER	−
2.7	KNOWLEDGE x OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	−
2.8	FUTURE	+
2.9	OUTDEGREE	+
2.9	DENSITY	+
	CITY	0

the last 3 months; how often did you join them?). Finally, *risk aversion* is measured to test whether risk averse subjects consider some aspects of embeddedness more important than others, because risk aversion can affect cooperative behavior in social dilemmas (Raub and Snijders, 1997). Moreover, the scenario implies a certain hazard that might vary with individual risk aversion. Risk preference was assessed using lotteries and probabilities equivalence questions (Donkers et al., 2001) based on Prospect Theory (Kahneman and Tversky, 1979).[6] The hypotheses tested with the variables included in the experiment are summarized in table 2.2.

2.3.4 Experimental design

A first choice in the design of the experiment regards the number of pairs that need to be presented to each respondent. In order to avoid boredom and loss of concentration, we decided to limit the number of pairs to ten per subject. Given that the vignettes consist of three variables with two categories, one with three categories, and one variable with five categories, there are $2 \times 2 \times 2 \times 3 \times 5 = 120$ different vignettes, and hence $(120 \times 119) / 2 = 7140$ different pairs (variables may be constant within pairs). This is the universe of possible pairs from which we chose a sample. We excluded a number of pairs from the set of possible pairs, because we considered the choice between these too obvious. For example, a comparison between two vignettes with FUTURE = 1 and FUTURE = 0, ceteris paribus, seems

[6] This set of questions is probably not sufficient to assess the actors' preferred structure, but it does provide an indicator, which we used as a control variable for risk aversion.

less interesting, as everybody would presumably prefer a partner with whom she has a common future (FUTURE = 1). We reduced the number of feasible pairs to unordered pairs in the sense of Pareto ordering, excluding pairs of which one vignette has only advantages, and no disadvantages compared to the other vignette.[7] As a consequence of this restriction, the pairs of vignettes we did use vary in at least two independent variables. The variable related to information available to Ego has 5 categories, which means 10 combinations of two different values. Each combination occurs exactly once within the set of vignettes for each subject. We excluded pairs of vignettes that did not vary with regard to this variable. Pairs in which CITY equals 1 in both vignettes are also excluded.[8] These restrictions dropped the number of possible pairs to 1700. Variables constant within each pair were displayed anyway in order to be able to test the hypotheses on interaction effects. Each vignette was assigned randomly to the left or right side of the pair. The order of variables on each vignette was always the same. Subjects were asked first to choose which vignette within a pair they preferred. Subsequently, they were asked to state how strong their preference was on a four point scale: 1 = very weak; 2 = weak; 3 = strong; 4 = very strong.[9]

2.3.5 Statistical model

For the statistical analysis of paired comparison, we apply a random utility model (McFadden, 1973). This model assumes that subjects attach a certain utility (u) to each vignette, depending in a linear manner on its attributes (z) plus a random component (ε). This random component is included to account for the residual part of the utility that does not depend linearly on the attributes of the vignettes. Formally,

$$u(z) = z'\beta + \varepsilon.$$

Subjects' are assumed to choose the vignette with the highest utility, and this choice depends on the differences between the attributes of each pair of vignettes. The probability of a particular vignette being chosen can be estimated by applying a probit model in which the differences between the variable values of the two vignettes are used as independent

[7] A vignette can be represented by a vector $x = (x_1, x_2, x_3, x_4, x_5, x_6)$ where x_i represents the i^{th} variable of the vignette. A Pareto ordering can be defined for a pair (x, y) of vignettes such that $x \geq y$ if and only if $x_i \geq y_i$ for all $i = 1,\ldots, 6$.

[8] CITY is incorporated with PARTNER UNCERTAINTY that has 3 categories; this restriction excludes 2 of the 6 possible combinations.

variables. The coefficients β measure the effect of one unit difference in each of these variables on the attractiveness of the vignette. Independent variables are treated as qualitative attributes of the vignettes, enabling the coefficients to be compared. Their size, however, is not straightforwardly interpretable. Variables that are constant within pairs of vignettes, such as subject characteristics, are used only in interaction terms, because main effects are not identified. Interaction terms need to be computed as differences of products of the respective values in the vignettes, because the combined value of the two variables determines the utility of the combination for a given vignette. The difference between the values of the two products affects the choice between the vignettes. The model does not include a constant, because a constant would imply an a priori preference for the left or the right vignette. Standard errors are modified for clustering by using robust (Huber) estimator for clustered data (Rogers, 1993), because, since each subject had to make ten choices, observations are not independent. See Buskens and Weesie (2000b) for a slightly extended explanation of this analysis strategy in a similar experiment.

2.4 Results

2.4.1 Main effects

Table 2.3 shows two probit models on the choice of the vignettes. Model 1 only includes the main effects; model 2 also includes all the interaction terms. As discussed above, the statistical method for the analysis of paired comparison allows for a straightforward interpretation of the coefficients as the effects of the independent variables on the attractiveness of a vignette. Hence, a positive coefficient implies that an increase in the related independent variable determines an increase in the attractiveness of the vignette.

In model 1, most hypotheses on the main effects are supported. The attractiveness of a vignette decreases with PARTNER UNCERTAINTY, because uncertainty about the partner has a negative effect on the probability that trust is placed. All formulations of information available to Ego have a positive significant coefficient, except for OTHER EGOS' TRUSTFULNESS VS. ALTER. The coefficient of OTHER EGOS' TRUSTFULNESS VS. ALTER has the expected positive sign, but is not significant. The hypotheses about the difference between the coefficients are also supported, i.e. the effects of information only about the trustfulness of Other Egos (imitation) are smaller than the corresponding effects of the trustworthiness of

[9] This answer was used to transform preference into a scale, which was subsequently used as dependent variable to estimate subjects' choice with an ordinary regression model. However, these results are not presented in section 2.4, because they were not substantially different from the results presented here.

Table 2.3 Probit models of the choice of vignettes (69 subjects, 690 observations)

Independent variable	Hyp.	Model 1 Coeff.	Model 1 St. err.	Model 2 Coeff.	Model 2 St. err.
PARTNER UNCERTAINTY	−	-.45**	.107	-.52**	.120
TRUSTWORTHINESS OF ALTER	+	1.54**	.166	1.49**	.189
TRUSTWORTHINESS OF OTHER ALTERS	+	.91**	.116	.93**	.117
OTHER EGOS' TRUSTFULNESS VS. ALTER	+	.16	.110	.06	.147
OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	+	.39**	.094	.40**	.095
FUTURE	+	.50**	.088	.50**	.088
OUTDEGREE	+	.59**	.093	.59**	.092
DENSITY	+	.18*	.077	.18	.077
CITY	0	-.04	.096	-.03	.093
Interaction effects					
PARTNER UNCERTAINTY x TRUSTWORTHINESS OF ALTER	+			.14	.243
PARTNER UNCERTAINTY x OTHER EGOS' TRUSTFULNESS VS. ALTER	+			.26	.213
KNOWLEDGE x TRUSTWORTHINESS OF ALTER	−			-.18	.155
KNOWLEDGE x TRUSTWORTHINESS OF OTHER ALTERS	−			-.11	.124
KNOWLEDGE x OTHER EGOS' TRUSTFULNESS VS. ALTER	−			-.08	.098
KNOWLEDGE x OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS	−			-.09	.098
Tests of hypothesis 5				χ^2	*p*-value
TRUSTWORTHINESS OF ALTER > OTHER EGOS' TRUSTFULNESS VS. ALTER				53.71	.00
TRUSTWORTHINESS OF OTHER ALTERS > OTHER EGOS' TRUSTFULNESS VS. OTHER ALTERS				25.71	.00

**$p < 0.01$ and *$p < 0.05$ indicate two-sided significance based on Huber standard errors modified for clustering

Alter or Other Alters (learning). The most surprising result is that imitation related to Other Alters has a larger effect than imitation related to Ego's "own" Alter. One reason why this might be the case is that the fact that "Other Egos have made such investments with Other Alters" suggests that such investments make sense in general, whereas the fact that "Other Egos have made such investments with Ego's Alter" refers more specifically to Alter. In addition, the effect of imitation related to Ego's Alter is shown below to depend on the information Ego has about her Alter.

As expected, FUTURE has a positive significant effect on the attractiveness of a vignette, which is an effect of control via dyadic embeddedness. DENSITY has a positive effect, but is weakly significant in model 1 and it becomes non-significant at the 5% level in model 2. A possible explanation of this weak effect might be that the definition of DENSITY = 1 in our scenario lacks an explicit connection to Ego. This is in contrast with OUTDEGREE, which is a means of control via network embeddedness and provides one of the strongest positive effects. Thus, we find evidence for learning, imitation, and control through social networks.

2.4.2 Interaction effects with subject characteristics

The first two interaction effects regard information and uncertainty about the partner's capacities. The interaction of PARTNER UNCERTAINTY and TRUSTWORTHINESS OF ALTER shows

the expected sign, but the effect is very weak. Apparently, the value Ego attributes to this information does not depend on how uncertain she is about Alter's competence. The interaction of PARTNER UNCERTAINTY and OTHER EGOS' TRUSTFULNESS VS. ALTER is not significant. However, we tested the contrast between no available information and having information from OTHER EGOS' TRUSTFULNESS VS. ALTER in combination with high uncertainty, and this proved significant (p = .04). The test shows that the sum of these two effects is different from zero. This result supports our hypothesis implying that Ego values information of OTHER EGOS' TRUSTFULNESS VS. ALTER if she is uncertain about Alter's competence, but does not value this information if she knows (to a certain extent) that Alter is competent. The fact that Other Egos trust Alter is only important for Ego if she does not know how competent Alter is.

The other four interaction terms refer to interaction between knowledge about the stock market and the information available from Other Egos. Although all these interactions are in the expected direction, none of them is even close to significance. There are at least two explanations for this outcome. First, our design is not particularly suited to test effects of subject characteristics, because we only have 69 subjects. Thus, in this sense we only have 69 cases on which to test the effects of interactions with subject characteristics. Second, the data show that most subjects had very limited knowledge about the stock market. Hardly any of them were able to give an accurate estimate of the Dutch AEX index, and only a couple had an approximate idea about the value of this index. If one wants to investigate these interactions further, one should try to recruit subjects from a pool with more variance on the knowledge about the stock market.

We also tested a range of interactions of other subject characteristics, just to be sure that there were no clear indications against the statistical assumption that the weight subjects assign to the different variables are the same among subjects. It turned out that we could not significantly improve on model 1 by adding interactions with subject characteristics such as sex, age, birthplace, risk aversion etc. We also found no differences between subjects that found the vignettes more or less realistic, or between subjects for whom the described scenario was closer or less close to their own actual situation.

2.5 Conclusions and discussion

In this chapter we provide a theoretical explanation for possible effects of imitation in trust problems. Imitative behavior was incorporated in existing theories about the effects of social networks on trust as a particular form of learning by means of information accessible to Ego

through the network. We described four different types of information in order to distinguish learning effects from imitation effects. This distinction is based on the information available to Ego about transactions among third parties in the past. On the one hand, if Ego is informed that Other Egos trusted Ego's partner (Alter) or other partners (Other Alters) and that their trust was honored, Ego can learn from this information. On the other hand, if Ego is only informed about Other Egos trusting Alter (or Other Alters) *without* knowing whether their trust was honored, then Ego can merely imitate Other Egos. The importance of these types of information depends on Ego's uncertainty related to her trust problem with Alter. For example, she might be uncertain about Alter's competence and she might lack knowledge about the market in which her transaction with Alter takes place. We hypothesized that if Ego is uncertain about her partner, she will value information about capacities more, while if she is uncertain about the market, she will value any information about similar transactions more. We tested these hypotheses by means of a vignette experiment in which subjects had to choose between pairs of vignettes. The results confirmed that actors both learn and imitate when facing trust problems with uncertainty. However, we did not find support for the variations in importance of learning and imitation under more and less uncertainty. We only found a slight tendency that imitation of trustful behavior is more important when uncertainty about the competence of the partner is larger. Conversely, if Ego has (positive) information about Alter's competence, he does not imitate, but rather relies on the partner's competence. This result, as well as the significant effect of imitation of Other Egos' trusting behavior versus Other Alters, has interesting implications. First, it supports the idea that imitation should be considered among trust building mechanisms. Second, it implies that an environment in which people trust each other induces a virtuous cycle that brings even more trust. Furthermore, if imitation is particularly important when a trustor is uncertain about the trustee, a trusting environment is particularly important for newcomers.

For example, when new employees enter an organization, they will more easily integrate if they find a trusting and cooperative environment, because they will "learn" to trust their colleagues by imitating their behavior. Moreover, imitation is also particularly important for newcomers because other trust building mechanisms might not be immediately available to them. The illustrations in this chapter have focused on horizontal relations between colleagues, but of course similar processes can be expected to build trust in other types of relations, such as between managers and their subordinates. The knowledge that a manager is willing to support other in resolving their problems will increase Ego's trust (cf. Bijlsma and Van de Bunt, 2003). Merely observing others asking a manager to help them solve a problem

will also increase Ego's trust, although to a lesser extent than if Ego knows that appropriate help will be provided.

Although some hypotheses were not supported by the data, the theoretical ideas underlying the hypotheses about individual behavior in trust problems appeared to be promising and call for better tests. This chapter only represents a first attempt to distinguish imitation from learning, both theoretically as well as empirically. The inclusion of imitative behavior and learning in one theoretical model undoubtedly constitutes a major task for future research. In addition, alternative empirical research is necessary for a more extensive test of such a theory. In this respect, a promising option for further research includes laboratory experiments using controlled networks. Networks could be created in which actors play Trust Games and exchange information at the same time. Information would then not so much be predetermined by the experimenter, but would be created within the experiment. Such experiment could provide the possibility to observe imitation in actual practice. In such contexts, information will not only be positive, but at times also negative. Therefore, this context can be used to study perverse effects of imitation. We would expect that if networks are dense and the flow of information is fast, small mistakes in the decision processes of actors facing trust problems could have large consequences. If actors base their decision on imitation, for example, they might trust the "wrong" partner or distrust the "right" partner. Such mistakes are much more likely if uncertainty is high and information is limited, i.e., if imitation is the best available option for an actor. Chapter 3 provides some evidence for this conjecture.

Another improvement that could be included in the experiment is varying uncertainty more systematically between subjects, rather than regarding their expertise with respect to the specific trust problem as a potential element affecting the level of uncertainty. Moreover, one could think of other conditions in which imitation could be facilitated. For example, if information is costly, subjects might be willing to buy information about the behavior of others in similar roles, but might find it too expensive to buy information on the outcomes of such transactions as well, leaving them with information that only allows for imitation. Finally, experimental tests are typically strong tests of formal social theories; however, they often lack possibilities for statements about external validity. Therefore, it is important to investigate which real-life situations would be suitable for testing our theory on imitation in trust situations with survey data (see chapter 5).

Chapter 3

Third-Party Effects on Trust in an Embedded Investment Game*

Abstract

Most theories about the effects of social embeddedness on trust define mechanisms that more, or less explicitly assume actors' decisions are based on the information available to them. However, there is little empirical evidence about *how* subjects use this information. In this chapter, we derive hypotheses about the effects of information on trust from a range of theories and we devise an experiment that enables us to test these hypotheses simultaneously. We focus on the following mechanisms: learning, imitation, social comparison, and control. The results show that actors learn particularly from their own past experiences, and much less from past third-party experiences. Considering third-party information, we find stronger empirical support for imitation than for learning. Moreover, there is some evidence that actors dislike being treated worse than others (social comparison) and that actors anticipate to a certain extent their future sanctioning opportunities (control).

* This chapter is co-authored with Vincent Buskens. A slightly different version is currently under review (Barrera and Buskens, 2005b).

3.1 Introduction

Imagine that you have decided to make a financial investment, for example, for a private pension, and you have to choose among several companies offering similar services. Imagine also that you do not have much experience with this type of investment. You could investigate the past performances of all of the companies offering such services and compare them, but this would take much time, especially if there are many of them. You could ask a friend who has made a similar investment in the past about her experience, but this only provides you with information on one company. You could choose by reputation, simply picking the most "well-known" company, but companies with the most successful marketing strategy do not always offer the best products. Malicious companies might invest your money in a risky manner, making large profits themselves if things go well, while you end up with the costs if the investment goes wrong. Typically, in markets characterized by asymmetry of information between buyer and seller, these problems are not per se solved by "market forces" (Akerlof, 1970). To make your choice even more complex, the success of your investment will also depend on chance, e.g., if you are planning a long-term investment, you need to take into account that the behavior of financial markets over longer periods of time is hard to predict. Therefore, part of the information that you are able to gather might be hard to interpret, for example, the failure of a specific investment might have been caused by a "bad" financial advisor, but it could also have simply been due to adverse contingencies. Starting such an investment represents a typical trust problem, whereby trustworthy investors invest money in such a way that it is both in their own and in the consumer's interest, while untrustworthy investors invest only to maximize their own profits without taking the consumer's interests into account.

A setting as the one described above can be analyzed by applying existing theories on the effects of information in trust problems. Here we focus on an actor's (Ego) decision to trust her partner (Alter) based on the relevant information available to her. More specifically, this chapter aims at providing empirical evidence for the different types of mechanisms that influence trusting behavior in settings with network embeddedness. Given the existing theories about these effects, we investigate the conditions under which these different effects operate. Moreover, interpreting information about a partner's behavior can be more, or less difficult depending on uncertainties in the setting. Therefore, we also explore the relation between available information and uncertainty in trust problems.

Experimental research on trust in games has focused primarily on conditions that affect actors' decisions to trust and reciprocate in one-shot games, which are abstract

representations of single encounters between strangers (e.g., Berg et al., 1995; Snijders, 1996; Snijders and Keren, 2001; Camerer, 2003: ch. 2.7). However, most trust problems in real life differ from such abstract situations in many ways. First, in most trust problems, there is a positive probability that the same actors will meet in the future (dyadic embeddedness) and face a similar trust problem again. Second, actors are embedded in a social structure characterized by social relations, ethical norms, laws, etc. (network and institutional embeddedness) (Granovetter, 1985; Raub, 1997; Raub and Weesie, 2000). Since we want to study the effects of information here, we focus on a situation in which pairs of actors repeatedly face a specific trust problem and are embedded in a network of relations from which they can obtain information, but we neglect "institutional" aspects such as laws and norms.

The effects of dyadic and network embeddedness on trust problems have been theorized and the existing models identify two types of mechanisms: *learning and control* (Raub, 1997; Buskens, 2002; Buskens and Raub, 2002; see also Yamagishi and Yamagishi, 1994: 138-139). However, these models make rather strong assumptions about actors' computational abilities, and they neglect the possibility that actors might apply simpler heuristics such as imitation, or be influenced by the outcomes obtained by others, through a mechanism of social comparison. Moreover, empirical research on trust problems in informal situations characterized by network embeddedness is scarce: Buskens (2002: chs. 5 and 6) provided an empirical test for his learning and control models; Gautschi (2000) and Cochard et al. (2002) investigated trust problems with dyadic embeddedness; Duwfenberg et al. (2001), Güth et al. (2001), and Buchan et al. (2002) included a certain degree of network embeddedness in their experiments (see also Burt and Knez, 1995 for non-experimental research on the effects of third-party information on trust among colleagues). These experiments, however, do not deal with the effects of information provided by networks. An experiment in which the effects of information stemming from both dyadic and network embeddedness on a trust problem are analyzed is offered by Bolton et al. (2004).

We present a laboratory experiment designed to disentangle the effects of various types of information stemming from dyadic and network embeddedness. More precisely, this experiment represents an empirical test in which relatively complex rational arguments for trust, such as learning and control effects, are compared with other "simpler" heuristics, such as imitation or social comparison. In this experiment, groups of actors embedded in small networks play a repeated Investment Game (Berg et al., 1995) and exchange information concerning their own behavior as well as their partner's behavior in the game. The

manipulation of information exchange resembles the experiment conducted by Güth et al. (2001), i.e., Egos know exactly what happened to other Egos, in some experimental conditions, and they know only the choices of the other Egos, but not all the related choices of the Alters in other conditions. We also vary uncertainty in the sense that the choices of Alters are ambiguous for Egos in some conditions (see Coricelli et al., 2002 for a similar manipulation). Due to space constraints, we only analyze the behavior of subjects in the role of Ego and not the behavior of subjects in the role of Alter. We first deal with theories and hypotheses in section 3.2. The experimental design is described in section 3.3. Finally, the results and conclusions are presented and discussed in the last two sections.

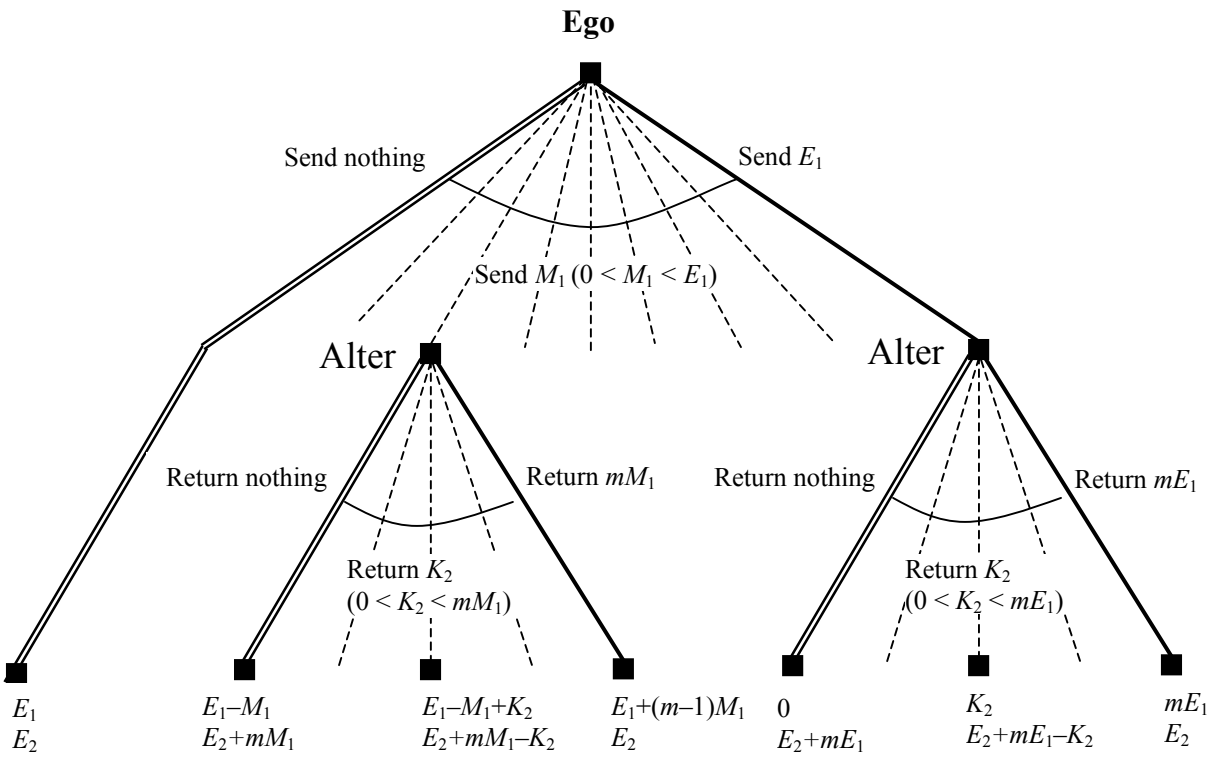
3.2 Theory and hypotheses

We conceptualize trust as an interaction involving two interdependent actors. According to Coleman (1990: ch. 5), a trust problem is defined by four characteristics:

- Ego has the possibility to place some resources at the disposal of Alter, who has the possibility to either honor or abuse trust.
- Ego prefers to place trust if Alter honors trust, but regrets placing trust if Alter abuses it.
- There is no binding agreement that protects Ego from the possibility that Alter abuses trust.
- There is a time lag between Ego and Alter's decisions.

This definition is consistent with game-theoretic formalizations of the *Trust Game* (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990) and the *Investment Game* (Berg et al., 1995; see also Ortmann et al., 2000 for a replication of the original experiment). These two games differ in the following way. In the Trust Game, "trust" and "trustworthiness" are represented by dichotomous choices – trust versus no trust, honor trust versus abuse trust – while the Investment Game exhibits some "continuity" both in the choice of placing trust and in the choice of honoring or abusing trust. Because this continuity implies that we can distinguish not only between whether Ego trusts Alter or not, but also to what extent she trusts him, we employ the Investment Game (see figure 3.1) in our theoretical analysis as well as in our experiment.

Figure 3.1 Investment Game



In the Investment Game, the two players start with an initial endowment E_1 and E_2. Ego then has the possibility to send all, some, or none of her endowment to Alter. The amount of money that she decides to send, say M_1 ($0 \leq M_1 \leq E_1$), is then multiplied by a factor m (with $m > 1$) by the experimenter. Alter receives an amount equal to m times the amount M_1 sent by Ego. The parameter m can be interpreted as the returns Alter makes due to Egos' investment. Subsequently, Alter can decide to send back to Ego all, some, or none of the money he has received. The amount returned by Alter is denoted K_2 ($0 \leq K_2 \leq mM_1$). After all subjects have concluded their task, their earnings are computed as follows:

- Ego earns $V_1 = E_1 - M_1 + K_2$ and
- Alter earns $V_2 = E_2 + mM_1 - K_2$.

3.2.1 One-shot game

Assuming complete information, standard forward-looking rationality, and selfish actors who are only interested in their own payoffs, the one-shot Investment Game has a straightforward subgame-perfect equilibrium: Alter maximizes his payoff by returning nothing to Ego, therefore, Ego, who anticipates this behavior from Alter, maximizes her own payoffs by

sending nothing to Alter in the first place. Therefore, "send nothing" and "return nothing" are the equilibrium choices (in figure 3.1 this is represented by double lines) and the payoffs in equilibrium are E_1 and E_2. This outcome is Pareto-suboptimal, because both actors would prefer any outcome yielded in a situation in which trust is to some extent placed and honored, $E_1 - M_1 + K_2$ and $E_2 + mM_1 - K_2$, with $M_1 > 0$ and $K_2 > M_1$. The pie that the actors divide reaches its maximum when Ego sends everything ($M_1 = E_1$), which means that Pareto improvements are always possible if $M_1 < E_1$. Ego gains from trusting Alter if Alter returns more than what Ego sent ($K_2 > M_1$), but, once M_1 has been chosen, Alter's decision resembles the move of the dictator in the Dictator Game: he decides how to split the pie of size mM_1. Given Ego's decision, all possible outcomes are Pareto non-comparable, since whatever Alter returns goes directly to Ego.

The analysis discussed above is valid for a one-shot game played by two actors who know the structure of the game, but have no additional information about each other, e.g. about other games played in the past, or with other actors. In the next subsection, we consider other information conditions and discuss a finitely repeated Investment Game in an embedded setting.

3.2.2 Learning and control through dyadic embeddedness

Dyadic embeddedness refers to a situation in which two actors repeatedly play an Investment Game together. Thus, Ego has the possibility to *learn* about Alter's trustworthiness. Learning models typically assume that actors do not look ahead, but they rather adapt their behavior according to their past experiences. Different types of learning mechanisms can be distinguished (see Camerer, 2003: ch. 6, for an overview of such models). The most widely applied families of learning models are *belief learning* and *reinforcement learning*. Belief learning models assume that actors update their belief about the other player's type or about the other player's expected behavior. Players then calculate the expected payoffs based on their beliefs concerning the other player's strategy and subsequently choose the strategy with the highest expected payoff. Conversely, reinforcement learning models are based on the payoffs that actors received in previous games: the higher the payoff obtained by a given decision, the more likely it is that a player will make that same decision again. Reinforcement types of models are more straightforwardly applicable to the Investment Game, because (1) it is not directly clear how beliefs about Alter's expected responses to choices that are not yet made by Ego should be estimated; and (2) a heuristic of the type "reward trustworthiness and punish abuse" seems particularly realistic for the Investment Game, because of the

"continuity" of the actors possible moves in the game. This heuristic, in fact, implies that Ego compares the amount received in previous games with the amount sent in previous games. The more satisfied she is with the amount she receives back, the more she will send in the next game; if she is unsatisfied with the amount she receives back, she will decrease the amount sent in the next game. This reinforcement could depend on both the payoff earned in the previous game (that is, $E_1 - M_1 + K_2$), and on the proportion returned by Alter (that is, K_2/mM_1).[1] Therefore, assuming that subjects playing an Investment Game learn by applying a reinforcement rule, we expect the following effect of learning from dyadic embeddedness.

> **Hypothesis 3.1 (dyadic learning)** The higher the amount earned by Ego (proportion returned by Alter) in previous games, the more Ego sends in the present game.

In order to introduce the effects of control we now turn back to game theory. If we assume a finitely repeated game and complete information, standard game theory predicts that Alter will send nothing back in the last game (because $E_2 + mM_1 > E_2 + mM_1 - K_2$, for any M_1, $K_2 > 0$) and Ego, anticipating Alter's behavior, will then send nothing in the last game. Knowing that he has nothing to lose in the last game, Alter will not return anything in the last but one game and accordingly, Ego will send nothing as well. This argument, known as *backward induction* (see Selten, 1978, for a prominent application), unravels the whole game back until the first stage, making any trust impossible. However, in their articles on sequential equilibrium, Kreps et al. (1982) and Kreps and Wilson (1982) have shown that assuming incomplete information in the sense of Harsanyi (1967-68), cooperation can be sustained in the first games of a finitely repeated Prisoner's Dilemma. Similarly, this argument can be applied to a finitely repeated Investment Game. Kreps et al.'s (1982) sequential equilibrium is based on the assumption that there exist some Alters who have no incentive to abuse trust – for example, because they are in some sense altruistic – and that Ego is uncertain about her partner's incentives and will update her beliefs about Alter after obtaining information about him. Thus, while a non-selfish Alter will not abuse trust anyway, even a selfish Alter will return an amount $K_2 \geq M_1$, in order to build a trustworthy reputation, if he is aware of Ego's uncertainty. Only when the repeated game approaches its end, a selfish Alter will abuse trust

[1] However, other effects due to the amounts returned by Alter are possible if Ego interprets these returns in a different way. For example, a low return following a low investment could simply mean an abuse of trust, but it could also be interpreted as disdain, caused by an offensively low investment.

because he has nothing to lose in future interactions.[2] Consequently, Ego will send positive amounts in the early stages of the game because she knows that even a selfish Alter will return positive amounts. The model predicts that, towards the end of the game, selfish Alters will become indifferent between honoring and abusing trust. As soon as trust has been abused once, Ego will know that Alter is a selfish player and will stop placing trust. Empirically, it is regularly observed in experiments with finitely repeated games that only in the very last periods trust and cooperation rates decrease dramatically (e.g., Selten and Stoecker, 1986; Camerer and Weigelt, 1988). This leads to the following two hypotheses on dyadic control effects.

Hypothesis 3.2a (dyadic control) The higher the number of expected games in the future, the higher the amount that Ego is willing to send.

Hypothesis 3.2b (end-game effect) The amount sent by Ego decreases to a larger extent in the last games than in earlier games.

3.2.3 Learning through network embeddedness

The situation analyzed in the previous section represents a repeated interaction between two isolated strangers. However, most transactions in real life take place between actors that are embedded in a social structure. In particular, other actors could have some kind of relation with Ego, Alter, or both. Therefore, we will now releasethe assumption of isolated actors introducing social networks in the game. We start by adding one other actor. Imagine there are two Egos playing a finitely repeated Investment Game with one Alter. Moreover, these two Egos can exchange information about their interactions with Alter. Although learning models are widely applied in sociology to study the behavior of groups in social dilemmas (see, for example, Heckathorn, 1996; Macy and Skvoretz, 1998; Flache and Macy, 2002), learning models have not yet been applied to study the Investment Game. If two Egos play a repeated Investment Game and can exchange information with each other, each Ego obtains additional information from which she can learn, namely information concerning games that the other Ego played with Alter. Assuming that this is a game of incomplete information, the

[2] Strictly speaking, Kreps et al.'s (1982) sequential equilibrium is based on a learning mechanism, i.e., actors update their beliefs concerning Alter's type by applying Bayes' rule. However, we discuss this model in the section on control because it applies forward-looking rationality, whereas the learning models discussed before apply backward-looking rationality.

additional information concerning games played by Alter with another Ego can reveal to Ego what type of player Alter is. Therefore, Ego's decision is expected to be influenced by this information.

We now introduce some additional complexity in the network. Imagine that there is more than one Alter in the network, for example two Alters, each of them playing a repeated Investment Game with two Egos. Moreover, we will assume that every Ego can receive information from another Ego playing with the *same* Alter and/or from another Ego playing with *another* Alter. Information concerning another Alter is relevant if we assume that it affects Ego's idea about the population of Alters as a whole. Positive information about any Alter thus increases Ego's expectation that "her" Alter is trustworthy as well.[3] For example, if Ego is informed that another Alter has been returning a high proportion of what he receives to another Ego, Ego will raise her estimate of her Alter's propensity to return a high proportion to her and she will be more inclined to send her Alter a higher amount. In chapter 2, we find some evidence for effects of this type of information using a vignette experiment. As for dyadic learning, information utilized by Ego to adjust her expectations about her Alter's behavior can include information about proportion returned by any Alter to another Ego and/or information about amount earned by this other Ego. This leads to the following two hypotheses concerning Ego using information about her Alter playing with another Ego and information about another Alter playing with another Ego, respectively.

Hypothesis 3.3a (network learning) Assuming that Ego receives information concerning previous game(s) played by her Alter with another Ego, the higher the proportion returned by her Alter to another Ego (amount earned by another Ego) in the past, the more Ego sends to her Alter in the present game.

Hypothesis 3.3b (network learning) Assuming that Ego receives information concerning previous game(s) played by another Alter with another Ego, the higher the proportion returned by another Alter to another Ego (amount earned by another Ego) in the past, the more Ego sends to her Alter in the present game.

[3] To prevent confusing between which Alter is meant, we will refer to the Alter playing with the focal Ego as "her" Alter and the other Alter as "another" or "the other" Alter whenever this seems necessary.

3.2.4 Imitation

One of the possible effects of information stemming from network embeddedness is imitation. Imitation is usually considered a form of learning that plays an important role in socialization processes (for example, Bandura and Walters, 1963: ch. 2). In interactions resembling social dilemmas, imitation could be viewed as a parsimonious way to achieve the optimal decision (see Hedström, 1998 on "rational imitation"), especially in settings where information is scarce. Some imitation models have been proposed by economists (for example, Pingle, 1995; Pingle and Day, 1996; Schlag, 1998), but these models apply to rather specific situations in which it is typically assumed that actors are fully informed about the past. In all these models actors make their decisions after receiving some information about the actions of others *and* the outcomes obtained by them. However, the latter information might not always be available. For example, in an Investment Game, Ego could be informed about the choice of another Ego, but she may be unaware of Alter's response in that game. In chapter 2, we propose to restrict the term "imitation" to situations in which available information does not include the outcomes obtained by others, but only their behavior. Conversely, the label "learning" has been used for decisions based on "full" information, information that includes the outcomes obtained by others.

In the Investment Game, we can imagine a situation in which two Alters play a finitely repeated Investment Game with two Egos each, just like before, but now every Ego only receives information concerning the amount sent by the other Ego. If an Ego receives information that another Ego has repeatedly sent high amounts to her Alter, she could infer from this information that her Alter is returning high amounts to this other Ego; if this were not the case, this other Ego would stop sending anything to Alter. Therefore, we expect that also such partial information will influence Ego's decision, particularly if full information concerning the behavior of Alter is not available. As for hypothesis 3.3b, if Ego's trusting decision is based on her estimates of the capability of a population of Alters to honor trust, her decision could also be influenced by information concerning the behavior of another Ego in interaction with *another* Alter. This leads to the following two hypotheses.

> **Hypothesis 3.4a (imitation)** Assuming that Ego is informed about games played by her Alter with another Ego, the more another Ego has sent to her Alter in previous games, the more Ego sends to her Alter in the present game.

Hypothesis 3.4b (imitation) Assuming that Ego is informed about games played by another Alter with another Ego, the more another Ego has sent to another Alter in previous games, the more Ego sends to her Alter in the present game.

3.2.5 Social comparison

In order to account for deviation from standard rationality – such as cooperation in Prisoner's Dilemmas or Trust Games and contribution in public good type of games – observed in a number of experiments, some scholars have developed models that release the assumption of purely selfish behavior, substituting it with the assumption of partly altruistic behavior.[4] These models assume that subjects are not only interested in their own outcomes, but also, to some extent, in the outcomes obtained by the other player. Thus, in these models, the utility function incorporates different types of "non-standard" preferences, such as *fairness* (Rabin, 1993) and *equity* or *inequality-aversion* (Fehr and Schmidt, 1999; Bolton and Ochenfels, 2000). Rabin's fairness model assumes that actors are nice to those who have been nice to them, and retaliate against those who have harmed them. Fehr and Schmidt (1999) proposed a model in which actors care about their own outcomes as well as about the difference between their own outcomes and the outcomes obtained by others. According to this model, actors dislike receiving lower payoffs (envy), but also, to a smaller extent, higher payoffs (guilt). Finally, in the model proposed by Bolton and Ochenfels (2000), individual utility depends on both an actor's own payoffs and his/her relative share. Individuals prefer to receive a relative payoff that is equal to the average earned by all other players. These models can be applied to settings in which actors are assumed to compare their outcomes with that of their partner, but they are not designed for comparisons within a network of actors who do not directly interact with each other. In particular, if actors are embedded in a network, they might compare their outcomes with those of others who occupy similar positions instead of the outcomes obtained by their exchange partner. Although these social comparison effects are not the main focus of this chapter, we do pay attention to the most obvious effect, envy. Egos will sanction Alter if they feel unfairly treated compared to other Egos. More specifically, Ego will decrease the

[4] There is empirical evidence that some actors do indeed have altruistic preferences. For example, in a specific experiment combining the Investment Game and the Dictator Game, Cox (2004) has shown that cooperation in the Investment Game can be partly attributed to a reciprocity norm governing the behavior of Alters, on which Egos anticipate, and partly to altruistic preferences observed in a non-trivial number of subjects. Conversely, see Hoffmann et al. (1994) for an experimental study on conditions facilitating the observation of self-regarding preferences.

amount she sends if she sees that either her Alter or another Alter returns a larger proportion of the pie to another Ego than what the focal Ego obtains herself.

Hypothesis 3.5a (envy) The higher the (positive) difference between the proportion Alter returned to another Ego and the proportion he returned to Ego in previous games, the less Ego sends to her Alter in the present game.

Hypothesis 3.5b (envy) The higher the (positive) difference between the proportion returned by another Alter to another Ego and the proportion returned by her Alter to Ego in previous games, the less Ego sends to her Alter in the present game.

3.2.6 Control through network embeddedness

As for dyadic embeddedness, control effects have been also theorized for network embeddedness. Buskens and Weesie (2000; see also Buskens, 2002, ch. 3) developed a model for a repeated Trust Game with a network of Egos. This game-theoretic model predicts control effects via network embeddedness, but it applies to infinitely repeated games. In another study, Buskens (2003) applied Kreps and Wilson's (1982) finitely repeated Prisoner's Dilemma model to a finitely repeated Trust Game. Buskens (2003) extended the original model by including an "exit" and a "voice" option for Ego. In the voice model, two Egos can inform each other about Alter's behavior in previous interactions. This model assumes incomplete information just as in Kreps and Wilson (1982) and predicts that Ego's decision to place trust increases with the frequency at which the two Ego's can inform each other.

Looking at the embedded Investment Game and assuming that Egos have incomplete information – that is, there are two types of Alters, selfish ones and nice ones, the nice ones have no incentive to abuse trust – and that any abuse of trust is type-revealing, Buskens (2003) showed that Egos' possibility to inform each other about Alter's behavior makes Alter more trustworthy than if Egos play with Alter individually. Thus, while nice Alters will not abuse trust anyway, selfish ones will mimic the behavior of nice Alters for longer than if they were only playing with one Ego, in order to keep a positive reputation. Therefore, the effect of the expected duration of the game (hypothesis 3.1a) should be stronger if Egos can inform each other, because a longer future implies that Ego has the possibility to punish her Alter for abusing trust, not only by withholding trust herself in future games, but also by informing

other Egos and thus further damaging her Alter's reputation. This argument is summarized in the following hypothesis.

> **Hypothesis 3.6 (network control)** The more Ego is able to inform other Egos, who are also playing with her Alter, about Alter's behavior, the stronger the positive effect of the expected duration is on the amount sent by Ego

3.2.7 Uncertainty

In a trust problem as the one described by the Investment Game, Ego might be uncertain about the meaning of the amount that Alter returns. Reconsider again the example in which Ego asks Alter to invest her money. Ego might be uncertain about the actual profit Alter has made in a certain period. Even if Alter is a good investor, he might be luckier at some times than at other times. If, in such a situation, Ego is unable to observe how successful Alter was, Alter could simply return a small profit to Ego and claim that he did not make a large profit, while he actually did. In terms of the Investment Game, this implies that Ego is uncertain about the multiplier *m* used by the experimenter.[5] Assuming that Ego is uncertain about how much Alter received, information about Alter's behavior becomes more difficult for Ego to interpret. A low return could be due to a low return on the investment rather than to abuse of trust. Because information is more difficult to interpret under this kind of uncertainty, all the effects of Alter's past behavior on trust are expected to become weaker:

> **Hypothesis 3.7a (dyadic learning under uncertainty)** If Ego is uncertain about the returns on investments made by her Alter, the effect of her Alter's past behavior in interactions with Ego on Ego's trusting decision is smaller.

> **Hypothesis 3.7b (network learning under uncertainty)** If Ego is uncertain about returns on investment for any Alter, the effect of this Alter's past behavior in interactions with *other* Egos on Ego's trusting decision is smaller.

> **Hypothesis 3.7c (envy under uncertainty)** If Ego is uncertain whether or not another Alter, who is interacting with another Ego, has the same returns on

[5] In correspondence with the interpretation given in the case that an investor being lucky depends on exogenous circumstances, the multiplier *m* chosen by the experimenter in our experiment is determined again in every single period of a supergame independent of earlier periods.

investment as her Alter, the effect of the difference between the amount returned to another Ego and the amount returned to Ego is smaller.[6]

3.3 Method

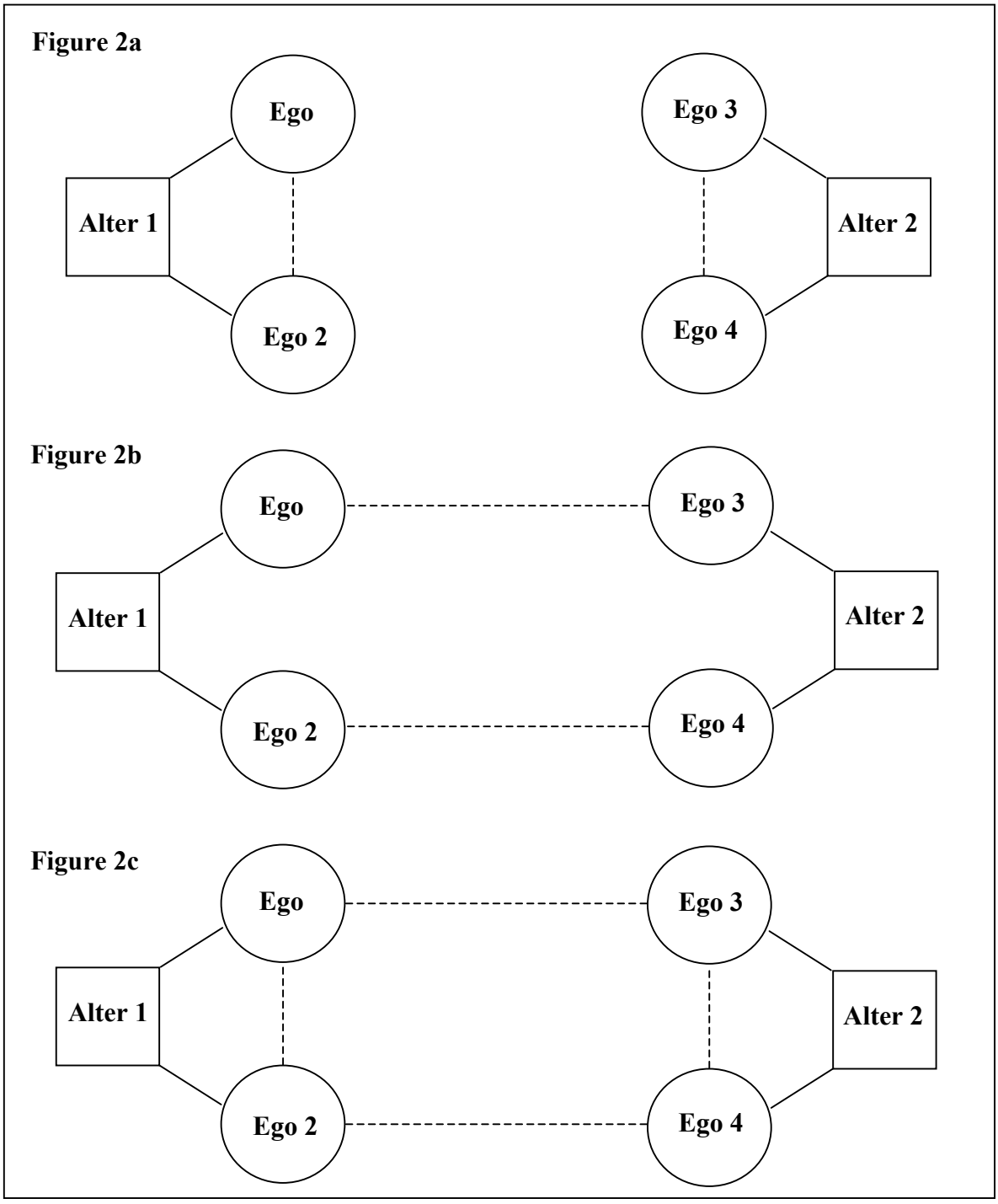
3.3.1 Experimental design

The constituent game in the experiment is the Investment Game (Berg et al., 1995), described in the previous section. The experiment is designed to investigate the effects of dyadic and network embeddedness on Ego's decision under more, or less uncertain conditions. Three features are therefore manipulated: structure of the information network, amount of information carried by network ties, and Egos' uncertainty about the returns on the investment. Dyadic embeddedness is also implemented in the experiment since all subjects play a finitely repeated Investment Game with the same partner. The structure of the information network is manipulated in three different ways as illustrated in figure 3.2. Each network consists of six subjects, four Egos and two Alters. Each Alter plays the Investment Game with two Egos; in figure 3.2 this is indicated with straight lines. The Egos are variously connected with each other, and a connection between two actors, denoted by a dotted line, indicates an exchange of information between them. Information available to one node is automatically transmitted to all other nodes with which the focal node is connected by a dotted line. The software takes care of the transmission of information through the network, which is provided to the subjects in "history boxes" that are displayed on their computer screens.[7] History boxes are windows located at the lower part of the screen and they provide subjects with information about previous games. Thus, when a game is played at time t_n, information about all games previously played from t_1 until t_{n-1} is available to the subjects in their history boxes. The Alters are not connected and their history boxes only show outcomes of their own past transactions. We discuss the content of the history boxes more elaborately when we describe how we manipulated information.

In the first setting (see figure 3.2a) every Ego receives information from another Ego playing with her Alter. Hereafter, we will refer to this Ego as *Ego 2* and to the Alter playing with Ego 2 as well as with the focal Ego as *Alter 1.* A tie such as this provides Ego with information about exchanges involving Alter 1 and Ego 2, with whom she is connected by a

[6] In our experimental conditions, the returns of investment *m* are always the same for parallel interactions with the same Alter. Therefore, this hypothesis can only be tested for envy toward an Ego who is involved with another Alter. We formulate this hypothesis in terms of "amount" returned rather than "proportion" returned, because the proportion is unknown if *m* is unknown.

Figure 3.2 Experimental networks



network tie. Thus, Ego can use this tie to learn or make inferences about the trustworthiness of Alter 1. In the second setting (see figure 3.2b) every Ego receives information from another Ego playing with *another* Alter. Hereafter, we refer to this Ego as *Ego 3* and to the Alter playing with Ego 3 as *Alter 2*. Thus, Ego can learn or make inferences about the

[7] The experiment was programmed and conducted with the software z-Tree (Fischbacher, 1999).

trustworthiness of Alter 2 who is interacting with Ego 3, but does not obtain information about Alter 1 other than from her own interactions. In the third setting (figure 3.2c), every Ego receives information from *two* other Egos, one (Ego 2) playing with her Alter (Alter 1) and one (Ego 3) playing with another Alter (Alter 2). The structure of the information network varies within subjects: every participant plays three supergames of 15 games each, one for every network condition, in a fixed order: in the first supergame Ego only has a tie to Ego 2, in the second supergame she only has a tie to Ego 3, and finally, in the third supergame, she has two ties, one to Ego 2 and one to Ego 3. This design is used to analyze how subjects process information coming from different sources; the order of the three parts of the experiment is kept constant for every subject in order to provide subjects with the same sequence and reduce the impact of individual learning processes throughout the experiment.

The amount of information carried by the ties between the Egos is also manipulated: information can be *full* or *partial*, irrespectively of the type of the tie. If a tie carries full information, subjects at both ends receive information about *both* the amount sent by the other Ego *and* the amount returned by the related Alter for every game previously played. By contrast, if a tie only carries partial information, subjects at both ends only receive information about the amount sent by the other Ego, *but not* about the amount returned by the related Alter. In other words, this manipulation is implemented in the experiment as a quality of ties: some ties carry full information whereas others only carry partial information. For example, assuming that Ego in figure 3.2c has a tie to Ego 2 carrying partial information and a tie to Ego 3 carrying full information, her history box will display: the amount sent by Ego 3 to Alter 2 and amount returned by Alter 2 to Ego 3 for all games previously played, the amount sent by Ego 2 to Alter 1 (but *not* the amount returned by Alter 1 to Ego 2) for all games previously played and, finally, the amount she herself sent to Alter 1 and the amount returned by Alter 1 to her for all games previously played (the latter information is always available for all players in all experimental conditions). The amount of information carried by ties varies both between and within subjects. A given tie of any given actor never changes from full to partial information or vice versa, however, actors can have one tie carrying full information and one carrying partial information. Therefore, the tie to Ego 2 in the third supergame carries the same information as the tie to Ego 2 in the first supergame. Similarly, the tie to Ego 3 in the third supergame carries the same information as the tie to Ego 3 in the second supergame. Hence, four information conditions are possible (2 times 2): full information on both ties (FF), partial information on both ties (PP), full information on the tie to Ego 2 and partial on the tie to Ego 3 (FP), and vice versa (PF). Note that the positions of

Table 3.1 Experimental conditions (number of subjects per condition in brackets)

	FFC* (*N*=36)	FFU* (*N*=36)	PPC* (*N*=36)	PPU* (*N*=36)	FPC* (*N*=36)	FPU* (*N*=30)	PFC* (*N*=36)	PFU* (*N*=36)
Tie to Ego with *her* Alter	full	full	partial	partial	full	full	partial	partial
tie to Ego with *another* Alter	full	full	partial	partial	partial	partial	full	full
Multiplier *m*	3	2 or 4	3	2 or 4	3	2 or 4	3	2 or 4

*The first letter refers to the information condition concerning the tie between Ego and Ego 2; the second letter refers to the information condition concerning the tie between Ego and Ego 3; the third letter refers to the certainty/uncertainty condition. F = full; P = partial; C = certainty; U = uncertainty.

the four Egos within one network are symmetrical with respect to the information they receive through their ties.

Finally, uncertainty is implemented by means of the multiplier *m*: in the treatment with no uncertainty $m = 3$ for all Alters (C), while in the treatment with uncertainty $m = 2$ or 4 with probability 0.50 each for all Alters (U).[8] Uncertainty varies only between subjects. In the condition with uncertainty, the value of the multiplier is chosen independently for the two Alters at the beginning of every period and the Alters are informed of the value of their *m* before Ego makes her choices. The value of the multiplier of a given Alter for a given period applies to the amount of points sent by *both* Egos playing with this particular Alter. The Egos do not find out what the value of *m* is either during or after the game. However, occasionally Alter's choice may reveal the value of *m*, for example if, in a game with uncertainty, Alter chooses a value of $K_2 > 2M_1$, Ego can infer that the value of *m* for this period was 4. Combining these four conditions with the two possible conditions for uncertainty (C and U) yields eight possible experimental conditions (2 times 2 times 2). The eight conditions are summarized in table 3.1, including the number of subjects participating in each condition. All the information concerning network embeddedness, the amount of information transmitted, and uncertainty is common knowledge: all players have the same information and everybody knows that everybody has the same information.

The experiment runs as follow: the participants are divided into groups of six subjects each and every participant is randomly assigned a role, Ego or Alter. Each group consists of four Egos and two Alters. Subjects keep the same role throughout the experiment. The experiment consists of 3 supergames, each divided into 15 periods. During each supergame, two Egos are matched with one Alter, and they both play the Investment Game with him 15 times. Thus, each Ego plays one Investment Game every period, whereas each Alter plays

two games per period, one per each Ego. Before the beginning of the first supergame, subjects run through a tutorial in which they have to answer certain questions on whether they understand the stage game. If they give wrong answers they receive feedback on what the correct answer is and why this is the correct answer. Then, they play twice an Investment Game against the computer, in order to learn how the game works. They are aware that these two periods are merely practice without actual payment, and that the answers are preprogrammed.

After these practice rounds, all subjects are assigned to a group of six; they do not know who the other subjects in their group are. Then, the first supergame starts. At the beginning of every period, all players receive an initial endowment of 10 points (1 point = 0.01 Euro). The Egos then have the possibility to send all, some, or none of their points to their Alter. They are instructed that the points that they receive are completely at their disposal and they can freely decide whether they want to send anything to their Alter and if so how much. The experimenter multiplies the amount of points that they decide to send by a factor m, where $m = 3$ in the condition without uncertainty, and $m = 2$ or 4 each with probability 0.50 in the condition with uncertainty. The Alters receive an amount equal to m times the amount sent by the Egos. The Alters can then decide to send back to the Egos all, some, or none of the points they have received. Obviously, the Egos have to decide first and the Alters must wait until all the Egos have entered their decisions. After Ego has made her choice, a waiting screen appears on her monitor and she has to wait until all the Egos and Alters have entered their decisions. When all four Egos have completed their task, the two Alters have to decide how much they want to return to each of the two Egos separately. The two decisions that the Alters have to make in every period appear simultaneously on their screen, and the game does not proceed until all Alters have entered both decisions. After all six subjects have completed the task, the computer displays their earnings and the history boxes are updated. The history boxes of the Alters contain information about: the period number, the amount of money received from each of the two Egos, and the amount returned to each of the two Egos. The Egos' history boxes contain the number of the period, the amount of money sent and returned *and* information about the other Egos with whom they are tied. The information displayed in the history boxes of both Ego and Alter is reported for all

[8] Duwfenberg et al. (2001) manipulated uncertainty in a similar way, but in their experiment m was private information held by Ego and not by Alter. In other words Duwfenberg et al. (2001) treated m as a property of Ego.

of the previous periods played and it remains available to the subjects until the end of the supergame.

After all tasks have been completed and the history boxes have been updated, a new period starts. When 15 periods have been played, the supergame finishes and subjects move on to the next supergame. The Egos are always matched to a different Alter in every supergame and they are (partially) embedded with new Egos. The roles stay the same throughout the whole experiment; the Egos always play as Egos and the Alters always play as Alters. Each session of the experiment utilizes 18 subjects, except for one session in which only 12 subjects participated. The 18 subjects are divided into 3 groups, each with 2 Alters and 4 Egos. After every supergame, players are re-matched so that the Egos are never paired with the same Alter in their network. The complete instructions of the experiment for the Egos in one of the experimental conditions are provided in Appendix B.

3.3.2 Statistical model

The dependent variable we want to predict in the analyses is how much does subject *i* trust his or her partner at time *t*, operationalized as the amount sent by actor *i* at time *t*, say y_{it}. We assume that we can predict y_{it} as a linear function of the predictors *x*, which have been discussed in the theory section above. However, we take into account the panel structure of the data, namely, that we have multiple observations per subjects. Therefore, we estimate the model

$$y_{it} = x_{it}\beta + \nu_i + \varepsilon_{it},$$

where ν_i is the random effect at the subject level and ε_{it} is the random effect at the observation level. Both random effects are assumed to be normally distributed, to be independent from each other, and to have a mean equal to 0. x_{it} is the vector of predictors that includes variables for learning, imitation, envy, and control.

The dependent variable is measured by the amount of points, varying between 0 and 10, that a subject sends to the partner. Theoretically, the latent dependent variable is a continuous property of subjects. Therefore, we assume that our measurement of trust can be interpreted as an interval measurement for the actual trust level. For example, if a subject sends 1 point, this implies that his or her trust levels correspond with sending a value between 0.5 and 1.5 points. Similarly, the intervals are determined for sending 2, 3, …, 9 points. Because a subject cannot send more than 10, sending 10 only indicates that a subject wants to

send more than 9.5. Therefore, the upper bound of the interval for sending 10 is set to infinity. Defining the appropriate interval of trust levels related to sending 0 is even more difficult. We assume that there are many different levels of distrust that all lead to sending nothing, therefore we set the lower bound of the interval around 0 at minus infinity.[9] Regression models in which the observed values represent intervals are called *interval data regression models,* we estimated a panel version of this type of models using the xtintreg command in Stata 8.2 (Stata Corporation 2003b: 108-114).

3.3.3 Operationalizations

Our analysis focuses on trusting behavior, therefore we operationalize trust as the amount of points that an Ego decides to send to her Alter in a given period of the Investment Game, while we treat this measurement as an interval measurement as discussed in the previous subsection.

For dyadic learning (hypothesis 3.1), we looked both at the amount earned in the past and at the proportion returned by Alter 1 in the past. The amount earned by Ego in previous periods is operationalized by taking a discounted sum of the difference between the amount sent in previous periods and the amount returned in previous periods. Assuming that recent experiences are more important, experiences are discounted by a weight w_1 ($0 \leq w_1 \leq 1$) for each period further back in the past they are. Thus, at time t,

$$\text{amount earned}_t = \sum_{i=1}^{t-1} w_1^{t-i-1}(E_{1i} - M_{1i} + K_{2i}),$$

where S_{1i} and R_{2i} are the amounts sent and returned at time i. Similarly, the proportion returned by Alter 1 in the past is operationalized by adding the proportion returned by Alter 1 in all previous periods, discounted by a weight w_2 ($0 \leq w_2 \leq 1$). Thus, at time t,

$$\text{proportion returned}_t = \sum_{i=1}^{t-1} w_2^{t-i-1} \frac{K_{2i}}{mM_{1i}}.$$

[9] We compared our analysis with other plausible implementations such as setting the lower bound related to sending 0 at 0. We also compared the analysis with alternatives such as a tobit regression in which we consider only sending 10 as a left-censored observation and ordinary random-effects regression considering the amount sent as an interval variable. All these alternative analyses substantially led to the same conclusions, although significance levels might slightly vary.

Under uncertainty, we also computed the proportion returned assuming $m = 3$ since in this case m is equal to 2 or 4, both with probability 50%. Moreover, we include in the analyses one variable for the amount sent by Ego in the past. This variable captures the individual propensity to trust and to stick to past decisions. This variable is operationalized by adding the proportion sent by Ego in all previous periods discounted by a weight w_3 ($0 \leq w_3 \leq 1$).[10] Thus, at time t,

$$\text{proportion sent}_t = \sum_{i=1}^{t-1} w_3^{t-i-1} \frac{M_{1i}}{10}.$$

Dyadic control (hypothesis 3.2a) is operationalized simply by taking the number of periods still to go before the end of the supergame, while for the end-game effect (hypothesis 3.2b) we use a dummy variable which takes value 1 in the last period of a supergame and 0 otherwise. More complicated operationalizations for end-game effects did not improve the model. The variables for network learning (hypotheses 3.3a and 3.3b) are constructed in a similar way as the variables for dyadic learning. We took a discounted sum (w_4, $0 \leq w_4 \leq 1$) of the proportion returned from Alter 1 to Ego 2 for hypothesis 3.3a and a discounted sum (w_5, $0 \leq w_5 \leq 1$) of the proportion returned from Alter 2 to Ego 3 for hypothesis 3.3b.[11] For imitation, assuming that Egos reacts to the observed behavior of other Egos when the behavior observed differs from one's own, we took a discounted sum of the difference between the amount sent by Ego and the amount sent by Ego 2 in previous games for hypothesis 3.4a. Thus at time t,

$$\text{difference in proportion sent}_t = \sum_{i=1}^{t-1} w_4^{t-i-1} \frac{M_{1i}^{\text{Ego 2}} - M_{1i}^{\text{Ego}}}{10},$$

where M_{1i}^{Ego2} is the amount sent by Ego 2 at time i and M_{1i}^{Ego} is the amount sent by Ego at time i. For hypothesis 3.4b we took the same difference with respect to Ego 3, discounted by

[10] We also estimated a model with the same discount parameter w for all three variables operationalizing own past, but the model with three different weights fitted the data better.

[11] Clearly, we could include two parallel effects as we did for dyadic learning, adding a variable related to the amount earned by the other Ego. However, the two effects can be disentangled for the dyadic effects, because we have more observations and the effects are stronger. We run into collinearity problems if we try to disentangle these effects for third-party information. Therefore, we restrict ourselves here to the stronger effect, because substantially these two effects represent the same mechanism anyway. Moreover, the proportion returned by Alter 2 to Ego 3 seems a better operationalization for network learning, because this information is more easily accessible to Ego since it requires fewer calculations.

Table 3.2 Summary of the hypotheses and operationalizations

Hypotheses about effects on Egos' sending decision M_1	Expected sign	Operationalization
3.1 dyadic learning (amount earned)	+	Discounted sum of $E_1 - M_1 + K_2$
3.1 dyadic learning (proportion returned)	+	Discounted sum of K_2/mM_1
3.2a dyadic control	+	Number of periods to go
3.2a dyadic control (end-game effect)	+	Dummy = 1 for the last period
3.3a network learning (versus Ego 2)	+	Discounted sum of K_2/mM_1 (Ego 2)
3.3b network learning (versus Ego 3)	+	Discounted sum of K_2/mM_1 (Ego 3)
3.4a imitation (versus Ego 2)	+	Discounted sum of M_1 (Ego 2) – M_1 (Ego)
3.4b imitation (versus Ego 3)	+	Discounted sum of M_1 (Ego 3) – M_1 (Ego)
3.5a envy (versus Ego 2)	–	Discounted sum of max[0, K_2/mM_1 (Ego 2) – K_2/mM_1 (Ego)]
3.5b envy (versus Ego 3)	–	Discounted sum of max[0, K_2/mM_1 (Ego 3) – K_2/mM_1 (Ego)]
3.6 network control	+	Number of periods to go in conditions with full information on the tie to Ego 2, 0 otherwise
3.7a dyadic learning × uncertainty	–	Discounted sum of past K_2/mM_1 times uncertainty
3.7b network learning × uncertainty	–	Discounted sum of past K_2/mM_1 (Ego 2) times uncertainty
3.7c envy (versus Ego 3) × uncertainty	+	Discounted sum of max[0, K_2/mM_1 (Ego 3) – K_2/mM_1 (Ego)] times uncertainty

w_5.[12] For social comparison (envy), we took a discounted difference between the proportion returned from Alter 1 to Ego 2 and the proportion returned from Alter 1 to Ego in previous periods, for hypothesis 3.5a. Thus, at time t,

$$\text{envy}_t = \sum_{i=1}^{t-1} w_4^{t-i-1} \max[0, \frac{K_{2i}^{\text{Ego 2}}}{mM_{1i}^{\text{Ego 2}}} - \frac{K_{2i}^{\text{Ego}}}{mM_{1i}^{\text{Ego}}}],$$

where the superscript indicates which Ego received or sent the indicated amount, and m is equal to 3.[13] Similarly, we looked at the same difference with respect to Ego 3 in interaction with Alter 2, discounted by w_5 for hypothesis 3.5b.[14] For network control, we constructed an interaction term between the number of periods remaining before the end of the supergame and a dummy variable taking value 1 when the tie to Ego 2 carries full information. We operationalized network control in this way because the effect described in the theory and hypotheses section only applies if Egos can exchange full information. If Egos receive only partial information, the advantage of such exchange as derived by Buskens (2003) disappears.

[12] We use the same discount parameters w_4 and w_5 for all variables operationalizing information concerning Ego 2 and Ego 3, respectively.

[13] For all variables constructed using the proportion returned by Alter 1 or Alter 2 in previous periods, we assumed $m = 3$ in the experimental conditions with uncertainty.

[14] The effects of "guilt" could also be tested by looking at how Egos react when they are treated *better* than other Egos. However, preliminary analyses showed that actors only reacted when they were treated worse than other Egos, but did not care if they were treated better. Therefore, we include only envy in the analyses displayed here.

Uncertainty is included in the analyses simply as a dummy taking value 1 in the experimental conditions with uncertainty and 0 otherwise.[15] The hypotheses and operationalizations are summarized in table 3.2.

3.3.4 Individual characteristics

At the end of the experiment, subjects filled in a short questionnaire concerning some individual characteristics, such as gender, age, field of study, number of friends participating in the same session, and whether the subject is a blood donor.[16] Moreover, we included a set of 18 items on trusting attitude. Some of the items are adopted from Yamagishi and Yamagishi (1994) and Wrightsmann (1974). Eight of the initial items were excluded after a reliability analysis and the remaining 12 were entered in a factor analysis. Two factors were found and the standardized scores were used as trust indices. The first factor loads stronger on items referring to a preference for dealing with others with whom the respondent has a long-lasting relation and this factor can be compared to Yamagishi and Yamagishi's (1994: 151) "knowledge-based trust," while the second factor represents a general positive and benign attitude and can be compared with Yamagishi and Yamagishi's (1994: 147) "general trust scale." Assuming that subjects might differ in the extent to which they evaluate third-party information and are influenced by it, we included in the questionnaire a set of items that form an interpersonal influence scale. This two-dimensional scale is similar to Bearden et al.'s (1989) scale of susceptibility to personal influence, but we had to change the content of the items in order to suit the experimental context. The two dimensions for informational and normative influence could nicely be separated out using factor analysis.

3.4 Results

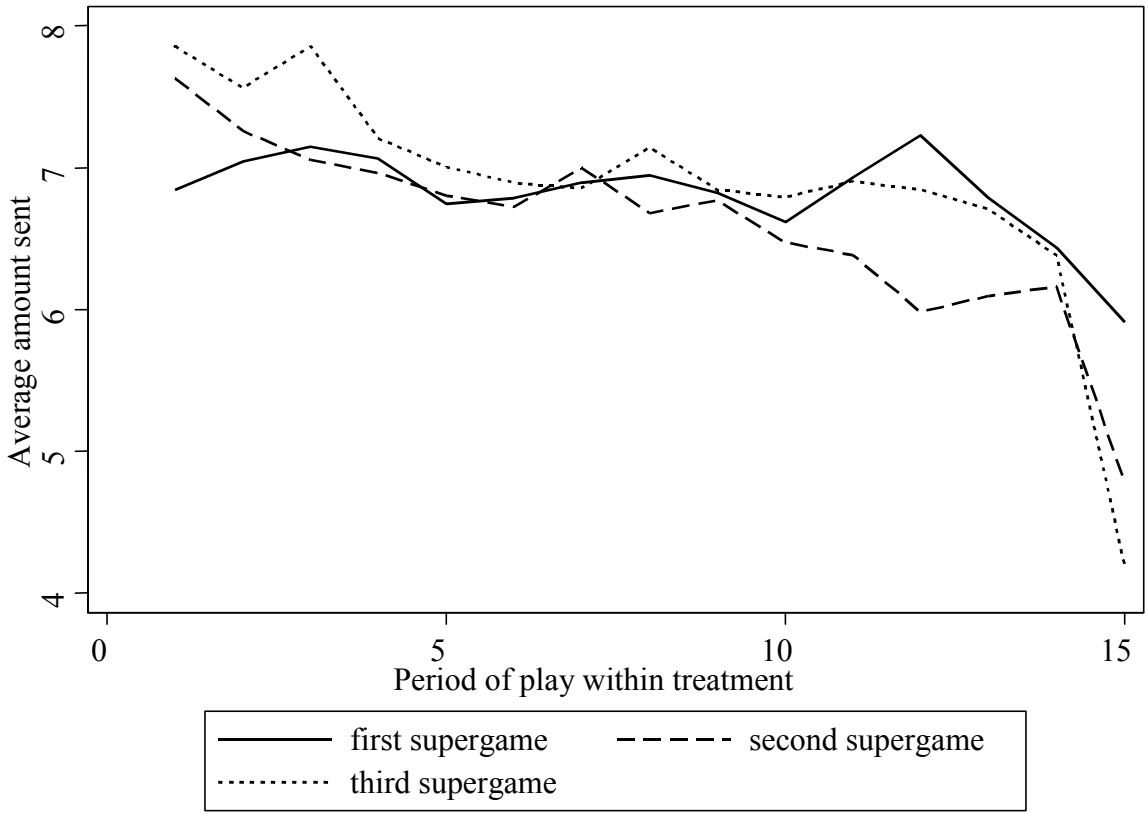
3.4.1 Description of the data

282 subjects participated in this experiment: each of the eight experimental conditions was implemented twice, each time with three networks of six subjects each, except in one case in which we only had two networks of six subjects. Therefore, $2 \times 6 \times 3 = 36$ subjects for seven

[15] Although we did not specify an hypothesis about the main effect of uncertainty, we included this variable in all models because we have hypotheses concerning interaction effects between uncertainty and network learning as well as envy.

[16] The experiment setting guarantees anonymity in the sense that subjects do not know with whom they are playing, but they often arrived at the laboratory in small groups. Therefore, if one subject knows some of the other participants this could influence her choices, as there is a higher probability that she might actually play with one of the participants she knows. We also asked our subjects whether they were blood donors, since this could be an indicator for more altruistic dispositions (for a similar use of this question see Snijders, 1996: ch. 4 and chapter 4 in this book).

Figure 3.3 Average amount sent per period in the three supergames



conditions, plus 30 for one condition (see table 3.1). Since we focused on the behavior of the Egos, only two thirds of the subjects were included in the analyses, while all the Alters were excluded. Every subject participated in three supergames of 15 games each. Thus, we have 45 × 188 = 8460 observations.[17]

First, we present some summary statistics for the experimental conditions. On average, most trust is placed in the conditions in which there is full information between the Egos playing with the same Alter. There is hardly any difference between certainty and uncertainty conditions and between partial or full information on the tie between the Egos playing with different Alters. As we see below, the effect of full information on the tie between two Egos playing with the same Alter is explained away by learning, control, imitation, and social comparison when the variables operationalizing these mechanisms are added to the model. In other words, trust is explained better by what happened and what is expected to happen in the game rather than by the experimental conditions only.

[17] Eight times an undergraduate student subject was replaced by a stand-in, mostly a PhD student. We excluded the choices of the PhD students from the analyses because some of the Ph.D. students have specific knowledge about the scope of the experiment. Still, excluding these subjects did not significantly affect the results of our analyses.

Figure 3.4 Average amount sent per period in all experimental conditions with certainty

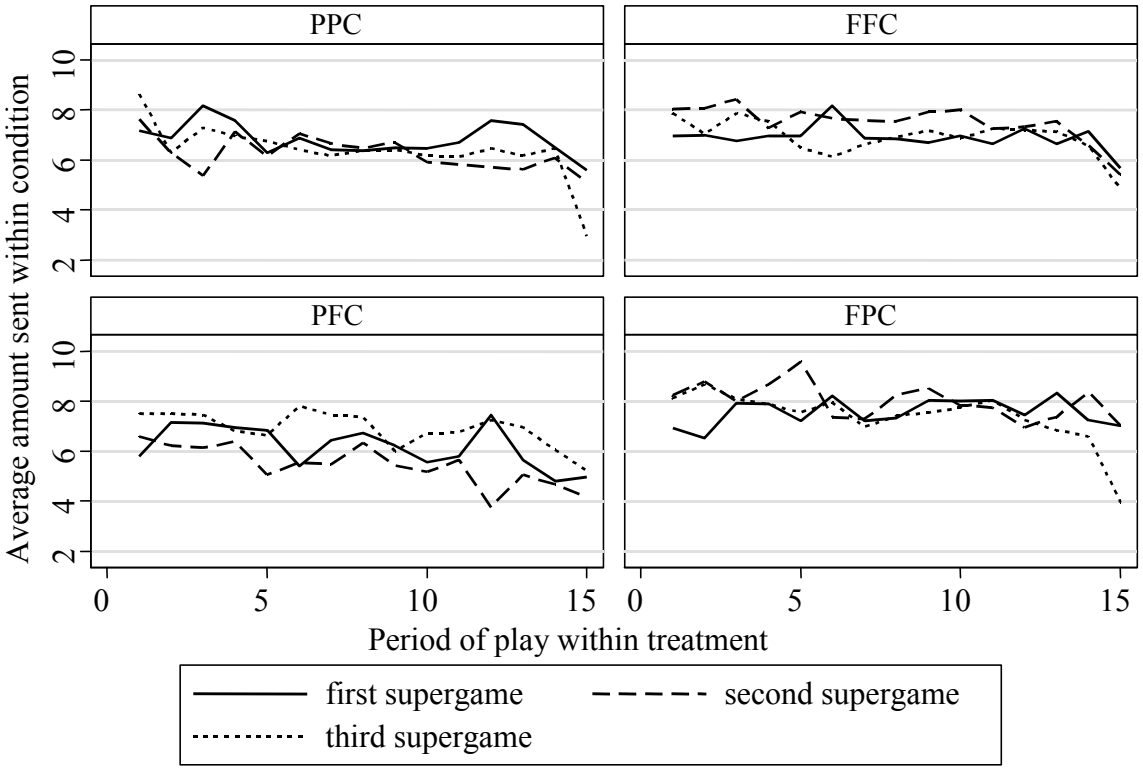
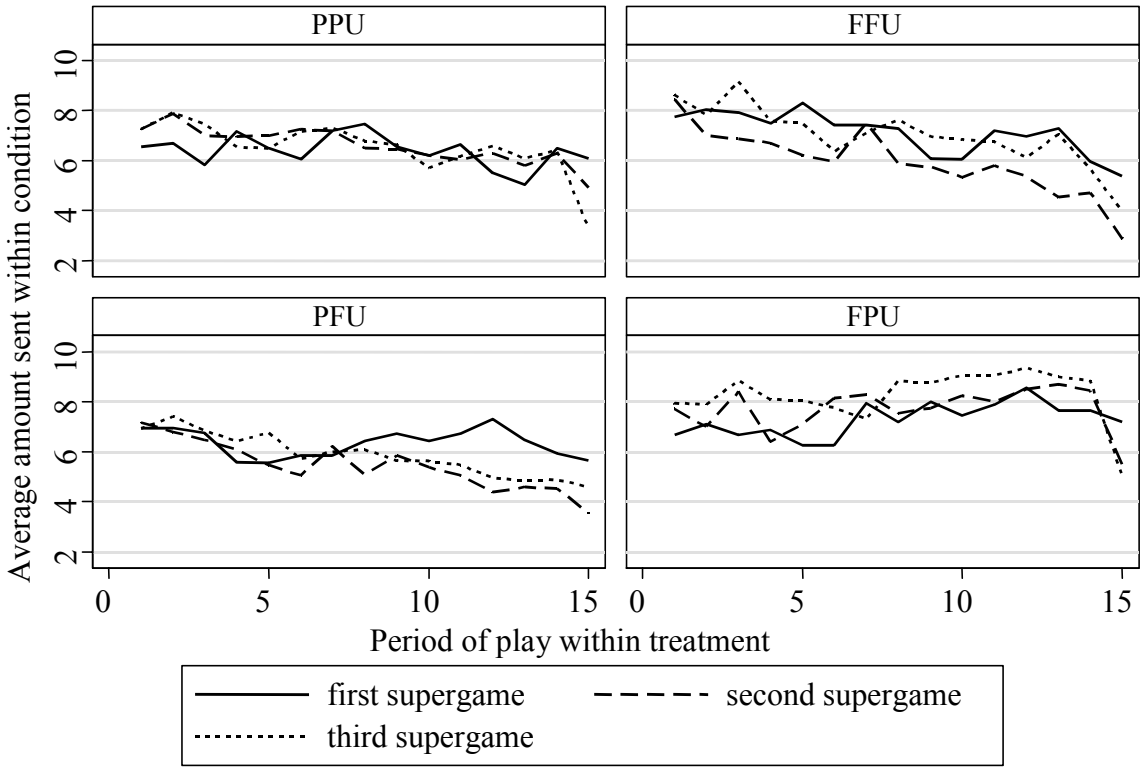


Figure 3.3 displays the average amount sent in every period of the three supergames. The graph makes directly evident that trust declines over time in all supergames and that the decline also tends to become steeper over time. Particularly, the initial level of trust increases from the first to the third supergame, whereas the final level of trust decreases from the first to the third supergame. This is partially due to the end-game effects which are clearly visible in the graph and become stronger in later supergames. In addition, we think that subjects realize, after having some experience, that starting with trust can be mutually beneficial. Figure 3.4 and 3.5 display the same information but now separately for every experimental condition. Interestingly, the average level of trust is slightly higher in the treatments on the right hand side of both figure 3.4 and 3.5. The difference between left and right hand of the figures is that the treatments on the right hand side start with full information in the first supergame, while on the left hand side they start with partial information in the first supergame. This seems to indicate that full information leads to more trust in the first supergame and the first supergame has some "spillover" effects on the following supergames: after full information in the first supergame, the average level of trust remains slightly higher and after partial

Figure 3.5 Average amount sent per period in all experimental condition with uncertaintv.



information in the first supergame, the average level of trust remain slightly lower. However, this spillover effect vanishes when controlling for all of the hypothesized effects.

Table 3.3 and 3.4 display the average percentage sent and returned respectively in all experimental conditions. As in figures 3.4 and 3.5, the average amount sent is slightly higher in experimental conditions starting with full information in the first supergame (table 3.3). Looking at table 3.4, the average amount returned is higher under conditions of full information on the tie to the Ego playing with the same Alter. Finally, uncertainty does not seem to affect the amount sent or the amount returned.

3.4.2 Tests of the hypotheses

Because different subsets of mechanisms are applicable in each supergame and because there might be spillover effects between supergames, the three supergames are analyzed separately. For every supergame, three models are presented, model 1 includes only main effects, model 2 also includes the interaction terms with uncertainty, and in model 3 variables concerning individual attributes are added. In the first supergame, Ego has a tie to Ego 2 but not to Ego 3

Table 3.3 Average number of points sent per experimental condition in every supergame (number of Egos in brackets)

	First supergame (Tie to Ego 2)		Second supergame (Tie to Ego 3)	
	Full	Partial	Full	Partial
Certainty	7.22 (48)	6.51 (48)	6.47 (48)	7.12 (48)
Uncertainty	7.19 (44)	6.37 (48)	5.68 (48)	7.11 (44)
	Third supergame			
	(Ties to Ego 2 and Ego 3)		(Ties to Ego 2 and Ego 3)	
	Full, full	Full, partial	Partial, full	Partial, partial
Certainty	6.90 (24)	7.37 (24)	6.89 (24)	6.37 (24)
Uncertainty	7.01 (24)	8.25 (20)	5.87 (24)	6.52 (24)

Table 3.4 Average number of points returned per experimental condition in every supergame (number of Alters in brackets)

	First supergame (Tie to Ego 2)		Second supergame (Tie to Ego 3)	
	Full	Partial	Full	Partial
Certainty	10.73 (24)	8.90 (24)	9.57 (24)	9.78 (24)
Uncertainty	10.10 (22)	7.92 (24)	6.83 (22)	9.76 (24)
	Third supergame			
	(Ties to Ego 2, Ego 3)		(Ties to Ego 2, Ego 3)	
	Full, full	Full, partial	Partial, full	Partial, partial
Certainty	10.50 (12)	10.45 (12)	10.26 (12)	9.11 (12)
Uncertainty	10.06 (12)	11.44 (10)	7.89 (12)	8.66 (12)

and vice versa in the second supergame. In the third supergame, both ties are present. Therefore, all variables related to Ego 2 are included in the analyses of the first and third supergame, but not in the second, while all variables related to Ego 3 are included in the analyses of the second and the third supergame, but not in the first. For all variables referring to past experience, it seems reasonable to assume that recent experience has a stronger effect on current decisions than experiences from further back in the past. Thus, a discount parameter was applied to all past variables. This discount parameter was estimated by iterations, and the value of this parameter that gave the best fit based on the log-likelihood of the models was chosen. Nine variables referring to past experience are included in the analyses: three for own past (the amount sent in previous periods, the points earned in

Table 3.5 Optimal discount parameters for various learning variables

Variable	w_i	value
Dyadic learning 1 (amount earned)	w_1	0
Dyadic learning 2 (proportion returned)	w_2	0.9
Ego's past sending decisions	w_3	0.5
Network learning (Ego 2)	w_4	0
Network learning (Ego 3)	w_5	0

previous periods, and the proportion returned by Alter 1 in previous periods), three for Ego 2's past (the proportion returned by Alter 1 in previous periods, the difference between the amount sent by Ego 2 and the amount sent by Ego, and the difference between the proportion returned to Ego 2 and the proportion returned to Ego), and the same three variables for Ego 3 in games played with Alter 2. We used three different weights for own past, one per every variable, but we used only one weight for Ego 2's past and one for Ego 3's past. Initially, we also tried different values for different types of past with respect to the third parties, but whatever combination we tried, the conclusion was always the same only third-party experiences from the last period matter for Ego's current decision, i.e., these weights related to Ego 2 and Ego 3's past always equal 0. This is in line with the results found by Buskens (2004) in a similar experiment on the Trust Game.

Also for the amount earned by Ego in the past, the discount parameter w_1 that fits the data best equals 0. The proportion returned to Ego seems to loom longest, since for that parameter w_2 is estimated at 0.9. Finally, the estimated discount parameter for the amount sent by Ego w_3 is 0.5. These discount parameters were estimated independently for all three supergames. These estimations proved quite consistent, and therefore the same values of the discount parameters were fixed for all analyses (see table 3.5). We were not able to simultaneously estimate the discount parameters and the random-effects interval regression model. Therefore, we do not have confidence intervals for the estimations of the discount parameters and the standard errors in the analyses provided below are conditioned on the assumption that the discount parameters indeed equal the estimated value.

The analyses of all three supergames are displayed in table 3.6. We added a dummy variable for the first period in order to control for how subjects start the game. This variable is positive and significant in all models, showing that Egos, on average, start by investing a relatively large part of their initial endowment. The second variable in the model is *Ego's past sending behavior,* which accounts for individual propensity to stick to one's own trust

decisions. This variable is strongly significant in all analyses, implying that subjects might adjust their behavior based on their experiences or on changes in the circumstances, but their own past decisions determine their current choices to a considerable degree. Hypotheses 3.1a and 3.1b on *dyadic learning* are consistently supported in all models. The amount earned in the past as well as the proportion returned in the past have a strong positive effect on Ego's trusting decision. Hypotheses 3.2a and 3.2b on *dyadic control* are also consistently supported. The end-game effect ("last round") is not significant in the three models referring to the first supergame, but it becomes increasingly significant in the two following supergames. This result can also be seen in the graphs displayed in figure 3.3. The amount sent declines steadily from period 1 to period 14 and then it drops almost to zero in the last period and the effect of the last period is stronger in later supergames. This result indicates that in the first supergame subjects experience that trust is more likely to be abused in the last round, and therefore they become more careful in the last rounds of subsequent supergames. The increasing effect of dyadic control might also be caused by the fact that subjects realize only after a certain amount of experience that they have more sanction opportunities against their Alter in earlier periods of a supergame and that Alter might take this into account as well. The dyadic variables provide the most consistent results and are the most important predictors for the behavior of Egos.

Now, we turn to the network effects. *Network learning* is significant only in the first supergame, where information about the proportion returned to Ego 2 by Alter 1 in the past has a significant positive effect on Ego's present trusting decision. Therefore, hypothesis 3.3a is supported only in the first supergame. Conversely, Hypothesis 3.3b is not supported. Actors do not learn from the behavior of other Alters in interactions with other Egos, in fact network learning with respect to Ego 3 is not significant in any of the models concerning the second supergame nor in any of the models concerning the third supergame.

Imitation is the effect of the behavior of other Egos in the past on Ego's decision in the present. We included this variable twice in order to control separately for the effects of the behavior of other Egos when information about the related Alter's returning decisions was available (full information), and when it was not available (partial information). We did this by interacting this variable once with a dummy with value 1 if information was full, and once with a dummy with value 1 if information was partial. Both these variables are strongly significant, which means that actors imitate both when they have partial information and when they have full information. Therefore, hypothesis 3.4a is supported in both supergames with information about Ego 2. The combination of the effects of network learning and

imitation under full information gives an indication about the extent to which Egos actually learn or just imitate what Ego 2 does. In the first supergame, learning as well as imitation plays a role. Surprisingly, the learning effect disappears in the third supergame. One ad-hoc explanation for this might be that the higher complexity of the third supergame leads subjects to use the more straightforward mechanism, namely imitation. Conversely, hypothesis 3.4b is not supported. In the second supergame, the results show some weak support for the hypothesis that Egos imitate Ego 3 only when information concerning the behavior of Alter 2 is not available (partial information), otherwise they ignore it. Apparently, Egos do not become more, or less trustful towards their own partner from observing Ego 3 interacting with Alter 2. We do not have an explanation for the even negative imitation effect related to Ego 3 under full information in the third supergame.

Concerning envy, we find mixed results. Hypothesis 3.5a is supported in the first supergame, but not in the third supergame, although this effect is in the expected direction. The strong negative effect in the first supergame implies that if Alter 1 returned more to Ego 2 than to Ego in the past, Ego punishes him by sending significantly less in the current period. Again the much weaker effect in the third supergame might be caused by the increased complexity, which decreases subjects' concern with this rather subtle effect. Concerning envy toward an Ego 3 playing with Alter 2, we particularly expect an effect under certainty because returns made to Ego 3 under uncertainty are difficult for Ego to evaluate since the multiplier of Alter 2 can be different from her Alter's multiplier. In the second supergame we do not find any effects of envy toward Ego 3. However, in the third supergame, there is a strong negative effect for envy toward Ego 3 under certainty, while the interaction effect with uncertainty shows that this effect does not exist under uncertainty. One problem with testing the hypotheses with respect to envy is that we can only test them in a meaningful way if Alters provide Egos with a reason to be envious. We know that the behavior of the Alters is rather consistent toward the two Egos they are playing with, which implies that the Egos do not often have a reason to be envious toward Ego 2. The two Alters are not informed about each others' behavior, so one could expect more possibilities for envy between the focal Ego and Ego 3.

Table 3.6 Random-effects interval regression with random effects at the level of the subjects and at the level of the observations

Hyp.	Dependent variable: Ego's choice M_1 / Variables	Expected sign	1st supergame (tie to Ego 2) Model 1	Model 2	Model 3	2nd supergame (tie to Ego 3) Model 1	Model 2	Model 3	3rd supergame (tie to Ego 2 and Ego 3) Model 1	Model 2	Model 3
	First round		3.78**	3.77**	3.79**	5.66**	5.68**	7.08**	5.98**	5.90**	6.02**
	Ego's past trustfulness		3.17**	3.16**	3.18**	3.83**	3.85**	5.33**	4.00**	3.93**	3.97**
	Uncertainty		.29	.03	-.09	-.23	.02	.02	.19	.43	.25
3.1	Dyadic learning 1 (amount earned)	+	.24**	.24**	.24**	.33**	.33**	.34**	.43**	.43**	.43**
3.1	Dyadic learning 2 (proportion returned)	+	.72**	.65**	.64**	2.36**	2.49**	1.86**	1.63**	1.63**	1.66**
3.2a	Dyadic control	+	.21**	.21**	.21**	.51**	.51**	.46**	.41**	.41**	.41**
3.2b	Last round	–	-.52	-.52	-.52	-1.47**	-1.47**	-1.31**	-3.82**	-3.79**	-3.77**
3.3a	Network learning (Ego 2)	+	1.61**	1.41*	1.43*				-.27	-.31	-.03
3.3b	Network learning (Ego 3)	+				-.49	-.73	-1.24	.46	1.30	1.56
3.4a	Imitation (Ego 2) × full information	+	1.06**	1.07**	1.07**				2.33**	2.25**	2.27**
3.4a	Imitation (Ego 2) × partial information	+	1.33**	1.33**	1.34**				1.26**	1.27**	1.30**
3.4b	Imitation (Ego 3) × full information	+				.13	.11	.39	-.97*	-.91*	-.85*
3.4b	Imitation (Ego 3) × partial information	+				.80*	.82*	1.00**	-.35	-.35	-.33
3.5a	Envy (Ego 2)	–	-3.33**	-3.34**	-3.13**				-.89	-.87	-.90
3.5b	Envy (Ego 3)	–				.23	.34	.51	-1.73	-3.68*	-3.81*
3.6	Network control	+	-.00	-.00	.00				.06	.06	.07*
3.7a	Dyadic learning 2 × uncertainty	–		.15	.17		-.28	-.35		.09	.07
3.7b	Network learning (Ego 2) × uncertainty	–		.48	.34					-1.28	-.40
3.7b	Network learning (Ego 3) × uncertainty	–					.41	1.17		-2.12	-2.24
3.7c	Envy (Ego 3) × uncertainty	+					-.17	-.99		4.03*	4.12*
	Man				.05			-.16			-1.50**
	Age				-.05			.07*			.07
	Friends				-.05			.16**			.13
	Donor				.28			-.01			-.44
	Economics				-1.42**			-.79*			-1.27*
	General trust				.04			-.10			-.04
	Knowledge-based trust				.46**			-.01			.26
	Constant		.41	.56	1.88	-3.88**	-4.02**	-6.22**	-2.78**	-2.90**	-4.04**
	Random effect at the subject level		1.64	1.65	1.54	1.77	1.75	.43	2.15	2.17	2.00
	Random effect at the observation level		3.60	3.60	3.60	4.58	4.58	4.73	4.57	4.56	4.56
	Log likelihood		-4943.7	-4943.3	-4935.8	-4370.8	-4370.2	-4378.4	-4081.2	-4079.0	-4069.5
	Number of observations (subjects)		2700 (180)	2700 (180)	2700 (180)	2700 (180)	2700 (180)	2700 (180)	2700 (180)	2700 (180)	2700 (180)

**, * Indicate significance levels of $p < 0.01$, $p < 0.05$, respectively. One-sided significance for effects for which hypotheses are indicated in the table and two-sided significance for the other variables.

Network control is only weakly significant in the last model of the third supergame, but not in the first supergame, thus hypothesis 3.6 is not supported. The slight increase of the effect from the first to the third supergame might indicate that some of the subjects start to appreciate sanction opportunities via the network. This result is consistent with Camerer and Weigelt (1988) who, in their well-known experimental test of the sequential equilibrium in a finitely repeated Trust Game, report that subjects learned to play the predicted equilibrium after they experienced some supergames. Thus, in our experiment, a longer sequence of supergames would be necessary in order to see whether this effect really becomes significant if subjects have even more experience.

Finally, *uncertainty* does not seem to affect dyadic and network learning effects. Uncertainty has no effect on imitation, because imitation is not based on the returns of an Alter anyway, so it is not affected by whether or not Ego knows how much an Alter can return. None of the interactions with dyadic and network learning are significant. Hence, hypotheses 3.7a and 3.7b are not supported. Only in the third supergame, we find the clear and well-interpretable interaction with envy discussed above. In fact only one interaction term is significant in the third supergame. Thus, we find some support for hypothesis 3.7c.

In all supergames, the third model includes some of the variables accounting for individual attributes. It is possible that subject characteristics determine the extent to which they trust as well as the extent to which they are influenced by experiences in games within the experiment. Therefore, in order to make sure that the differences in trusting behavior are caused by the experimental manipulations, rather than by differences between subjects, we ran several analyses to see whether main or interaction effects with subject characteristics change the results of the analyses. The following main effects that account for individual attributes are included in model 3: gender, age, number of friends participating in the same experimental session, being a blood donor, studying economics, and the two standardized scores obtained from a factor analysis of the trust scale. Comparing model 3 across the three supergames, it is reassuring to see that the effects of the variables for which we derived hypotheses do not depend on whether or not the variables for individual characteristics are included. However, the effects of the individual characteristics themselves look rather unstable. The only consistent finding is that economists trust less than students from other disciplines (in this case mostly sociology and psychology). Even the items that are intended to measure trust do not affect the extent to which subjects trust others. However, given the relatively small number of subjects in the experiment and the limited variation in some of these variables, it is not surprising that we find no significant individual differences.

We tested several hypotheses on the interaction effects between individual characteristics and the other variables. The two most important are discussed below. One might think that subjects with a higher tendency to trust would initially trust more, but that this effect would disappear after some experience with their partner. However, we also did not find interactions with subject characteristics and the extent to which they place trust in the first period of a supergame. We included a set of items in the questionnaire that form an interpersonal influence scale in order to be able to control whether subjects reacted differently to the manipulation of third-party information. Although these items form a clear two-dimensional scale, we do not find consistent interactions of either one of these dimensions with the effects of past experiences. However, in some of the analyses there were some weak effects, especially concerning information variables that contain ambivalent information, such as partial information from Ego 3 about past experience with Alter 2.

3.5 Conclusions and discussion

In this chapter, different effects of third-party information in trust problems are compared. A trust problem is defined and operationalized by means of the Investment Game. Hypotheses derived from a range of theories are tested in a laboratory experiment in which subjects play a repeated Investment Game and simultaneously exchange information about the game played. Two types of embeddedness are discussed, dyadic embeddedness, referring to situations in which two actors play the Investment Game repeatedly together, and network embeddedness, referring to situations in which two actors play the Investment Game while being part of a network of actors connected to one another by a certain relation. Particularly, the analyses focus on information exchange relations. Existing theories stress the importance of mechanisms such as learning, control, imitation, and social comparison. The experiment allowed us to test hypotheses reflecting all of these mechanisms in a controlled environment. Moreover, since the effects of information are expected to be particularly important under uncertainty, uncertainty was manipulated together with information conditions. The analyses focused on actors' trusting behavior, while past trustworthiness of other actors was used as one of the predictors for trusting behavior.

The effects of dyadic embeddedness on trust were strong and consistent in all experimental conditions. The Egos were particularly influenced by their own past experience with their Alter (dyadic learning) and by the length of the expected future with their Alter (dyadic control). For network embeddedness, not all predicted effects were consistently

supported. We found strong support for imitation of the behavior of other Egos playing with the same Alter as the focal Ego.

The most striking new result from this experiment is that only in the less complicated manipulations the Egos were influenced by how their Alter behaved towards other Egos. In more complicated settings, the Egos imitated what other Egos did with their Alter, but they hardly took the responses of their Alter towards the other Egos into account. Furthermore, the Egos were hardly influenced by the behavior of other Egos involved with other Alters. This seems in contrast with the findings from chapter 2 where the Egos' choices were affected by information about other Alters. However, in this experiment, the Egos *either* had information about their Alter *or* about another Alter. Our experiment shows that if Egos have a combination of both types of information, information about another Alter becomes irrelevant.

Another new result in the context of Investment Games is the support we found for the effects of social comparison. In the network configuration characterized by only one tie between two Egos playing with the same Alter, the Egos punished their Alter if he treated the other Ego better than them. Conversely, in another network configuration in which every Ego had two ties, one to another Ego playing with the same Alter and one to another Ego playing with another Alter, Egos reacted by punishing their Alter when they saw that the other Alter was being more generous than their own Alter. There was hardly any support for network control. Contrary to our hypotheses, the learning and social comparison effects were hardly mitigated by uncertainty.

Summarizing, this chapter provides new and complementary evidence for learning and control mechanisms on trust (see Buskens and Raub, 2002). While in Buskens and Raub (2002) evidence for learning and control effects was provided from a survey on IT transactions and two vignette experiments, here we find similar evidence in a laboratory experiment. Moreover, this experiment provided the possibility to distinguish between learning, imitation, and social comparison, while the earlier studies focused on learning only. However, we also encountered some puzzling results, probably due to the complexity of our experimental design. In particular, the lack of evidence for the effects of uncertainty and the strong support found for imitation effects, as opposed to the weak support found for a real learning mechanism, seem to indicate that our subjects preferred to opt for more parsimonious heuristics rather than thoroughly evaluate all the information that was made available to them. Furthermore, Alter's behavior is difficult to interpret, as a high return might reflect other-regarding preferences, a reciprocity norm, or it could simply result from a strategic concern

for future losses. Consequently, Egos might decide to copy others' choices and neglect information about Alter's behavior in interactions with other Egos.

In addition, some of our findings indicate that subjects learn how to play throughout the different parts of the experiment. Thus, some effects become stronger in later stages, e.g. end-game effects, whereas other effects become weaker, e.g. network learning effects. Although we analyzed all supergames separately, since subjects were systematically reshuffled after every supergame, some spillover effects could have affected the choices made in later stages of the experiment. This may have caused subjects to start focusing more on certain information, such as the number of periods to go, and less on other information, such as the Alter's past behavior with a different Ego.

The problems raised above call for future research. Particularly, Alter's behavior still remains largely uninvestigated, although understanding Alter's motivations could prove very helpful also in order to improve the explanation of Ego's behavior. Part of the problem can be due to the complexity of the Investment Game. However, Alter's choice could be simplified by restricting it to a dichotomous choice, as in the Trust Game. We found no support for the effects of uncertainty on the use of information. It might be possible to observe this effect by using a laboratory experiment with a simpler design, focusing specifically on uncertainty. Finally, the results presented here support a range of different mechanisms operating simultaneously while the predictions made here are derived from various theoretical arguments, rather than from an integrated theoretical model. Building such an integrated model will be a challenge for future research. The outcomes of this study provide useful information on the importance of certain assumptions related to the importance of third-party information which could be included in these future models. More specifically, such a model should include forward-looking arguments related to control, backward-looking arguments on learning and imitation, and even sideward-looking arguments on social comparison and other-regarding preferences (cf. Macy and Flache, 1995; Flache, 1996).

Chapter 4

Trust and Trustworthiness in Negotiated Exchange*

Abstract

Negotiated exchanges and trust problems can be regarded as two different forms of exchange, the former representing exchanges with negotiation and binding contracts, the latter representing asymmetric transactions in which one actor has the opportunity to deceive the other. Both forms of exchange have been extensively studied, but the two respective research traditions exhibit very little overlap. In this chapter we investigate the effects of negotiated exchanges in different network structures on the development of mutual trust. We derive hypotheses from various theories and test them by means of an experiment in which subjects first undertake a series of negotiated exchanges under various power conditions, and then face a trust problem with one of the actors that was involved in the previous exchanges. The negotiated exchanges create transaction-unspecific information that the actors can use to make their decisions in the subsequent trust problem. The trust problem is operationalized by means of a one-shot Investment Game which allows us to look separately at trust and trustworthiness. Our results demonstrate that negotiated exchanges increase mutual trust, but not trustworthiness.

* A slightly different version of this chapter is currently under review (Barrera, 2004).

4.1 Introduction

Since the beginning of the 80s "social exchange" and "trust" have been extensively studied by scholars from different disciplines such as sociology, social psychology, economics, and business administration. The social exchange tradition originated from Blau's (1964), Homans' (1958), and Emerson's (1981) classical contributions and developed predominantly in the direction of negotiation in small exchange networks. Research on trust, on the other hand, has mainly focused on the role of trust as a "lubricant for cooperation" (Arrow, 1974: 23). However, albeit many social exchanges in real life involve trust (e.g., economic transactions or labor relations), the two topics have constantly been kept separated and the two research traditions exhibit very little overlap (Kollock, 1994 and Molm et al., 2000 are two exceptions). Research on social exchange focuses on exchanges that involve negotiation and result in binding agreements. Conversely, research on trust focuses on exchanges that do not necessarily involve negotiation and that result in non-binding agreements. Thus, in negotiated exchanges actors typically cannot deceive each other, whereas the risk of deception is one of the key features of trust problems. However, the distinction between trust and exchange is never so sharp in real-life situations. For example, two firms engaged in an economic transaction with each other might undertake extensive negotiations over the specific terms of the exchange and draw up a detailed contract specifying reciprocal obligations, thus minimizing the risk of deception. However, if the two firms have an established commercial relation involving repeated transactions, they might come to learn about the trustworthiness of their partner and develop some form of mutual commitment, economizing on the legal expenses for writing extensive contracts (see Macaulay, 1963 for a classical study of the role of legal sanctions in exchange relationships). This way a relationship regulated by fully binding agreements can develop into a relationship based on mutual trust.[1] In addition, the two firms could bargain from different power positions, for example because alternative exchange partners are available to only one of them. How would the negotiation between two such partners affect the development of mutual trust?

Research on the effects of negotiation in exchanges concerns, on the one hand, social-psychological literature on the development of commitments and group formation (Lawler and Yoon, 1993, 1996, 1998; Lawler, 2001) and, on the other hand, research on economic contracts (Sitkin, 1995; Malhothra and Murnighan, 2002). The first line of research has paid

[1] Consistent with this arguments, contractual safeguards have been studied as means to reduce trust problems and the extent to which formal safeguards are applied in contracts has been taken as a measure for lack of trust (Buskens, 2002: ch. 5; Batenburg et al., 2003).

little attention to the emergence of interpersonal trust, focusing instead on the effects of repeated exchanges between actors embedded in different types of power relationships on relational commitment and affection. The body of research produced in this line of study indicates emotions that are associated with the exchange as the explanatory mechanism for the development of committed relationships (see Thye et al., 2002 for a review of the research program). The second line of research focuses on the effects of negotiation and contracts on trust. In the literature on contracts, two contrasting arguments are found: one stressing the positive effects of contracts on trust, the other emphasizing the negative effects. The "positive effects" argument claims that contracts are used to overcome initial trust problems in economic transaction. Thus, contracts are useful in order to establish cooperation between strangers (see Sitkin, 1995 for an example in this line of research). The counterargument focuses on the importance of risk in the development of trust relations. According to this argument, when actors have the possibility and the incentive to deceive their partners but do not, they are showing that they can be trusted. Therefore, the option for the actors to deceive their partner is considered an essential element for the development of a trusting relation and hence formal contracts, insofar as they remove this option, do not allow trust to develop. Theoretically, assuming that actors cannot assess their partners' trustworthiness if they do not run the risk of being deceived, two consequent scenarios are possible: either the level of interpersonal trust does not change after negotiated exchanges have taken place or the level of interpersonal trust decreases after actors have had negotiated exchanges, resulting in binding agreements. According to the first scenario, the effects of contracts on interpersonal trust would actually be null rather than negative and would only be truly negative in the second scenario. However, the second scenario requires additional assumptions about actors' cognitive response to contracts, for example, framing effects: a request for a contract contemplating all possible mishaps and deceptions might convey a non-cooperative signal to the partner (Lindenberg, 2000) or cause her attention to focus more on the risks involved in the transaction, so that, once the contract is removed, trust becomes more problematic. Nevertheless, in the literature these two scenarios are not theoretically distinguished, and there is more empirical evidence for negative rather than for null effects (see Malhothra and Murnighan, 2002 for a recent example). Moreover, literature on contracts and negotiation in economic transactions generally neglects the role of power differences in the emergence of trust relations. Therefore, this study aims at exploring the impact of negotiated exchange under different power conditions on the development of trust.

Molm et al. (2000) provided one of the few studies that investigated the effects of repeated exchanges on the emergence of commitment and mutual trust. However, this study focuses on comparing different forms of exchanges to see which one yields more interpersonal trust. Moreover, Molm et al. measured trust by means of a single-item attitudinal question. This measure, however, might prove problematic due to limited validity. In fact, in a recent study about the measurement of trust, Glaeser et al. (2000) found that attitudinal measures of trust predict trustworthy behavior better than trusting behavior. Therefore, the aim of this chapter is twofold: we designed an experiment to analyze the effects of negotiation in repeated exchanges on the development of mutual trust under different power conditions and we applied a behavioral measure of trust in order to overcome validity problems concerning attitudinal measures of trusting behavior. Thus, we operationalize trust using the Investment Game devised by Berg et al. (1995), which also allows to distinguish between trusting and trustworthy behavior.

The next section provides background concerning the literature on exchange and trust and illustrates the constituent game applied in our laboratory experiment. Section 4.3 outlines the theoretical arguments from which we derive our hypotheses. Section 4.4 deals with methodological issues, section 4.5 presents the empirical results of our experiment, and section 4.6 concludes and addresses possibilities for future research.

4.2 Background

4.2.1 Exchange and power

Experimental research in social exchange started with the seminal work of Stolte and Emerson (1977), who designed the first laboratory experiment in which actors embedded in small social networks could exchange with each other. In this pivotal experiment, the effects of small social structures on individual activity were observed for the first time. Subsequently, social relations became increasingly salient and research in social exchange moved its focus towards the study of more complex social structures. Sociological theories of exchange identified four different types of exchanges: *negotiated*, *reciprocal*, *generalized,* and *productive* (see Emerson, 1981; Molm, 1994; Molm and Cook, 1995). Negotiated exchanges involve binding agreements between exchanging partners which cover the terms of the exchange, such as actor A selling a good to actor B. Reciprocal exchanges are sequential unilateral transfers of benefits over time between two exchanging partners such as actor A helping actor B at time t and actor B helping actor A at time $t+1$ (see Molm, 1990, 1997 for a research program on reciprocal exchanges). Generalized exchanges involve more than two

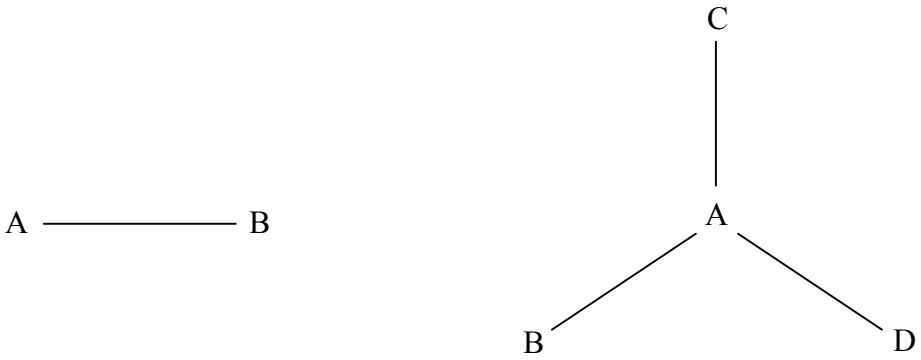
actors and the exchange of benefits is indirect, for example, actor A helps actor B at time *t*, actor B helps actor C at time *t*+1, and actor C helps actor A at time *t*+2. Productive exchanges are actor-to-group transactions in which all members of a group contribute to create a collective endeavor from which in turn all actors benefit.

Research in network exchange has focused especially on the development of theoretical models predicting the division of a given pool of resources in negotiated exchanges. The experimental manipulation of simple networks allowed scholars to study human activity, such as power exercise, resulting from restrictions imposed by given social structures. Actors exercise power by exploiting the opportunities that the structure offers them in order to obtain greater benefits from the interaction. Network exchange theorists usually consider settings in which actors are embedded in a given network structure that specifies exchange relations available to them. Formalized theoretical models are used to predict actual exchanges and their outcomes. These predictions are subsequently tested in laboratory experiments. The exercise of power is inferred by observing the transfer of valued resources between actors embedded in a network. High power actors gain most of the resources available to the exchange. Several contrasting theoretical models for predicting rates in negotiated exchanges have been proposed. Important contributions include applications of the game-theoretic core (Bienenstock and Bonacich, 1992, 1993), expected value theory (Friedkin, 1992, 1993), identity theory (Burke, 1997), power-dependence theory (Cook et al., 1983; Cook and Yamagishi, 1992), and exchange resistance theory (Markovsky et al., 1988; Willer and Markovsky, 1993; Willer, 1999).[2]

Assuming that individuals try to maximize their earnings, power in exchange networks depends on the possibility that one or more actors are excluded from the exchange. A network in which, under specific exchange conditions, one or more actors are necessarily excluded is called *strong power*. More precisely, "a network is strong power if and only if (1) its positions can be divided into one or more high power positions that are never excluded, (2) two or more low power positions, at least one of which is always excluded; and (3) low power positions can exchange only with high power positions" (Willer, 1999: 56-57). For example, figure 4.1a represents a simple dyad in which the two positions A and B are perfectly identical. This type of exchange relation does not contain power differences, therefore the exchange rate between A and B is the equal power ratio and the relation AB is called *equipower*. Figure 4.1b represents a four actors network called branch31. If the actors in this network are only

[2] For a comparison of most of these theories see Skvoretz and Willer, 1993; Lovaglia et al., 1995 or the special issues of *Social Networks* 14, No. 3-4.

Figure 4.1 Network structures: equipower versus strong power



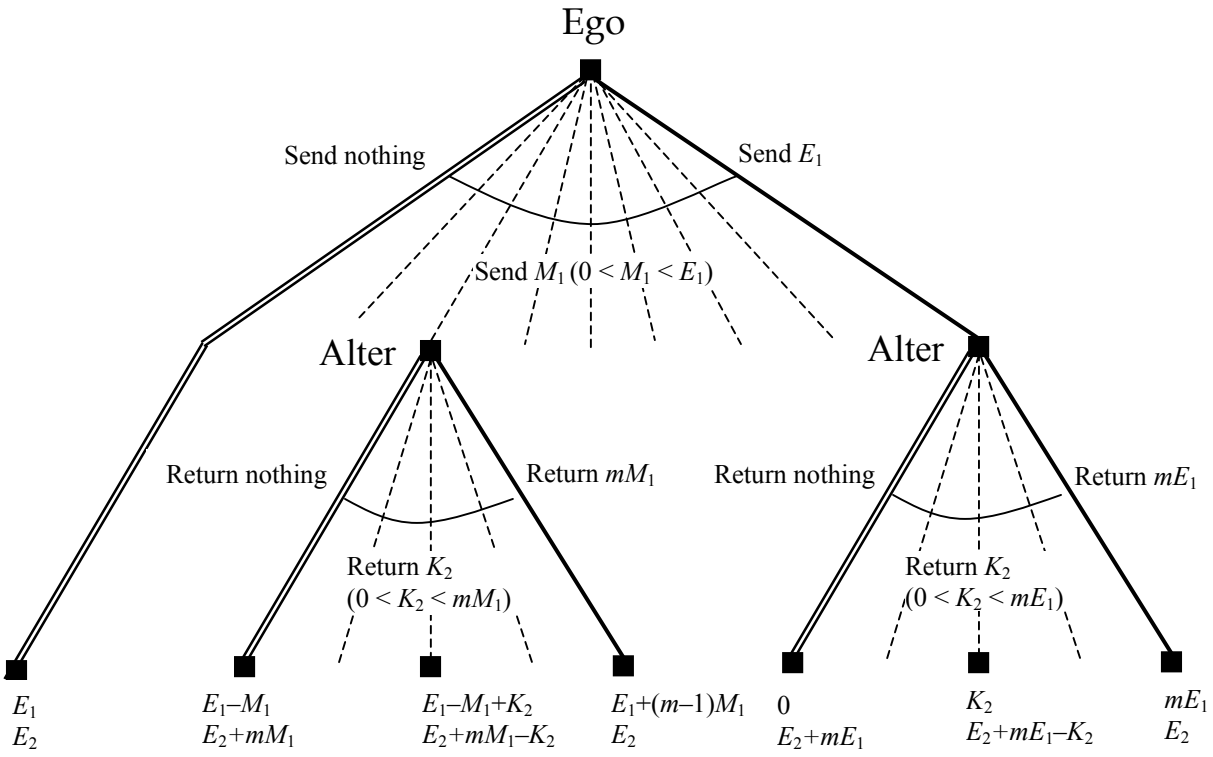
(a) Dyad (b) Branch31

allowed to complete one exchange, position A has a structural advantage over the three peripheral actors, because two of them will necessarily be excluded from the exchange while A can never be excluded. Thus, actors occupying positions B, C, and D will offer exchange rates increasingly favorable to actor A trying to avoid exclusion, and actor A will gain most of the resources available in the exchange. Therefore, position A is high in power while positions B, C, and D are low in power. Although they make different assumptions about the actors, most exchange theories make rather accurate predictions on the division of resources for these simple networks.

4.2.2 Trust and the Investment Game

Following Coleman (1990, ch. 5) we conceptualize trust as an interaction involving two interdependent actors. According to Coleman, a trust problem is defined by four characteristics: 1) actor 1 (Ego) has the possibility to place some resources at the disposal of actor 2 (Alter), who, in turn has the possibility to honor or abuse trust; 2) Ego prefers to place trust if Alter honors trust, but regrets placing trust if Alter abuses it; 3) there is no binding agreement that protects Ego from the possibility that Alter abuses trust; 4) there is a time lag between Ego and Alter's decisions. This definition is consistent with the game-theoretic formalizations of the *Trust Game* (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990) and the *Investment Game* (Berg et al., 1995; see also Ortmann et al., 2000). These two games differ because in the Trust Game "trust" and "trustworthiness" are represented by dichotomous choices – trust vs no trust, honor vs abuse –, while the Investment Game exhibits a certain degree of "continuity" both in the choice of placing trust and in the choice

Figure 4.2 Investment Game



of honoring or abusing trust. For this reason, we employ the Investment Game (see figure 4.2) in our theoretical analysis as well as in our experiment.

In the Investment Game, the two players start with an initial endowment E_i. Ego then has the possibility to send all, some, or none of her endowment to Alter. The amount of money that she decides to send, denoted M_1, is then multiplied by a factor m (with $m > 1$). Alter receives an amount equal to m times the amount sent by Ego. Then he can decide to send back to Ego all, some or none of the money he has received. The amount returned by Alter – denoted K_2 – is not multiplied. After players have chosen their actions, the game ends and the payoffs are computed (in figure 4.2 the payoffs earned by Ego and Alter are displayed one above the other next to the end nodes of the game). The payoff earned by Ego (V_1) is:

$$V_1 = E_1 - M_1 + K_2,$$

while the payoff earned by Alter (V_2) is:

$$V_2 = E_2 + mM_1 - K_2.$$

The amount that Ego is willing to send to Alter indicates the extent to which Ego trusts Alter. Therefore, we refer to Ego's choice M_1 as *trust.* Conversely, the amount that Alter is willing to return to Ego represents Alter's trustworthiness. Therefore we refer to Alter's choice K_2 as *trustworthiness.*[3] The Trust Game can be seen as a "special case" of the Investment Game in which Ego decides whether to send everything or nothing to Alter ($M_1 = E_1$ or $M_1 = 0$) and Alter – if Ego chooses to send everything – can choose to keep everything ($K_2 = 0$) or split the amount received in such a way that both actors end the game earning the same payoff ($K_2 = ½mE_1 + ½E_2$).

Assuming perfect information and a one-shot non-cooperative game, Alter maximizes his revenues by keeping everything Ego has sent him, thus choosing $K_2 = 0$. Consequently, knowing the structure of the game and anticipating Alter's behavior, Ego will maximize her revenues by choosing $M_1 = 0$, since $E_1 - M_1 < E_1$ if $M_1 > 0$. Therefore, "Send nothing" and "Return nothing" are the equilibrium choices (in figure 4.2 this is represented by double lines) and the payoffs in equilibrium are E_1 and E_2. This outcome is Pareto-suboptimal, because both actors would prefer the payoffs yielded in a situation in which trust is placed and honored, $E_1 - M_1 + K_2$ and $E_2 + mM_1 - K_2$, with $M_1 > 0$ and $K_2 > M_1$. In general, if $M_1 < E_1$ Pareto improvements are always possible. In fact, the pie that the actors are dividing reaches its maximum when Ego sends everything ($M_1 = E_1$), Ego only gains from trusting Alter if Alter returns more than what Ego sent ($K_2 > M_1$), but, given $M_1 = E_1$, all possible K_2 chosen by Alter induce outcomes that are Pareto non-comparable.

Standard game-theoretic formalizations of trust problems represent isolated encounters between two strangers who do not have any information about each other. However, in real life situations, trust problems are likely to occur between actors who are embedded in a more complex setting (Granovetter, 1985; see also Raub, 1997 and Raub and Weesie, 2000). Two types of embeddedness can affect trust problems: first, Ego and Alter can meet repeatedly (dyadic embeddedness), and second, Ego and Alter may have common acquaintances (network embeddedness). In negotiated exchanges both these aspects are present; actors negotiate and exchange repeatedly with each other and they are embedded in small social networks. Two mechanisms have been identified through which dyadic and network embeddedness induce cooperation: *learning* and *control* (Raub, 1997; Buskens, 2002;

[3] In the economic literature, K_2 is most often labeled *reciprocity*. However, this term implies some psychological speculation about the cause of Alter's choice R_2. Thus, we opted for the more neutral term *trustworthiness*.

Buskens and Raub, 2002; see also Yamagishi and Yamagishi, 1994: 138-139).[4] Learning refers to changes in Ego's trust in Alter due to information about Alter's past performance either from her own experiences or from third-party experiences. Control is based on Alter's anticipation of future sanctions for abuse of trust. However, control can only operate if the trust problem is repeated and it also requires assumptions about actors' forward-looking capacities (Macy and Flache, 2002). Conversely, Learning effects are possible whenever actors share a common past. For example, in a situation where a trust problem follows a phase of negotiated exchanges, actors could obtain, as a by-product of the exchange, information concerning their partner and they could subsequently use this information in their decision whether to cooperate in the following trust problem.

4.3 Theories and hypotheses

Most of the literature on social exchange is generally silent about the consequences of exchanges for trust and in particular about the effects of power differences on the development of interpersonal trust. However, some scholars have investigated the effects of repeated exchanges on the development of durable relations, as a mean to reduce uncertainty involved in the exchange (Kollock, 1994; Molm et al., 2000) or as an affective link developed through positive emotions that actors have experienced in repeated exchanges (Lawler and Yoon, 1993, 1996, 1998; see also Thye et al., 2002 for a review of the research program). All these theories assume that actors try to maximize their earnings, although some theories add supplementary assumptions, such as the influence of emotions.

Kollock designed an experiment to test the effect of uncertainty on the development of stable exchanges. He implemented uncertainty by having sellers deceive buyers and found that buyers assessed sellers exchanging goods of uncertain quality as being more trustworthy than those exchanging goods of certain quality. However, Kollock (1994) had his subjects match freely with their exchange partners and, focusing on the emergence of social relations, he treated the exchange network as a dependent variable. Therefore, he did not look at power differences in the exchange relation.

Lawler and Yoon (1993) studied the effects of power differences in negotiated exchanges on the development of durable relations, focusing on affective commitment as measured by gift-giving behavior and by staying in a given relation in spite of the availability of alternatives. In a following paper, Lawler and Yoon developed these ideas into a theory of

[4] See Buskens (2002: ch. 4) for a model of learning effects in social networks; see Buskens and Weesie (2000) or Buskens (2002: ch. 3) for a game-theoretic model of control effects through social networks.

relational cohesion (Lawler and Yoon, 1996). Assuming that during repeated exchanges actors not only earn resources but also experience emotions, this theory maintains that repeated exchanges produce affective commitment as well as interpersonal trust. However, the authors provided no specific test for the emergence of trust. In a series of laboratory experiments, Lawler and Yoon (1993, 1996, 1998) found that equipower exchange relations produce a higher frequency of exchanges, which in turn produce positive emotions that actors attribute to the relation itself, increasing its expressive value. Relational cohesion theory places the foundations of commitment behavior in the emotions that actors experience in repeated exchanges.

Lawler (2001) extended the theoretical analysis of the role of emotions in exchanges developing an "affect theory" of social exchanges. This theory aims at explaining under what structural conditions exchanges produce emotions which lead actors to develop stronger or weaker ties to specific social units such as other individuals, networks, or groups. According to affect theory, exchanges can be classified on two dimensions: the "nonseparability" of the contribution to the collective task, and the perception of "shared responsibility" for the success or failure of the exchange task. Nonseparability refers to the extent to which individual's own contributions to the success of the exchange are identifiable and separable from the contributions of others and it varies across different types of exchanges. The perception of shared responsibility is a consequence of actors' interdependence. Since actors are interdependent, the responsibility for the outcome of the exchange falls on all contributors. Lawler argues that the nonseparability of individual contribution increases the perception of shared responsibility which in turn leads actors to attribute the success or failure of the exchange to the social units involved in it. Thus, these two properties of exchange relations affect the actors' emotional response to the outcomes of the exchange and subsequently the level of cohesion and solidarity towards the relevant social unit. Affect theory could be used to make predictions about the level of trust in different types of exchange relations, but it does not account for the effects of power differences in relations.

Molm et al. (2000), on the other hand, specifically theorized and tested the effects of power on trust in repeated exchanges, comparing reciprocal and negotiated exchanges. Building on Yamagishi and Yamagishi's (1994) distinction between trust and assurance, and in line with Kollock's (1994) argument on uncertainty reduction, Molm et al. claim that trust only develops under the condition of risk, that is, only if actors are liable to be exploited by

their partners.[5] Therefore, interpersonal trust can develop in reciprocal exchanges that imply the risk of non-reciprocity, whereas negotiated exchanges can only provide assurance because exchange agreements are fully binding. Molm et al. argued that actors who complete a series of negotiated exchanges have no means to infer their partners' trustworthiness, because in negotiated exchanges conditions of exchange are fully specified and are binding. According to Molm et al., in other words, negotiated exchanges do not imply the risk of deception; therefore actors cannot develop mutual trust, but only assurance (Yamagishi and Yamagishi, 1994). Consistent with this claim, Malhotra and Murnighan (2002) maintained that exchanges enforced by binding contracts do not lead to the development of mutual trust, but rather undermine it, because actors attribute the success of the transaction entirely to the binding nature of the agreement. If the argument of "no trust without risk of deception" holds, then actors involved in repeated negotiated exchanges should display the same level of mutual trust as strangers who meet for the first time and have had no previous relations. Alternatively, if actors react to negotiated exchanges as hypothesized by Malhotra and Murnighan, or if they interpret the removal of binding agreements as a non-cooperative signal (Lindenberg, 2000), their level of mutual trust is expected to be even lower than the level of trust existing between two strangers.

Conversely, relational cohesion theory argues that actors who exchange repeatedly with each other experience emotions, which they attribute to the relation, which in turn achieves an expressive value (Lawler and Yoon, 1993, 1996, 1998). Thus, actors involved in repeated negotiated exchanges are expected to develop mutual trust, as a by-product of the exchange process. Since different theories lead to different predictions, we present three competing hypotheses concerning the effects of negotiation on mutual trust. In statistical terms, the first hypothesis, predicting no difference in the level of trust and trustworthiness between actors who have undergone negotiated exchanges and perfect strangers, is the null hypothesis.

> **Hypothesis 4.0** Assuming that the level of trust and trustworthiness can increase only if actors have run the risk of deception in previous exchanges, we expect actors involved in repeated negotiated exchanges to be as trusting and trustworthy as perfect strangers.

[5] In Yamagishi and Yamagishi's (1994: 132) terms "…trust is expectation of goodwill and benign intent" whereas assurance is "… an expectation of benign behavior for reasons other than goodwill of the partner … [and] is based on the knowledge of the incentive structure surrounding the relationship."

Hypothesis 4.1a Assuming that actors attribute successful negotiated transactions to binding agreements and react negatively if the terms of the exchange cease to be binding, we expect actors involved in repeated negotiated exchanges to trust each other less and to be less trustworthy than perfect strangers.

Hypothesis 4.1b Assuming that actors attribute positive emotions associated with successful negotiated transactions to the exchange relation, we expect actors involved in repeated negotiated exchanges to trust each other more and to be more trustworthy than perfect strangers.

As described in the background section, network exchanges can differ with respect to the power that actors are able to exercise in order to increase their profit from exchange. However, the effect of power on trust has been largely neglected in the literature on social exchange. In one of the few exceptions, Molm et al. (2000) argued that power inequality decreases mutual trust, but they focused on reciprocal exchanges and did not look at equipower relations. The idea that equipower relations should yield more mutual trust is also consistent with relational cohesion theory. Lawler and Yoon (1993, 1996, 1998) in fact argued that equal power relations increase the frequency of exchange, and higher frequency of exchange implies more earnings, more positive emotions, and hence more interpersonal trust. Assuming that the amount of resources actors earned through exchanges is a good individual indicator for the success of the exchange relation, we pose the following hypothesis for actors embedded in equipower relations:

Hypothesis 4.2 The higher the earnings from exchange in equipower relations, the more the actors embedded in such relations will trust each other and the more trustworthy they will be.

However, relational cohesion theory takes the dyad as a unit of analysis and hence it does not make distinct predictions for the two members involved in an exchange relation. This is problematic for our analysis because we want to keep A's trust in B separated from B's trust in A. In social network terminology, we conceive a relation of trust as *directional* and therefore such a relation can also be *asymmetric* (e.g., A trusts B, but B does not trust A) (see Wasserman and Faust, 1994). For equipower relations this is not a problem because the

positions of the two actors in an equipower relation are perfectly symmetric with respect to power, therefore the effect of power on interpersonal trust is the same for the two actors and there is no need to make separate predictions for A's trust in B and B's trust in A. Conversely, relations predictions are more complex for unbalanced power. Unbalanced power relations are asymmetric: assuming that A and B are a high power actor and a low power actor respectively, A's trust in B and B's trust in A are affected differently by power inequality.

Relational cohesion theory argues that unbalanced power decreases mutual trust, but since it takes the dyad as a unit of analysis it does not allow predictions at the individual level. According to relational cohesion theory, an exchange relation acquires an expressive value through the emotions that actors experience in the exchange and attribute to the relation. Following Weiner's (1986) attribution theory, Lawler (2001) listed emotions that can be experienced in exchange relations and connected them with the relevant social object.[6] In addition, in his affect theory of exchange, Lawler argued that when fulfilling joint tasks characterized by a high level of shared responsibility for the success or failure, actors will tend to attribute the resulting feelings to the social unit (i.e. dyad, group, network), rather than to one's self or to the other (the exchange partner). However, a trust relation is a relation directed towards an individual actor rather than a social unit. Therefore, it should not be affected by emotions that are attributed to a different social object. If we assume that actors in repeated exchanges not only experience "global" emotions that they attribute to the social unit, but also other emotions that they attribute to themselves or to the other, we can expect that if they are confronted with a trust problem concerning the same other with whom they had negotiated exchanges before, emotions attributed to the other will be more salient. According to Lawler (2001), these emotions attributed to the other could include "gratitude" if the exchange was successful or "anger" if the exchange was unsuccessful. This conjecture could help us to generate hypotheses about trust in unbalanced power relations. As explained in section 4.2.1, a high power actor can never be excluded from exchange, and generally she earns larger shares of the resources available in the exchange. Thus, an actor high in power will predominantly experience positive emotions due to the high frequency of exchange and high earnings. Furthermore these emotions will be (partly) attributed to her exchange partner(s). Conversely, a low power actor always risks exclusion from the exchange and is forced to bid against other low power actors to avoid exclusion. Therefore, a low power actor

[6] Positive emotions such as pleasantness, pride, gratitude, and affective attachment or negative emotions such as unpleasantness, shame, anger, or affective detachment can be directed at the task, one's self, the other, or the social unit (i.e., the dyad).

predominantly experiences negative emotions and low earnings due to exclusion and will also attribute these emotions to her exchange partner. Assuming that the amount of resources earned by actors through the exchange is a good individual indicator for the success of the exchange relation, we propose the following hypotheses for high and low power actors embedded in power-unbalanced relations:

> **Hypothesis 4.3 (gratitude/anger)** The more a high power actor has earned from exchanges with a low power actor, the more she will trust the low power actor and the more trustworthy she will be.

> **Hypothesis 4.4 (gratitude/anger)** The more a high power actor has earned from exchanges with a high power actor, the more she will trust the high power actor and the more trustworthy she will be.

Finally, we examine trust problems involving two low power actors. Low power actors do not have the possibility to exchange with each other; therefore they do not have any reason to attribute positive or negative emotions associated with the exchange relations to other low power actors. The only information concerning other low power actors available to them stems from observation of these other low power actors' bargaining behavior in exchanges with the high power actor. However, since low power actors typically bid against each other in order to gain inclusion in the exchange with the high power actor, their earnings will be reduced, to the advantage of the high power actors, if the competition is fierce. Assuming that a low power actor could consider the other low power actors partially responsible for the amount she managed to earn in the exchange, we propose the following hypothesis concerning effects on a trust relation between two low power actors.

> **Hypothesis 4.5 (blame)** The lower the earnings of low power actors in exchanges with a high power actor, the less these low power actors will trust each other and the less trustworthy they will be.

Hypotheses 4.1 to 4.5 are based on the assumption that actors try to maximize their earnings, but in doing so are also influenced by the cognitive response to previous exchanges or by emotions they experienced during these previous exchanges. Now we propose a number of hypotheses based on some additional assumptions. As anticipated in section 4.2.2, assuming

purely money-maximizing actors, standard game theory predicts that Ego will send nothing in the one-shot Investment Game. Moreover, assuming complete information, the players' choices in the Investment Game are not expected to be affected by whatever happens before the Investment Game. However, several experiments have shown that (1) a considerable proportion of subjects cooperate even when strategic rationality predicts they should not and (2) pre-game experiences do affect subjects' decisions (Colman, 1982).

In order to account for these empirical anomalies, some scholars proposed models that replace the assumption of purely selfish preferences with (partly) altruistic preferences. These models assume that subjects are not only interested in their own outcomes, but also in the outcomes obtained by the other player, by means of some *value transformation*. For example, a value transformation introduced by McClintock (1972) assumes that the utility of an actor associated with the outcome of a strategic interaction involving a second actor is a function of both her own payoff and the payoff earned by the second actor. The dependency of individual utility on the welfare of the partner is referred to as the actor's *social orientation*. Other scholars have modeled the individual utility function, incorporating different types of "non-standard" preferences, such as *fairness* (Rabin, 1993) and *equity* or *inequality-aversion* (Fehr and Schmidt, 1999; Bolton and Ochenfels, 2000). Rabin's fairness model assumes that actors are nice to those who have been nice to them and retaliate towards those who have harmed them. Fehr and Schmidt proposed a model in which actors care about their own outcomes and about the differences between their own outcomes and the outcomes obtained by others. According to this model, actors do not like receiving lower payoffs (envy), but nor, to a smaller extent, do they like receiving higher payoffs (guilt). Finally, in the model proposed by Bolton and Ochenfels, individual utility depends on both the own payoffs and the relative share. Individuals prefer to receive a relative payoff that is equal to the average earned by all other players.

If some actors have different, "non-standard" social orientations with strong enough preferences for equity and/or fairness, "send nothing" is not necessarily the only equilibrium choice of the Investment Game. On the one hand, a "non-standard" Ego, being interested in Alter's wealth, might send a positive amount, irrespective of the expected amount returned. On the other hand, a "non-standard" Alter, whose preference for fairness or equity is strong enough, will return a positive amount to Ego. Finally, also a "standard" Ego, who is purely interested in her own wealth, will send a positive amount if she believes that she is dealing with a "non-standard" Alter. Thus, the trustworthiness of Alter – the amount he wishes to return to Ego – is influenced by his social orientation and preference for equity and fairness,

that is, by how much he is interested in the outcome obtained by Ego. Consequently, Ego's trust in Alter – the decision concerning how much she wishes to send him – will be affected not only by her own social orientation and preferences, but also by her belief about Alter's social orientation and preferences. If Ego and Alter have experienced negotiated exchanges with each other before they undergo a trust problem, this might influence their belief about the social orientation and social preferences of the other. For example, a "non-standard" actor whose preferences for fairness or equity are strong enough is expected to offer to her partner fairer amounts than a "standard" self-interested actor. Therefore, we propose the following two hypotheses for the effect of the own social preferences and for the effect of the belief concerning social preferences of the partner.

Hypothesis 4.6 The fairer the offers Ego sent in previous negotiated exchanges are, the more Ego will trust Alter.

Hypothesis 4.7 The fairer the offers Alter sent in previous negotiated exchanges are, the more Ego will trust Alter and the more trustworthy Alter will be.

If individual social orientations and preferences are stable, they will not be affected by previous negotiated exchanges.[7] If we also assume that actors do not have any incentive to mimic a non-standard social orientation in order to build a trustworthy reputation and subsequently deceive their partner in future interactions (for example, because they do not expect to have any future interaction), repeated negotiated exchanges could provide actors with information about their partner's social preferences.

4.4 Method

In order to analyze the effects of power in negotiated exchange on the development of interpersonal trust, we designed a laboratory experiment which consists of two phases. In the first phase, subjects negotiate the division of a pool of points under different network conditions. After completion of the exchange phase, subjects play a one-shot Investment Game (Berg et al., 1995) with one of the persons with whom they exchanged in the first phase. Actors who exchanged in dyads are simply re-matched with the same partner; actors who exchanged in larger networks are matched randomly with another member of the same

[7] Social orientation is usually assumed to vary within the population, but to be relatively stable within individual subjects (McClintock and Liebrand, 1988).

exchange network. At the beginning of the Investment Game, subjects are informed about who their partner will be. In order to ensure that subjects know they are playing with a person they have already met in the exchange phase, we use the same labels throughout the whole experiment. The behavior of subjects in the Investment Game is compared with that of a control group playing the Investment Game without the initial phase of negotiated exchange.

4.4.1 Experimental design

144 subjects (undergraduate students) participated in the experiment. Subjects are individually ushered into cubicles and they do not meet or see each other before or after the experiment. The first phase of the experiment is entirely computer based. Before the beginning of the negotiations, actors are given a tutorial from which they learn how to send and accept offers using ExNet, a system of networked PCs. The tutorial also informs the subjects that they will partake in 15 negotiation rounds, and that in every negotiation they can split a pool of 24 points. Every negotiation round lasts up to two minutes, during which they can send an unlimited number of offers to each other until an agreement is reached or the time is over. Subjects participating in the experiment are fully informed about their own offers as well as about offers sent and received by all other subjects in their network. Their computer screen displays the experimental network and continually updates the status of all offers and agreements reached. Subjects are also told that the points earned in exchanges will be translated into money at a fixed exchange rate, but they are not informed about the real value of every point until the end of the exchange phase.[8] Moreover, to avoid subjects trying to build up a cooperative reputation in the exchange phase to exploit their partner's trust in the Investment Game, subjects are not informed beforehand that they will play an Investment Game at the end of the exchange phase.

For the exchange part, we adopted the same setting used in traditional research on power in negotiated exchange (e.g., Skvoretz and Willer, 1991). In this setting actors are embedded in exchange relations and they negotiate for the division of a pool of 24 points with their partners. To study the effects of power on trust, we implemented the negotiated exchange in two different network structures: a *strong power* and an *equal power* (see figure 4.1). We use a *branch31* for the strong power. This is a network of four actors with three exchange relations and only one exchange is allowed per round. In a branch31 there is a

[8] This deviation from standard procedures in experiments on exchange networks was introduced in order to draw the attention of the subjects to the second phase where the stakes are much higher. Moreover, applying a very low exchange rate to the points earned in the first phase might limit satiation effects.

central actor who has three exchange relations available, while the other three actors have only one, namely with the central actor. Due to these restrictions, two of the peripheral actors (positions B, C, and D in figure 4.1) are always excluded from exchange whereas the central actor (position A in figure 4.1) is never excluded. Thus, the three peripheral actors are low in power because they bid against each other trying to exchange with the central actor, while the central actor is high in power and will gain most of the resources available in the exchange. We use a simple *dyad* for the equal power structure. Since none of the two actors in a dyad has alternative exchange partners, they are by definition equal in power and therefore they will predominantly settle on an equal exchange pattern. None of these actors will be excluded from exchange.

This design allows us to compare levels of trust and trustworthiness in network structures after the completion of a series of exchanges under equal versus strong power conditions. In a third treatment, we let pairs of subjects play the Investment Game without the previous phase of exchange. This treatment provides us with a benchmark representing the level of trust and trustworthiness between *strangers* without the experience of exchange and power within a network.

At the end of the exchange phase, the experimenter walks into the cubicle, informs the subjects about the second phase of the experiment, and gives them written instructions. At this point, subjects are also informed about the exchange rate applied to the points that they have earned in the first phase: $0.01 per point earned in the exchange. This implies that, depending on the network condition, most subjects only earn $1 or 2 in this phase. The subjects occupying high power positions can only earn a maximum of $3.50.

The second phase of the experiment consists of two one-shot Investment Games in which every subject first plays Ego and then plays Alter. Instructions for the two Investment Games (see appendix C) are given in two parts. First, all subjects are Egos, they receive $2.50 as initial endowment and they can decide to send a certain amount of their endowment to their partner, in any multiple of 50 cents. They are also told that the amount they decide to send will be multiplied by three by the experimenter and that their partner then decides how much he will return. Subjects are not informed in the first part of the instructions that they will subsequently play as Alters themselves with the same partner, because this might induce a feeling of “reduced responsibility” and thus affect the level of cooperation (Burks et al,

2003).[9] The first sheet of instructions for the second phase also informs the subjects about the identity of their partner. For this purpose, the same labels used to identify subjects in the first phase (A and B, or A, B, C, D, depending on the size of the exchange network) are also maintained in the second phase. Subjects write their decisions on the instruction sheet and use their computer to inform the experimenter that they have completed their task. Then, the experimenter walks into the cubicles again, collects the first sheet of the instructions and gives the second sheet to the subjects.

In the second part, we used the *strategy method* (Selten, 1967): Every Alter decides on a contingent action for every possible decision of Ego. In the second instructions sheet, subjects are required to fill in each amount that they would return to Ego for every possible amount that Ego could send. This method allows decisions that cover the whole strategy space to be elicited, facilitating the collection of richer data at a low cost. The amount returned is not multiplied by the experimenter. After subjects have completed the second part of the Investment Game, the experimenter enters their cubicles for the last time and collects the second sheet. The experiment ends with a small questionnaire about personal characteristics. While the subjects fill in the questionnaire, the experimenter matches the Egos with the Alters and computes relative earnings. Subjects are paid for two Investment Games, played as Ego and Alter respectively. Since Alters' decisions are collected with the strategy method, the amount returned corresponding to the actual amount sent by Ego is implemented and paid. Therefore, every subject earns $5.00 as show up fee, plus the points earned in the exchange phase (1 point = $0.01), plus the earnings from the two Investment Games.

In the second phase, our unit of analysis consists of a directed dyad. In fact, for any given pair AB, two sending decisions and two returning decisions are observed. First, A sends to B and B sends to A. Then, A returns to B and B returns to A. Given the setting of the first phase described above, five different pairs of matches are possible with respect to relative power within the relation. Subjects who did not participate in the exchange phase (strangers) have a *null* relation with respect to relative power. Subjects who partook in the exchange phase in dyads are matched with each other in the second phase and have an *equal* relation with respect to relative power. These subjects form directed relations that are perfectly symmetrical with respect to relative power: given an equal power relation AB, A's trust in B and B's trust in A are analytically equivalent since A and B do not differ in power. All groups

[9] In an experiment specifically designed to test the effects of different procedures, Burks et al. (2003) found that playing an Investment Game in both roles reduces the amount returned. Moreover, if subjects are informed beforehand that they will play both roles, the amount sent decreases as well.

of four subjects who participated in the exchange phase in branch31 networks can be matched in two types of relations differing with respect to relative power: a low power actor with the high power actor and a low power actor with another low power actor. Two low power actors form a symmetrical directed relation: *low to low* (LTL hereafter). In a sense, this relation is also "equal" with respect to power, but – since these actors do not exchange with each other – we prefer to label it LTL in order to keep it distinct from an equal power relation between two actors exchanging with each other in a dyad. A low power actor and the high power actor form two directed relations differing with respect to relative power: *high to low* (HTL) and *low to high* (LTH). Given a match AB in which A is a high power actor and B is a low power actor, A's trust in B and B's trust in A are analytically different and they are analyzed separately.

Out of the 144 subjects participating in our experiment, 72 partook in the first phase in branch31 networks, 36 in dyads and 36 in the strangers treatment. Therefore, counting the single Investment Games, we have 36 times an Investment Game between strangers; 36 times between actors who experienced repeated negotiated exchanges in an equipower relation; 36 times between 2 low power actors (LTL) who experienced negotiated exchanges in a branch31 network; 18 times between an Ego who experienced negotiated exchanges in a branch31 network as low power actor, and an Alter who experienced negotiated exchanges in a branch31 network as a high power actor (LTH); 18 times between an Ego who experienced negotiated exchanges in a branch31 network as high power actor and an Alter who experienced negotiated exchanges in a branch31 network as a low power actor (HTL).

4.4.2 Operationalizations

We operationalize trust as the amount sent in the first decision in the Investment Game. Trustworthiness can be measured as the amount returned. Since we used the strategy method for trustworthiness, subjects made 5 decisions, one per every possible value of the amount sent by the partner in the Investment Game. If Ego sends nothing, there is no decision for Alter to make. In the regression models presented in the next session, we summarized these five decisions into one variable by taking the average percentage returned *R*:

$$R = \frac{\left(\frac{k_1}{3m_1} + \frac{k_2}{3m_2} + \frac{k_3}{3m_3} + \frac{k_4}{3m_4} + \frac{k_5}{3m_5} \right)}{5},$$

where k_n is the amount returned if the amount sent is m_n.[10]

Our main independent variable is the experimental condition representing the type of power relation experienced in the first phase. Other independent measures refer to subjects' behavior during the negotiations in phase 1 of our experiment. Although some theories (e.g. relational cohesion theory) focus on the dyadic relation as a unit of analysis, we decided to focus our analyses on individual parameters in order to make the predictions of different theories easier to compare. Therefore, we used individual earnings in the exchange as an individual measure for the success of the exchange relation. Since individual earnings are obviously strongly affected by the power position of the actor in the exchange relation we standardized this measure within power conditions. We realize this is a deviation from relational cohesion theory arguments, but it has the additional advantage of making comparisons across experimental conditions possible. Assuming that in negotiated exchanges cooperative types offer more points to their partner and competitive types offer fewer points, we take the average offer sent by the actors during the negotiation phase as a measure of social preference. Since offers differ systematically between different types of exchange relations, this measure is also standardized within power conditions.[11]

At the end of the experiment, subjects fill in a short questionnaire in which we ask for certain personal characteristics: sex, age, and major. The questionnaire also includes an 18 item trust scale. Some of the items are adopted from Yamagishi and Yamagishi (1994) and Wrightsmann (1974). Eight of the initial items were excluded after a reliability analysis and the remaining 10 were entered in a factor analysis. Two factors were found and the standardized scores were used as trust indices. The first factor loads stronger on items referring to a preference for dealing with others with whom the respondent has a long-lasting relation. This factor can be compared to Yamagishi and Yamagishi's (1994: 151) "knowledge-based trust". The second factor represents a generally positive and benign attitude and can be compared with Yamagishi and Yamagishi's (1994: 147) "general trust scale." Furthermore, we asked our subjects whether they were blood donors, since this could be an indicator for a more altruistic disposition. All hypotheses are tested by means of OLS regressions with standard errors modified for clustering within networks using robust (Huber) estimators for clustered data (Rogers, 1993).

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[10] The five return decisions corresponding to different amounts sent could also be analyzed separately, but preliminary analyses showed that the amount returned depends almost linearly on the amount sent. Therefore, the use of the average percentage returned does not imply any loss of information.

[11] We preferred not to use a standard measure of social orientation (e.g., Liebrand, 1984), because we feared that this could provide a specific frame and thus influence the actors' subsequent decisions.

Table 4.1 Average points earned per exchange

Type of network position	Average points earned (SD)
Dyad	12.00 (1.12)
Branch31: position A	17.78 (3.07)
Branch31: position B, C, and D	6.28 (3.75)

4.5 Results

As predicted by network exchange theory, actors in dyads settled on an equal split of the resources available to the exchange, whereas in the branch31, high power actors gained considerably more than low power actors. The results of the exchange phase are summarized in table 4.1. The results for dyads are comparable with the results obtained by other scholars investigating negotiated exchanges in this type of network structure. Conversely, the subjects in our branch31 networks settled on average on a less uneven split than observed in most experiments using the same setting (see, for example, Skvoretz and Willer, 1993). This result could be due to a smaller emphasis on the possibility to earn money in the instructions for the exchange phase. However, our analysis focuses on differences emerging in the Investment Game played in the second phase. Therefore, these small discrepancies in the results of phase 1 do not have relevant consequences for our main results, except for making our statistical tests more conservative. In fact, the effects of power differences might be somewhat underestimated since power failed to develop to the maximum extent in strong power networks.

4.5.1 Effects of negotiation and power

Table 4.2 displays two OLS regression models on trust and trustworthiness respectively. These two models estimate the effects of repeated exchanges on trust and trustworthy behavior providing a test for our hypotheses 4.1a and 4.1b. As described in the methods section, the type of power relations experienced in the exchange phase is entered in the regression as a series of dummies with the baseline *null* as reference category. Thus, the coefficients show differences in trusting behavior of actors who exchanged under varying power relation conditions compared with the behavior of perfect strangers. For equipower relations, hypothesis 4.1b is supported and the null hypothesis 4.0 can be rejected. Actors who exchanged in equal power relations display a higher level of trust than strangers. Conversely, for unbalanced power relations, results differ depending on power position: high power actors trust low power actors more than strangers trust each others, but the trusting behavior of low power actors does not differ significantly from that of strangers. Therefore, for high power

Table 4.2 OLS regression models on trust and trustworthiness

Hypotheses	Independent variables	Expected sign	Dependent variable: trust		Dependent variable: trustworthiness	
			Coeff.	St. err.	Coeff.	St. err.
4.0 – 4.1a – 4.1b	Equal	0 – +	.86**	.347	-.00	.042
4.0 – 4.1a – 4.1b	HTL	0 – +	.75**	.361	.05	.036
4.0 – 4.1a – 4.1b	LTH	0 – +	.14	.420	-.04	.071
4.0 – 4.1a – 4.1b	LTL	0 – +	.11	.333	-.05	.045
	constant		1.97***	.202	-.35***	.029
R^2			.06		.02	
Number of Observations			144		144	
Number of networks			54		54	

***p < 0.01; **p < 0.05; *p < 0.1 indicate two-sided significance based on Huber standard errors modified for clustering within networks.

actors hypothesis 4.1b is supported and 4.0 is rejected, while for low power actors neither 4.1a nor 4.1b is supported and the null hypothesis 4.0 cannot be rejected. In the second model, where the average percentage returned in the Investment Game is the dependent variable, none of the effects of the power relation is significant, thus for the effects of repeated exchanges on trustworthiness, the null hypothesis 4.0 cannot be rejected and neither hypothesis 4.1a nor 4.1b are supported: repeated exchanges do not increase nor decrease trustworthy behavior under any power condition. Interestingly, however, all coefficients are negative in the second model in table 4.2, except for HTL relations. High power actors, in fact, return slightly more on average than strangers and, in general, more than actors embedded in any other type of power relations. In particular, focusing on branch31 networks, the difference in trustworthy behavior between high power and low power actors is statistically significant (t = -1.73, p = 0.04). Thus, high power actors are both more trusting and more trustworthy, whereas low power actors are both less trusting and less trustworthy.[12] This result implies that power differences damage trust relations because high power actors tend to be overconfident and run the risk of being exploited, whereas low power actors might loose good opportunities by being excessively distrustful.

Now we turn to the test of the other hypotheses. In the next two sections, we present estimation models for trust and trustworthiness separately.

[12] The fact that high power actors both sent more and returned more in the Investment Game might also suggest that these actors are simply more generous rather than more trusting and trustworthy. Particularly, this explanation holds if we assume that actors who earn more in the exchange phase perceive this as unfair with respect to low power actors who were typically exploited in negotiated exchanges. Given the available data, this explanation cannot be excluded, but this hypothesis could be tested by running a new session of the experiment with an additional manipulation. For example, letting high power actors play a dictator game with low power actors after the negotiated exchanges.

4.5.2 Trust

Table 4.3 presents four regression models on trust. Model 1 only includes four control variables that refer to the subjects' personal characteristics. Model 2 includes personal characteristics and the four variables representing four different power relations. Model 3 adds the individual earnings from the exchange phase (referring to hypotheses 4.2, 4.3, and 4.4), the average offer sent by Ego in the bargaining process (4.5), and the average offer sent by Alter in the bargaining process (4.6). Finally, model 4 includes an interaction term between own earnings and a dummy variable which takes value 1 if the trust problem involves the same couple who previously had an exchange relation. This term has been included in order to test whether the effect of individual earnings differs between those subjects who had previous exchange with each other and those who did not (i.e. LTL).

These four nested models show that trusting behavior is better explained by what happened before the Investment Game rather than by personal characteristics of the subjects. Model 1 is, in fact, statistically not significant ($F = 1.51$; $p = 0.21$) as are all variables included in this model, except for the index of knowledge-based trust, which is weakly significant. Model 2 displays the effects of the experimental manipulations controlling for personal characteristics.[13] As discussed in the previous section, actors in equipower relations and high power actors display more trust than strangers, while low power actors do not differ significantly from strangers, regardless of who their partner is. Looking at model 3, the effect of individual earnings from the exchange is not significant, thus hypotheses 4.2, 4.3, and 4.4 are not supported. However, running the same analyses separately for the four groups referring to different power conditions, we discovered that individual earnings have a positive effect for equipower, HTL, and LTH relations, but no effect for LTL relations. Thus, in model 4, we introduced an additional term in order to disentangle these two effects. We did this by adding an interaction between individual earnings and a dummy which takes value 1 if the subject plays the Investment Game with the same person with whom she had previous negotiated exchanges and 0 otherwise. Therefore, in model 4 the coefficient of the main effect of individual earnings represents now this effect for actors in LTL power relations, whereas the interaction term indicates how this effect differs for the subjects who played the Investment Game with a subject with whom they had had negotiated exchanges.[14] Thus, model 4 shows

[13] As in table 1, the power relations are entered as dummies and our control group (strangers) is the reference category.

[14] The coefficient of the main effect of "individual earnings" in model 4 represents the effects for LTL, because the earnings of strangers are obviously 0 since they did not have negotiated exchanges before the Investment Game.

Table 4.3 OLS regression models on Ego's trust

Hypotheses	Independent variables	Expected sign	Model 1	Model 2	Model 3	Model 4
			Coefficients (Standard errors)			
	Sex (female = 1)		-.43	-.49	-.54	-.49
			(.346)	(.317)	(.316)	(.318)
	Blood donor (yes = 1)		.27	.27	.25	.25
			(.311)	(.310)	(.307)	(.305)
	Trust (knowledge-based)		.25*	.25**	.23*	.26**
			(.134)	(.116)	(.120)	(.122)
	Trust (general)		.23	.27*	.27*	.24*
			(.149)	(.145)	(.144)	(.140)
4.0 – 4.1a – 4.1b	Equal	0 – +		1.00***	.87***	.73**
				(.329)	(.328)	(.322)
4.0 – 4.1a – 4.1b	HTL	0 – +		.75**	.74**	.70**
				(.334)	(.333)	(.337)
4.0 – 4.1a – 4.1b	LTH	0 – +		.22	.47	.29
				(.439)	(.495)	(.490)
4.0 – 4.1a – 4.1b	LTL	0 – +		.21	.10	.19
				(.328)	(.334)	(.337)
4.2 – 4.3 – 4.4 – 4.5	Individual earnings	+			.18	-.23
					(.184)	(.258)
4.6	Average offer sent by Ego	+			.24*	.28**
					(.135)	(.128)
4.7	Average offer sent by Alter	+			.26*	.06
					(.134)	(.142)
(4.2 – 4.3 – 4.4)[a]	Ind. earnings × same partner	?[a]				.75**
						(.290)
	constant		2.49***	2.12***	2.16***	2.13***
			(.301)	(.345)	(.348)	(.350)
R^2			.059	.122	.157	.184
Number of observations			144	144	144	144
Number of networks			54	54	54	54

***p < 0.01; **p < 0.05; *p < 0.1 two-sided significance based on Huber standard errors modified for clustering within networks.

[a] This term shows how the effects of earnings postulated by hypotheses 4.2, 4.3, and 4.4 differ between subjects depending on whether they played the Investment Game with the same subject with whom they had exchanges.

that the effect of individual earnings differ significantly depending on whether a subject played the Investment Game with the same subject with whom he or she had previous exchanges. On average, this effect is statistically not significant. However, an additional test showed that the effect is actually positive and significant (p = .016) for subjects who played with the same partner with whom they had had previous exchanges (i.e. equipower, HTL, and LTH) and negative and not significant for the others, that is, for low power actors playing the Investment Game with another low power actor. Models 3 and 4 also include tests of hypotheses 4.5 and 4.6. The average offer sent by both Ego and Alter increase Ego's trust in Alter significantly; therefore hypotheses 4.5 and 4.6 are supported: social preferences of both

Ego and Alter have a positive effect on mutual trust.[15] However, if these individual social preferences are stable across time, the effect of the type of power relation should vanish when we control for social preference indicators, but the effects of repeated exchanges in equipower and in HTL relations remain instead significant. Therefore, trusting behavior is affected both by the actors' social preferences and by their experience of successful negotiated exchanges.

4.5.3 Trustworthiness

Table 4.4 displays three regression models on the average percentage returned. In this case we present three models. Unlike our previous analysis on trust, these models show that only control variables have significant effects on trustworthiness. Trustworthiness seems to depend more on personal characteristics such as sex or general trusting attitude, than on social preference or characteristics of the exchange or of the power relationship. The experimental manipulations, individual earnings, and the other variables representing the behavior of subjects during the bargaining phase have no significant effect on trustworthiness. Models 2 and 3 do not explain our data any better than model 1.

Trustworthiness, as measured by the average amount returned, especially increases with the amount sent. Note that, since every subject played the Investment Game twice, first as Ego and then as Alter, "amount sent" does not indicate the amount received by the actor in the position of Alter, but rather the amount sent by the same actor when playing as Ego in the first Investment Game. Thus, the positive effect of "amount sent" in these models means that subjects who send more also return more. Furthermore, women return slightly more than men and attitudinal trust, as measured by our general trust scale, slightly increases both the amount sent and the amount returned. The last result is comparable with Glaeser et al. (2000) who found that attitudinal trust, as measured by the GSS questionnaire, predicts trustworthiness better than trusting behavior.

In preliminary analyses, we found that the amount returned depends linearly on the amount received. Therefore, in our study it appears that the use of strategy method (Selten, 1967) does not yield additional insights. Moreover, it is plausible that this linear relation between amount received and amount returned prevented the observation of other effects related to the exchange. Analyzing an Investment Game played in both roles, Burks et al. (2003) found that playing both roles reduces the amount returned, possibly because actors

[15] The effect of the average offer sent by Alter disappears in model 4 because this variable correlates with the interaction term, i.e. individual earnings for subjects playing with the same partner. Therefore, in model 4, we cannot distinguish the effects of own earnings from the effects of offers sent by Alter.

Table 4.4 OLS regression models on Alter's trustworthiness

Hypotheses	Independent variables	Expected sign	Model 1	Model 2 Coefficients (Standard errors)	Model 3
	Amount sent		.05***	.05***	.05***
			(.012)	(.013)	(.013)
	Sex (female = 1)		.06	.06*	.06
			(.035)	(.036)	(.037)
	Blood donor (yes = 1)		.07*	.06	.06
			(.036)	(.039)	(.039)
	Trust (knowledge-based)		.01	.00	.00
			(.019)	(.018)	(.019)
	Trust (general)		.03*	.03*	.03*
			(.019)	(.019)	(.019)
4.0 – 4.1a – 4.1b	Equal	0 – +		-.04	-.04
				(.047)	(.048)
4.0 – 4.1a – 4.1b	HTL	0 – +		-.00	-.00
				(.042)	(.043)
4.0 – 4.1a – 4.1b	LTH	0 – +		-.05	-.04
				(.056)	(.058)
4.0 – 4.1a – 4.1b	LTL	0 – +		-.06	-.06
				(.043)	(.042)
4.2 – 4.3 – 4.4 – 4.5	Individual earnings	+			.01
					(.018)
4.7	Average offer sent by Alter	+			-.01
					(.021)
	constant		.16***	.19***	.18***
			(.047)	(.058)	(.060)
R^2			.197	.209	.213
Number of observations			144	144	144
Number of networks			54	54	54

***p < 0.01; **p < 0.05; *p < 0.1 two-sided significance based on Huber standard errors modified for clustering within networks.

perceived a "reduced responsibility" for inequalities in the outcomes. Thus, in our experiment, returning decisions were possibly influenced both by "reduced responsibility," due to the fact that actors played both roles, and by a linear relation with the amount received, presumably induced by the use of the strategy method. In other words, while trusting decisions were affected by the previous exchanges, actors based their five returning decisions almost solely on the five corresponding amounts received.

4.6 Conclusions and discussion

In this chapter we study the effects of transaction-unspecific information on the development of trust and trustworthiness. We devised a specific experiment in which actors first experience a phase of negotiated exchange within given exchange relations and subsequently play an Investment Game with one of their exchange partners, first in the role of Ego and then in the role of Alter. The negotiated exchanges, experienced in the first phase of the experiment,

provide subjects with transaction-unspecific information. The Investment Game provides a reliable behavioral measure of trusting as well as trustworthy behavior. Consistent with most research on network exchange, the exchange phase is modeled as a division of a pool of resources among actors embedded in small networks. The flow of resources along the exchange relations indicates different power positions within the network. We compared levels of trust and trustworthiness, as measured by behavior in the Investment Game, among actors exchanging in an equipower relation (a simple dyad) and in a branch31 with the behavior of two strangers with no experience of previous exchanges. In the Investment Game, the subjects in the branch31 where matched randomly, one high power actor with a low power actor and the other two low power actors with each other. Obviously, members of dyads were matched with each other. We presented a set of hypotheses based on the literature on commitment and affection in exchange relationships and on individual social preferences. On the one hand, results show that repeated negotiated exchanges in equipower relations increase trust as measured by the amount sent in the Investment Game. Within unbalanced power relations, high power actors display a higher level of trust than strangers, whereas the trusting behavior of low power actors does not differ from the behavior of perfect strangers. On the other hand, repeated negotiated exchanges do not increase trustworthy behavior. Moreover, trustworthy behavior seems to depend more on personal characteristics than on what happened in the exchange phase. This result could be partly due to our design. In fact, we applied the strategy method for choices made in the role of Alter, asking subjects to indicate an amount they would return for every possible amount sent to them. This design induced a linear relation between the amount received and the amount returned, possibly washing away variance in trustworthy behavior due to other possible sources. However, although the amount returned by actors in any power position does not differ in comparison with the behavior of subjects who experienced no previous exchanges, comparing the behavior of high and low power actors with each other does yield a difference: high power actors are more trustworthy than low power actors. Comparing predictions stemming from different theories, we found some support for both relational cohesion theory and non-standard utility functions, but no decisive findings supported the one or the other. Our subjects seem to learn about their partners observing how they bargain, and they also seem to be influenced by their own social preferences, but at the same time power differences also matter. Interestingly, individual earnings affect subsequent trusting behavior only if they can be attributed (at least partly) to the partner. This means that individual earnings do not matter per se, but they promote trust only if they result from a dyadic relation.

Our results have interesting implications. Successful exchanges in equipower or high power positions promote trust, but this trust seems to be unjustified because actors in equipower or low power positions do not become more trustworthy towards their partners. Conversely, low power actors are just as trusting as strangers, both when they are matched with another low power actor and when they are matched with a high power actor. However, in the latter case they should be more trusting instead, because high power actors are more trustworthy than low power actors.

This chapter represents a first exploratory study of the relation between negotiation in repeated exchanges and trust. The results call for more research into this area. More theoretical work is needed to understand the behavior that we observed. Existing theories stress the role of emotions, but focus on the dyad as a unit of analysis. Trusting decisions are intrinsically individual, thus a theory of trust in exchange relations should address how actors assess their partner trustworthiness from the information they obtain during the negotiation. Furthermore, new experiments could be designed to analyze levels of trust in different forms of exchange and intermediate power relations, such as those yielded by weak power networks, could be investigated as well.

Chapter 5

Learning to Trust: Network Effects through Time*

Abstract

This chapter investigates the effects of Alter-specific and transaction-specific information originating from social networks on the development of interpersonal trust relations in the context of a dialysis department of a Dutch hospital. Hypotheses on learning effects are developed from existing theories and tested using longitudinal data concerning the complete networks of trust and (informal) communication relations among employees observed at four different points in time. The results show that actors learn to trust (or distrust) each other from their own past experience as well as from information that they receive from their colleagues.

* This chapter is co-authored with Gerhard van de Bunt. A slightly different version is currently under review (Barrera and Van de Bunt, 2005).

5.1 Introduction

In many organizations, cooperation among colleagues is an essential prerequisite for the effective functioning and performance of the organization itself. Interpersonal trust between colleagues has therefore received much attention in the field of organizational relations (Bradach and Eccles, 1989; Burt and Knez, 1995; Mayer et al., 1995; McAlister, 1995; Kramer and Tyler, 1996; Burt, 2001; Nooteboom, 2002; see Kramer, 1999 for a review). Functioning as a "lubricant" for cooperation (Arrow, 1974), trust can substitute more "expensive" monitoring devices (Chiles and McMackin, 1996; Creed and Miles, 1996; Das and Teng, 1998). Within organizations, dyadic relations of trust are typically embedded in a complex system of social relations with third parties (Granovetter, 1985). In fact, colleagues working in the same environment have frequent opportunities of contact ranging from formal meetings to informal gatherings such as those typically occurring during lunch breaks. This set of formal and informal contacts creates a network of relations. The importance of this network of relations for organizational performance (e.g., Uzzi, 1996; see Flap et al., 1998 for a review) and for intra-organizational dynamics (Burt and Knez, 1995; Burt, 2001; see Krackhardt and Brass, 1994 for a review) has been increasingly recognized. Particularly, informal conversations provide colleagues with opportunities to discuss personal issues and to gossip about other colleagues (e.g., Burt and Knez, 1995; Wittek, 1998; Burt, 2001). Thus, the development of dyadic trust relations between colleagues could be affected by the network of informal conversations, for example, if employees exchange information about the trustworthiness of other colleagues during such informal talks. Furthermore, an organization is a dynamic entity in the sense that members can leave and be replaced by new ones at any time. Consequently, the amount of information that every member possesses about their colleagues varies significantly. Therefore, the extent to which colleagues are uncertain about each other also varies. To what extent does the network of informal communication influence interpersonal trust relations among colleagues? Does the importance of the information available through informal networks vary depending on the extent to which colleagues are uncertain about each other? In this chapter, we provide an answer to these questions by analyzing networks of interpersonal trust and informal communication measured at four different time points within a dialysis department of a Dutch hospital.

In spite of the conspicuous body of research on trust, there is no universally accepted definition of the concept. Trust is viewed as a psychological state (Lewis and Weigert, 1985; McAlister, 1995), as a choice behavior (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps,

1990), or as a relational attribute possibly incorporating both aspects (Mayer et al., 1995).[1] Most of these definitions, but especially those that conceive trust as a choice behavior, share one key element: the trustor's (Ego) decision is based on her assessment of the trustworthiness of the person to be trusted (Alter) (Gambetta, 1988; Coleman, 1990; Hardin, 1992, 2002). In embedded settings, this assessment can be influenced by the information about Alter that is available to Ego at the moment she faces the trust problem. Consequently, insofar as social networks can function as conduits for information (Burt and Knez, 1995; Uzzi, 1997; Burt, 2001), they play an important role in the development of interpersonal trust.

The kind of information effects in which we are interested is typically associated with Coleman's conceptualization of network closure as social capital (Coleman, 1988, 1990: ch. 12). According to Coleman's argument, information circulates faster in denser networks. Thus, for every Ego-Alter pair, Ego's assessment of Alter's trustworthiness is facilitated by the amount of second-hand information that is available to Ego through third parties. This argument is consistent with both information diffusion models (e.g., Buskens and Yamaguchi, 1999; Buskens, 2002: ch. 4) and models of network control (e.g., Raub and Weesie, 1990).[2] However, there is little empirical evidence of how information available from third parties influences the building of trust in intra-organizational networks (Burt and Knez, 1995, Burt, 2001, and Wittek, 2001 are prominent exceptions). Moreover, most research on social networks is characterized by a cross-sectional design (see Wittek, 2001 for an exception), which makes observation of causal mechanisms virtually impossible since these mechanisms operate through time.[3] A different type of evidence comes from experimental research. Experiments with factorial survey designs are presented in Buskens and Weesie (2000b) and in chapter 2 of this volume. Laboratory experiments in which the network of information diffusion was exogenously fixed while subjects could choose how much they trusted their partner can be found in Buskens (2004) and in chapter 3 of this volume. However, experimental evidence poses a problem of external validity, due to the artificiality of the situations in which the behavior of experimental subjects is observed. Therefore, the aim of this chapter is to investigate the effects of information originating from informal social

[1] For a more extensive review of the literature on trust, we refer to chapter 1.

[2] However, models of network control generally adopt forward-looking rationality: it is the concern for future losses caused by a bad reputation that influences the actors' actions. In other words, if Alter knows that Ego's assessment of his trustworthiness is based on information about his past, Alter will make sure to have a good past so that when a trust problem between Ego and Alter occurs, Ego will receive no negative information about Alter from third parties.

[3] Few studies have been conducted using longitudinal network data and those few that did do not focus on the effects of information on trust, for example, see the January 1997 special issue of *Social Networks* on network change, or the review of longitudinal studies offered by Burt (2000).

networks on interpersonal trust between colleagues, addressing the shortcomings of existing research in two ways. On the one hand, we use data from a survey of a complete network of forty employees of a dialysis department of a Dutch hospital, thus improving external validity. On the other hand, we are able to make stronger claims on the causal relations observed, because we use data from a longitudinal survey in which the same network is observed at four subsequent moments.

The definition of a social network depends on the content of the relation under study. Thus, generally speaking, a social network can be defined simply as a set of nodes and the relations connecting these nodes with each other (Scott, 1991; Wasserman and Faust, 1994; Degenne and Forsé, 1999). Therefore, the relations of informal communication among colleagues within an organization identify one social network. If trust is defined at the dyadic level, every trust relation identifies a directed tie and the set of all trust relations among colleagues identifies another social network. Since people who trust each other are likely to speak with each other regularly, we can expect a certain extent of overlap between these two social networks. Both communication and trust relations evolve through time and presumably influence each other. Thus, it is plausible that the social network formed by the employees of an organization who talk regularly to each other influences the network of trust relations, but it is also plausible that the existing network of trust relations determines, to some extent, who talks regularly to whom. Ideally, the two types of effects should be addressed simultaneously. However, in this chapter, we focus on changes in the trust network resulting from exchange of information between the actors, neglecting potential effects of the trust network on the communication network. We opted for this approach for three reasons. First, this book focuses specifically on the effects of information provided by social relations on trust between actors. Second, existing theories stress the role of social networks in shaping trust relations and not vice versa (Coleman, 1990: ch. 12; Burt and Knez, 1995; Burt, 2001; Buskens, 2002). Third, given the current state of the art, our data are too complex to be analyzed using existing statistical methods – and related software – designed to tackle this kind of reverse-causality issues (see Snijders, 2001, 2005; Snijders et al. 2005). We elaborate on this issue in section 5.4.1, when describing the statistical model we applied. However, focusing only on the effects of the network of informal communication on dyadic trust relation is not a severe limitation because the descriptive analyses of our data (see section 5.3.2) show that the trust network changes significantly across time, while the network of informal communication is rather stable. In other words, the network of information exchange looks like a stable pipeline through which different pieces of information reach the actors who, subsequently, can decide

whether to start or end trust relations to all other colleagues, depending on the specific content of the information available to them.

We summarize existing theories and present hypotheses in the next section. Subsequently, we describe the data in section 5.3, and present our results in section 5.4. Finally, we conclude with a discussion of the findings, also addressing certain methodological issues and suggestions for future research, in section 5.5.

5.2 Theories and hypotheses

In line with Coleman (1990: ch. 5), in the previous chapters we conceived trust as a choice behavior and we described a trust problem as an interaction between two actors (Ego and Alter) characterized by an incentive structure corresponding to the Trust Game (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990). However, here we study trust relations between colleagues and our data do not contain any information on actual behavior in real trust problems. Therefore, we need to adopt a less formal definition of trust, focusing on Ego's attitude towards Alter. In this chapter, we refer to a trust relation between Ego and Alter as a directed tie from Ego to Alter that can exist in three different states: Ego trusts Alter, Ego distrusts Alter, or Ego is neutral towards Alter. We maintain that Ego trusts Alter *if she feels particularly close to Alter and is willing to confide personal information concerning both private and work-related information to him.* Conversely, Ego distrusts Alter *if she feels distant from him and would not take him into confidence even for unimportant matters*. Finally, we assume that a trust relation is in a neutral state if *Ego feels neither close nor distant from Alter* and that a state of neutrality represents the middle point on a hypothetical continuum between "closeness" (trust) and "distance" (distrust). Furthermore, since we have defined trust as a personal attitude held by Ego, we assume that Ego's attitude towards Alter depends on her assessment of Alter's trustworthiness (cf. Gambetta, 1988; Hardin, 1992, 2002).

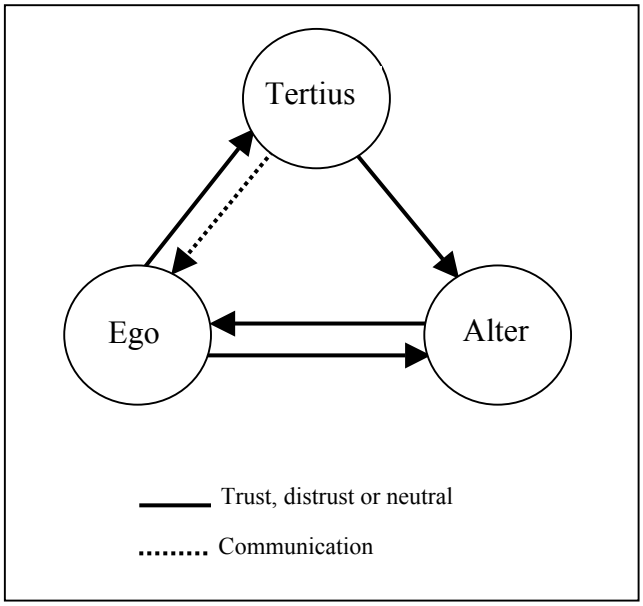
If Ego and Alter were complete strangers meeting for the first time, Ego would have no grounds on which to assess Alter's trustworthiness. Thus, her attitude would probably be based solely on her propensity to trust strangers. However, in everyday life Ego and Alter are generally not complete strangers because most trust problems occur in embedded settings (Granovetter, 1985). They could be friends, colleagues who only know each other superficially, or they could be strangers, but have common acquaintances. In all these situations, Ego possesses or can easily obtain information about Alter's trustworthiness. Consequently, Ego can form an opinion and develop a specific attitude vis-à-vis Alter. In

addition, if Ego is somehow related to Alter, directly or through third parties, she has the possibility to reward Alter if he honors her trust as well as to retaliate if he abuses her trust. Summarizing, two types of embeddedness can be identified: *dyadic embeddedness* and *network embeddedness* (Raub, 1997; Buskens and Raub, 2002; Buskens, 2002; see also Raub and Weesie, 2000). Dyadic embeddedness refers to situations in which a relation between Ego and Alter pre-exists the specific trust problem or to situations in which Ego and Alter are likely to be facing each other again after the trust problem in question. Conversely, network embeddedness refers to situations in which there exist third parties who are connected to both Ego and Alter by means of a relation, allowing third parties to provide Ego with information about Alter and to receive information about Alter from Ego.

The extra information available to Ego in embedded settings produces two types of effects on Ego's trust decision: *control* and *learning* (Raub, 1997; Buskens and Raub, 2002; Buskens, 2002; see also Yamagishi and Yamagishi, 1994: 138-139). Learning indicates that information about Alter's past behavior reaches Ego, either through dyadic embeddedness, because Ego herself has had previous interactions with Alter, or through network embeddedness, because Alter has had previous interactions with a third party (we refer to such a specific third party as Tertius, hereafter), who, in turn, can now inform Ego about Alter's behavior. Control, on the other hand, refers to Ego's possibility to sanction or reward Alter depending on his behavior. The embedded nature of a trust relation provides Ego with sanction and reward opportunities in two ways: through dyadic embeddedness, because Ego can punish (reward) Alter for abusing (honoring) trust by withholding (placing) trust in future interactions; and through network embeddedness, because Ego can affect Alter's reputation by informing third parties of his behavior, so that third parties will sanction (reward) Alter in the future. The sanction potential through dyadic embeddedness depends on the likelihood of future encounters between Ego and Alter, whereas the sanction potential through network embeddedness depends on the extent to which Ego is able to inform third parties about Alter's behavior (Buskens and Weesie, 2000a; Buskens, 2002).

In this chapter, we concentrate on the effects of learning both through dyadic and network embeddedness. We present hypotheses based on a broad range of theories about the effects of social networks on trust. We subsequently test them using data from a longitudinal survey in which a complete network has been measured at four different time points (Van de Bunt, 1999). We focus on learning effects because effects of control require information on Alter's behavior in interactions with Ego for all Ego-Alter pairs or information on the length of the expected common future, but this information is not available in the data. However,

Figure 5.1 Dyadic and network embeddedness



given our data, focusing on learning effects only is a sensible approach, because, in this context, we do not expect interaction effects between learning and control. Moreover, control effects have proven difficult to observe even in experimental research (e.g., see chapter 3).

We study a situation with three types of actors, as shown in figure 5.1: Ego, Alter, and Tertius; and two types of (directed) ties: trust and informal communication. In figure 5.1, we represent actors with circles and (directed) relations with arrows. Dotted lines indicate a relation of informal communication and straight lines indicate a relation of trust (or distrust). The straight arrow from Ego to Alter indicates the trust relation between these two actors. The state of this relation at time t is our dependent variable. As Ego assesses Alter's trustworthiness on the basis of the information available to her, the state of the trust relation from Ego to Alter depends on information originating from dyadic and network embeddedness. Since we are investigating learning effects, we focus on information about the past. Therefore, dyadic embeddedness refers to previously existing relations between Ego and Alter. In figure 5.1, if the dependent variable is measured at time t, dyadic embeddedness is represented by the two arrows connecting Ego and Alter, measured at time $t - 1$. These two arrows indicate the extent to which Ego trusted Alter at time $t - 1$ and the extent to which Alter trusted Ego at time $t - 1$. In addition, we assume that at least to some extent, these two relations capture the history of the relation between these two actors, and that a trusting relation indicates a positive past and a distrusting relation indicates a negative past. For example, Ego trusting Alter at time $t - 1$ suggests that, as far as Ego is informed, Alter has not

abused trust before. Similarly, Alter trusting Ego at time $t - 1$ suggests that, as far as Alter is informed, Ego has not abused trust before.[4] Thus, we expect Ego's trusting choice towards Alter at time t to be affected by her own attitude towards Alter at time $t - 1$, as well as by Alter's attitude towards Ego at time $t - 1$. However, the hypothesized influence of Alter's past attitude towards Ego on Ego's present attitude towards Alter is also consistent with a preference for reciprocal relations which has been theorized and observed in a number of longitudinal network studies (Hallinan, 1979; Van de Bunt, 1999). For this reason, we refer to this effect as a *reciprocity effect*.[5] Thus, we posit the following two hypotheses on the effects of learning through dyadic embeddedness:

Hypothesis 5.1 The more Ego trusted Alter in the past, the more Ego trusts Alter in the present.

Hypothesis 5.2 The more Alter trusted Ego in the past, the more Ego trusts Alter in the present.

Turning to the effects of network embeddedness, in figure 5.1 Tertius is another member of Ego and Alter's social network. The dotted line connecting him to Ego indicates the frequency at which Tertius talks to Ego. The straight line connecting Tertius to Alter indicates the extent to which Tertius trusts Alter. Similarly, the straight line connecting Ego to Tertius indicates the extent to which Ego trusts Tertius. Consistent with information-diffusion type of models, the information about Alter that Ego receives from network embeddedness depends on the number of third parties who talk regularly to Ego, and on what these third parties can tell Ego about Alter. Furthermore, considering that there might be differences in the importance that Ego attaches to information released by different third parties, we maintain that information originating from third parties is more important for Ego if she trusts the informant, and less if she does not trust the informant. Concerning the content of informal conversations regularly occurring between Ego and third parties, we assume that if third parties often talk with Ego, it is also likely that they will disclose the information they have

[4] Unlike in previous chapters, we do not investigate actual behavior in trust problems and our data contain no information about trustworthiness of other actors. As trust is measured as an attitude, here we refer to Alter's attitude towards Ego in the past as Alter's trusting Ego in the past.

[5] Note that reciprocity here only indicates that a social relation is mutual and should not be confused with the meaning it often takes in game-theoretical literature, where it indicates a specific norm driving human behavior in strategic interactions, according to which actors prefer to cooperate with cooperators and to defect with defectors (e.g., Bolton and Ockenfels, 2000; Diekmann, 2004).

about Alter's trustworthiness during these conversations, and that third parties who trust Alter release *positive* information about him, whereas third parties who distrust Alter release *negative* information about him. These two assumptions are necessary because our data contain information about the frequency of informal communication between all actors, but not about its content.

The second assumption is particularly relevant because there is some empirical evidence for types of effects of third-party information on interpersonal trust that differ from those we hypothesize here (Burt and Knez, 1995; Burt, 2001). Studying the same problem using survey data collected in various organizations, Burt in fact claimed, that due to etiquette regulating informal conversation among colleagues, information about Alter disclosed to Ego by third parties is selected in such a way that it only confirms Ego's previous beliefs about Alter, without providing any new insight (Burt, 2001: 41 and passim). In other words, Burt claims that third parties' true personal trusting attitude towards Alter is never communicated to Ego, unless Ego and third parties already have the same opinion about Alter. However, the empirical evidence presented by Burt comes from cross-sectional survey data that do not allow for observations of how networks actually change over time. Burt's hypotheses were tested comparing levels of trust in weak and strong ties, but the hypothesized mechanism was not explicitly tested. Moreover, most of the effects reported by Burt are compatible both with the argument of "selective disclosure of information in informal conversations," and with the learning mechanism hypothesized here.

What is assumed to be the content of informal conversations among colleagues is also important to distinguish between effects of learning and other types of mechanisms such as imitation. As we state in chapter 2, the distinction between learning and imitation is based on whether the information that Ego receives from third parties contains information on Alter's trustworthiness or just an indication that third parties trusted him. In the first case, Ego can actually learn from third parties, whereas in the second case, the effect induced by this type of information can merely be imitation. Concerning the setting under study in this chapter, learning and imitation make the same predictions for the effects of third-party information. Thus, the only way to distinguish between the two mechanisms is to observe empirically the content of the information transmitted by third parties. In our case, since we are analyzing a rather small department where all employees know each other and relations are presumably rather strong, we believe that third parties disclose complete information to Ego, thus including information on Alter's trustworthiness. Therefore, we describe third-party effects as learning effects.

Summarizing, we maintain that Ego's decision whether to trust Alter will be *positively* influenced by the number of third parties holding a trusting relation towards Alter who talk regularly to Ego and are trusted by Ego, because these third parties will provide Ego with positive information about Alter's trustworthiness. Conversely, Ego's decision whether to trust Alter will be *negatively* influenced by the number of third parties holding a distrusting relation towards Alter who talk regularly to Ego and are trusted by Ego, because these third parties will provide Ego with negative information about Alter's trustworthiness. Hence, we posit the two following hypotheses:

> **Hypothesis 5.3** The more information Ego received from third parties who trust Alter, the more Ego trusts Alter.

> **Hypothesis 5.4** The more information Ego received from third parties who distrust Alter, the less Ego trusts Alter.

Furthermore, we expect the effect of negative information to be stronger than the effect of positive information because trustworthiness could be simulated. In a world where all trusting opinions are formed according to third-party second-hand information, and where everybody knows that all trusting opinions are formed according to third-party second-hand information, an untrustworthy actor has an incentive to fake trustworthiness in order to build a positive reputation and then abuse trust at a later time. Therefore, if third parties report to Ego that they trust Alter, this information only implies that Alter has been trustworthy so far. However, if third parties report to Ego that they do not trust Alter, this information could imply that Alter abused their trust in the past. Therefore, Ego should take negative information into greater consideration than positive information. This hypothesis is consistent with game-theoretic arguments about repeated games with incomplete information (Kreps and Wilson, 1982; Kreps et al., 1982). In fact, according to the model developed by Kreps et al., trust increases gradually after positive experience with Alter, but it collapses abruptly after negative experience. Therefore, we posit the following hypothesis:

> **Hypothesis 5.5** Information stemming from third parties who distrust Alter should have a stronger effect on Ego's trusting decision vis-a-vis Alter than information stemming from third parties who trust Alter.

Finally, we look at conditions that potentially affect the relative importance of information released by third parties for Ego. We expect Ego's assessment of Alter's trustworthiness to be particularly crucial under the condition that Ego is uncertain about Alter. For example, if Ego (or Alter) has only recently entered the organization, Ego will be particularly uncertain about Alter's trustworthiness. Therefore, in this case, her decision whether to trust Alter will be more contingent on the information that she receives from the network (for a similar argument, see Podolny, 1993: 831 on "market status as a *signal* of the underlying quality of a product"; and Podolny, 2001: 37 on "altercentric uncertainty"). Thus, we posit the following hypothesis:

> **Hypothesis 5.6** The more Ego is uncertain about Alter, the stronger is the effect of third-party information about Alter on Ego's trusting decision vis-a-vis Alter.

5.3 Data

In this section we introduce our data from the dialysis department ($N = 40$) of a Dutch middle-sized hospital. For more details about the data collection process, we refer to Van de Bunt (1997, 1999). In a dialysis department, patients who suffer from kidney deficiencies are treated by means of dialysis, which is a method that takes over the kidney's functions. The department is a small organization within the hospital. The largest group of employees is the dialysis nursing staff, including a group of dialysis students. Approximately twice a year, a new group of dialysis students enters the department. Besides the nursing staff, the department has its own technical staff, its own laboratory, and its own group of social workers. Furthermore, there is a small group of doctors and the department's secretary. During an initial observation period of three months, interviews with key persons were held in order to improve the questionnaires and to provide us with a clear picture of the department and its history. The overall response rate was approximately 90 percent. Following the observation period, we collected data once every four months for a period of one year (from June 1995 to June 1996).

At the start of the project, the employees had worked at the dialysis department on average for almost eight years. A relatively large number (33%), however, had worked at the department for less than one and a half year. The average age of the organization members was 40 (all members, including the dialysis students, are between 25 and 57 years old). Almost two thirds of the dialysis nurses had irregular working hours, whereas the rest (including some nurses) had regular working hours during day time. Approximately half of the employees had a

full-time job (43%). Most nurses received an in-service education (37%). Almost one third of all employees had attended higher vocational school or university, and finally, 80% of all employees are female.

5.3.1 Operationalizations

Our dependent variable is the trust tie from actor *i* to actor *j* at time *t*: y_{ij}^{t}. It takes values -1 for a negative/distant relation; 0 for a neutral relation; and 1 for a positive relation.[6] Both variables concerning learning effects from dyadic embeddedness (hypotheses 5.1 and 5.2) have been constructed by taking the value of the specific trust relation at the previous observation point. Thus, we take the value of the trust relation from *i* to *j* at time $t-1$, y_{ij}^{t-1} as the operationalization of *i*'s *own past* and we use the trust relation from *j* to *i* at time $t-1$, y_{ji}^{t-1} to operationalize *reciprocity*.

The variables concerning the effects of information from third parties are constructed as follows. Assuming that third parties who trust Alter release positive information about him to Ego, while third parties who distrust Alter release negative information about him to Ego, the amount of positive information that Ego receives about Alter depends on the number of third parties holding a positive trust relation with Alter and talking regularly to Ego. Thus, we constructed the variable operationalizing positive third-party information about Alter as follows:

$$\ln \sum_{k=1}^{n} p_{kj}^{t-1} x_{ki}^{t-1} (y_{ik}^{t-1} + 1)\,;\; k \neq i; k \neq j\,,$$

where x_{ki}^{t-1} is the frequency at which *k* talks to *i* measured at time $t-1$, and y_{ik}^{t-1} is the extent to which *i* trusts *k* at time $t-1$ and $p_{kj}^{t-1} = 1$ if $y_{kj}^{t-1} > 0$, and 0 otherwise; y_{kj}^{t-1} is the trust relation between actor *k* and actor *j*, the extent to which *k* trusts *j* at time $t-1$. Conversely, negative information is computed using the same formula, but with $p_{kj}^{t-1} = 1$ if $y_{kj}^{t-1} < 0$, and 0 otherwise.[7] We took the natural logarithm of this sum in order to account for the fact that an

[6] The exact formulations of the two questions regarding trust and communication that we used to construct the variables are included in appendix D.

[7] Consequently, also if $y_{kj}^{t-1} = 0$, $p_{kj}^{t-1} = 0$. If Tertius' trust attitude towards Alter is neutral, she will release neutral information to Ego. This implies that neutral information has no effect on Ego's assessment of Alter's trustworthiness.

additional unit of positive information should have a diminishing effect on Ego's opinion about Alter if Ego already has a lot of positive information about him. If *i* is Ego, *j* is Alter and *k* is Tertius, the measures of the two relations x_{ki} and y_{kj} indicate the frequency at which Tertius talks to Ego and what Tertius can tells her about Alter, respectively. Therefore, they are essential for the construction of a variable operationalizing the amount of information about Alter that is available to Ego. Conversely, the third term, $y_{ik}+1$, has been added in order to weight third-party information by how much Ego trusts the specific third party who releases the information. This weight could be included in at least two different (meaningful) ways. First, we could simply multiply the first two terms by y_{ik}. Since y_{ik} is a trust relation, it can take the value 1, 0, or –1. Therefore, weighting third-party information by y_{ik} would imply that the information changes sign if Ego does not trust the informant. This solution is consistent with balance theory (Heider, 1958), implying that if Ego distrusts Tertius, but Tertius trusts Alter, Ego prefers to distrust Alter in order to keep the triad Ego-Alter-Tertius in a state of cognitive balance. Moreover, weighting information by y_{ik} obviously implies that Ego disregards the information if she holds a neutral relation towards Tertius ($y_{ik}=0$). Second, we could multiply the first two terms by $y_{ik}+1$. Weighting third-party information by $y_{ik}+1$ implies that this information is highly valuable to Ego if she trusts Tertius ($y_{ik}=1$), somewhat less valuable if Ego is neutral towards Tertius ($y_{ik}=0$), and it is disregarded if Ego does not trust Tertius ($y_{ik}=-1$). Since balance theory is aimed mainly at friendship relations, while we are dealing with trust relations, for which cognitive balance seems less important, we opted for this assumption and weighted the information variable by $y_{ik}+1$.[8]

Ego's Uncertainty about Alter is operationalized using the amount of time that Ego and Alter have been working together within the organization, assuming that if two employees have a longer common past they are also less uncertain about each other's trustworthiness. Consequently, high values of this variable correspond to low uncertainty. For this reason we hereafter refer to this variable as *certainty*. We took the natural logarithm of the common past expressed in years, because we assume that an additional year should have a diminishing effect if Ego and Alter have already worked together for a long time.

[8] However, we tried running the same analyses using information variables weighted by $y_{ik,}$ but the results did not differ substantively from the results presented here.

Furthermore, we included individual control variables, such as gender and hierarchical position within the organization, and we controlled for homophily effects. Homophily effects are documented in the literature on social relations (see McPherson et al., 2001 for a recent review). Particularly homophily on certain attributes is a good predictor for the formation of close ties, such as marriage (Kalmijn, 1998), friendship (Verbrugge, 1977; 1983), confiding relations (Marsden, 1987; 1988), or support at work (Ibarra, 1992; 1995). We controlled for homophily effects concerning age (*same age*) and function (*same function*). For Age we constructed a dummy variable taking value 1 when the difference between the age of Ego and Alter is smaller than 5 in absolute value. Since the personnel of the department can be straightforwardly classified as "nursing" and "non-nursing", function homophily is represented by a dummy variable taking value 1 for dyads belonging to the same group.

Finally, we controlled for effects of sex and type of hierarchical relation between Ego and Alter. These two variables could be included as homophily effects as well. However, sex is not a very important homophily variable as far as relations among colleagues are concerned, because working environments are often characterized by sex segregation. In the nursing department men are exactly one fifth of the population. Therefore, instead of simply looking at the effect of homophily as opposed to heterophily (e.g., including a dummy variable taking value 1 when Ego and Alter are both men or both women, and zero otherwise), we looked at gender effects comparing men and women in terms of both who trusts more and who is trusted more. We did this by including in the analyses two dummies, one taking value 1 when Ego is a man (*Ego is a man*), the other taking value 1 when Alter is a man (*Alter is a man*). The hierarchical position in the organization held by both Ego and Alter was included in the analysis because the formal structure of an organization has been found to influence the pattern of informal relations (e.g. Han, 1996; Lazega and Van Duijn, 1997). As we did for sex, we preferred to look separately at dyads in which Ego occupies a higher hierarchical position than Alter and dyads in which Alter occupies a higher position than Ego, instead of just looking at homophily effects. Thus, we opted to include two dummies, one (*Ego is higher)* taking value 1 when Ego occupies a higher position than Alter, the other (*Alter is higher*) taking value 1 when Alter occupies a higher position than Ego. For both these variables, the reference category refers to the situation in which Ego and Alter occupy the same position in the hierarchy of the organization.

Table 5.1 Trust network: frequencies

	Time 1		Time 2		Time 3		Time 4	
	N	%	*N*	%	*N*	%	*N*	%
Distrust	321	29.3	278	22.6	293	20.8	245	16.9
Neutral	508	46.4	558	45.3	727	51.6	723	49.8
Trust	265	24.2	395	32.1	389	27.6	484	33.3
Total	1,094	100	1,231	100	1,409	100	1,452	100

Table 5.2 Informal communication network: frequencies

	Time 1		Time 2		Time 3		Time 4	
	N	%	*N*	%	*N*	%	*N*	%
Never	59	5.1	76	5.9	73	5.1	44	3
Less than once a month	316	27.4	192	14.8	285	19.8	232	15.7
1-3 times a month	418	36.2	497	38.4	533	37	603	40.8
1-3 times a week	317	27.5	465	35.9	476	33	507	34.3
Daily	43	3.7	65	5	75	5.2	93	6.3
Total	1,153	100	1,295	100	1,442	100	1,479	100

5.3.2 Descriptive analyses

Before presenting the tests of our hypotheses, we provide a short description of the data, particularly concerning the two network variables used in our main analyses. Table 5.1 and 5.2 show frequencies of trust and communication ties at the four measurement points.

Table 5.1 shows that there is considerable variation in the dependent variable. Particularly, there is a relatively high number of distrust ties. The percentage of negative ties is, in fact, between 20% and 30% at all time points. This indicates that these network data contain enough variation in the trust variable to observe effects of both positive and negative information on trust relations. Table 5.2 shows the distribution of our "frequency of informal communication" network variable. Most ties lie in the central category and only about 10% of the dyads are concentrated in the upper and lower categories.[9]

Examining the changes in the networks between two subsequent time points, table 5.3 displays the number of ties changing and remaining constant in the trust network in all three time intervals. The rate of change of the trust network is rather constant: about a third of the ties change value between all time points. This indicates that the network of trust relations changes significantly over time. Consequently, we should have enough statistical power to estimate the effects of information.

[9] The highest category for frequency of communication (see appendix D) is actually excluded from the table because nobody answered that they speak with a colleague "several times a day."

Table 5.3 Changes in the trust network: frequencies

	Time 1 – 2		Time 2 – 3		Time 3 – 4	
	N	%	*N*	%	*N*	%
Constant	660	65.7	755	67	919	65.7
Changed	345	34.3	373	33	480	34.3
Total	1,005	100	1,128	100	1,399	100

Table 5.4 Changes in the communication network: frequencies

	Time 1 – 2		Time 2 – 3		Time 3 – 4	
	N	%	*N*	%	*N*	%
Constant	519	47.8	573	48.3	774	53.8
Changed	566	52.2	614	51.7	665	46.2
Total	1,085	100	1,187	100	1,439	100
Change > 1	98	9	89	7.5	90	6.2

Looking at the communication network (table 5.4), the number of dyads changing frequency of communication at work between time points is generally higher: More than 50% of these ties change in all three time intervals between subsequent measurements. However, most of the changes consist of small oscillations as illustrated by the last row of table 5.4 which displays the frequencies of changes larger than 1 in the network of informal communication. Changes larger than 1 are only 9, 7.5, and 6.2 percent of the total number of changes occurring in the three time intervals, respectively. Moreover, the average standard deviation of the values of the communication ties between the four time points is equal to 0.53. This indicates that, for all dyads, the values in the communication network change on average 0.53 in all three time intervals. Therefore, we can conclude that the communication network is quite stable. As we anticipated in the introduction, this indicates that neglecting the effects of the trust network on the communication network is not a severe limitation for our analyses, since the communication network remains almost constant through time. Conversely, estimating the effects of interpersonal communication on trust relations is not problematic, because, while the structure of the communication network is relatively constant, the content of the information that the actors transmit to each other depends on their trust relations, and the trust relations are not constant over time.

5.4. Results

5.4.1 Statistical model

The complete networks for trust and interpersonal communication at work are measured at four different time points. Thus, observations have multiple levels of interdependencies. Observations are (non-hierarchically) clustered within Ego, within Alter, within time points,

and within dyads. Moreover, we are implicitly assuming that the network only changes at the discrete points in which we measure it. Therefore, ideally, our statistical model should: 1) account for the interdependencies, 2) model unobserved changes occurring between actual observations, and 3) allow simultaneous estimations of both the effects of the communication network on the trust network as well as the effects of the trust network on the communication network. The first two problems could be addressed by applying models for the analysis of longitudinal network data for the study of the coevolution of networks and behavior (Snijders, 2001, 2005). These models assume that social networks evolve in continuous time, following a Markov process. They could be estimated using the SIENA program (Snijders et al. 2005). However, the current version of SIENA cannot be used to analyze our data for two reasons. First, the current version of SIENA does not support the estimation of network variables that are not dichotomous. Second, it does not support predictors that are also network variables changing over time. Therefore, we focus only on the effects of the communication networks on the trust networks, comparing subsequent observation points, thus neglecting effects caused by reverse causality as well as unobserved changes in the network.

We used the state of the networks at time $t - 1$ to predict the trust network at time t. We did this using a multilevel Social Relations Model (Snijders and Kenny, 1999) including multiple observations of directed dyads over time. This model has been developed to analyze relational data, and in particular family data, measured at the dyadic level. In directed dyadic data, like those we use for this analysis, the relation from Ego to Alter and the relation from Alter to Ego are two different measures. For example, concerning the variable trust, the relation from Ego to Alter is a measure of how much Ego trusts Alter, reported by Ego, while the relation from Alter to Ego is a measure of how much Alter trusts Ego, reported by Alter. A specific value on the trust relation from Ego to Alter could be affected by characteristics of Ego. For example, Ego could be a very trustful person who trusts others easily. It could also be affected by characteristics of Alter. For example, Alter could be a very trustworthy person, whom nearly everybody trusts. It could also be affected by relational specific features. For example, Ego might particularly trust Alter a lot, or Ego and Alter may have known and trusted each other for a long time before they became colleagues. Since we have four subsequent measures for every relation, we have to extend the original model by Snijders and Kenny (1999) to take into account the dependence of observations of the same dyads over time.[10]

[10] We thank Marijtje van Duijn for advice on these models and for the implementation of this extension in MLwiN.

Summarizing, the data imply a complicated multilevel model in which observations are nested through time within directed dyads. Then, directed dyads are pair-wise nested in undirected dyads. In addition to this, directed dyads are non-hierarchically nested within Egos as well as Alters. The model we present in this chapter includes most of the random effects that are implied by this structure and is specified as follows:

$$y_{ijt} = \mu_t + \beta Z_{t\text{-}1} + \gamma X_{ij} + E_i + R_{(ij)} + D_{ij} + v_{ijt},$$

where y_{ijt} is the dependent variable, the trust relation from i to j observed at time t. In order to control for unmeasured variations due to the specific time in which observation took place, we included fixed effects for time, μ_t. Therefore, this model effectively has three different constant terms, one for each measurement time. $Z_{t\text{-}1}$ stands for the independent variables built using observations measured at time $t - 1$. X_{ij} represents all time-constant covariates depending on i or j. E_i is the random effect for the error at the Ego level. $R_{(ij)}$ is the error at the dyad level (taking care of the interdependence between the two directed dyads ij and ji). D_{jj} is the error at the level of the (directed) dyad ij, and v_{ijt} is the residual at the observation level.

One obvious extension would be to also include a random effect at the level of Alter, possibly in combination with a correlation between actor-level errors referring to the same actor as i and j. We did estimate such a model, however, the random effects at the level of Alter and the correlation between the random effects for Egos and Alters were very small compared the other random effects. Moreover, the substantive results were practically the same, with the only difference being that the effect of positive third-party information became slightly less significant. Because the additional insight provided by this more complicated model is negligible, we choose to present the simpler model specified above. One could also imagine that the residuals differ between time points and, consequently, one might want to estimate different residuals for each time point in addition to the fixed effects for time points. However, the estimation of a model with separate actor-level residuals for every time point shows that the size of the residual term v_{ijt} does not vary between time points.[11]

[11] Since the dependent variable has a discrete distribution, we also estimated a maximum-likelihood ordered logit. However, this model did not yield substantively different results either, although we were not able to model the multilevel structure in such a detailed way as in the model presented here.

Table 5.5 Random effects regression models

Hyp.[a]	Independent variables	Expected sign	Model 1	Model 2	Model 3	Model 4
	Dependent variable: Ego's trust in Alter					
				Coefficient (standard error)		
	Constant (time 2)		.121**	.241**	.522**	.500**
			(.053)	(.060)	(.078)	(.089)
	Constant (time 3)		.097	.216**	.393**	.364**
			(.052)	(.060)	(.081)	(.090)
	Constant (time 4)		.183**	.304**	.513**	.491**
			(.052)	(.060)	(.080)	(.089)
5.1	Own past	+			.457**	.450**
					(.016)	(.016)
5.2	Reciprocity	+			.150**	.154**
					(.014)	(.015)
5.3	Positive information from third parties	+			.028*	.046**
					(.014)	(.014)
5.4	Negative information from third parties	–			-.144**	-.132**
					(.014)	(.015)
	Certainty					-.051
						(.029)
5.6	Certainty × pos. information	–				.022
						(.013)
5.6	Certainty × neg. information	+				-.019
						(.014)
	Control variables					
	Ego is a man			-.147	-.078	-.081
				(.111)	(.078)	(.075)
	Alter is a man			.027	.070**	.060*
				(.039)	(.024)	(.024)
	Ego is higher			-.174**	-.067*	-.130**
				(.045)	(.027)	(.034)
	Alter is higher			.064	.021	-.007
				(.048)	(.029)	(.029)
	Same age			.027	.013	.015
				(.045)	(.022)	(.022)
	Same function			.216**	.047*	.046*
				(.041)	(.023)	(.023)
	Model statistics					
	Random effect at the Ego level		.089	.069	.034	.031
			(.022)	(.017)	(.008)	(.008)
	Random effect at the undirected dyad level		.174	.159	.000	.000
			(.014)	(.014)	(.000)	(.000)
	Random effect at the directed dyad level		.068	.069	.000	.000
			(.009)	(.009)	(.000)	(.000)
	Random effect at the observation level		.195	.195	.269	.268
			(.006)	(.006)	(.007)	(.007)
	Number of observations		3,266	3,266	3,266	3,266
	Number of subjects		40	40	40	40[b]
	Maximum likelihood		5673.72	5624.15	5058.48	5044.48

**, * Indicate two-sided significance levels of $p < 0.01$, $p < 0.05$, respectively.

[a] Hypothesis 5.5 concerns the difference between the effects of positive and negative information from third parties. Given the size of the two coefficients and relative standard errors, these two effects are significantly different. Therefore, hypothesis 5.5 is supported.

[b] Seniority (which we used to create the variable "certainty") was missing for one subject. Since the missing case was a nurse, we replaced this case with the average seniority computed over all nurses, in order not to lose too many observations.

Estimating how trust relations evolve over time, we lack information about the origin of the network. In fact, the first observation does not correspond with the moment in which the network came into existence. On the contrary, the network had existed a long time before the observation started. Therefore, since we do not have measurements of the lagged variables $Z_{t\text{-}1}$ for the first time point, we excluded these cases from the analyses. In other words, we estimate change in trust relations in the second, third, and fourth observations as a function of information available to the actors at the first, second, and third time point, respectively. Thus, observations concerning trust relations at the first time point are included in the independent variables as part of the information about the past available to the actors to predict trust at the second time point.

5.4.2 Tests of the hypotheses

The results of the multilevel analyses are shown in table 5.5, where four different models are presented. Model 1 is presented as a benchmark, including only the fixed effects for time and the random effects. Model 2 contains fixed effects for time and control variables. In model 3, four variables referring to hypotheses 5.1 to 5.4 are added and, finally, in model 4, interaction effects are included as well.

Looking at the maximum likelihood, we can see that it improves from model 1 to model 4. However, the difference in the maximum likelihood is particularly large when comparing models 1 and 2 with models 3 and 4. This indicates that the models including only fixed effects for time (model 1) and time-constant characteristics of the actors (model 2) fit the data less well than models that also include time-varying network variables (models 3 and 4). In model 1, the fixed effects for time indicate that, on average, there is more trust at the fourth time point. The random effects in model 1 show that there is considerable unexplained variance at all levels. The value of the residual v_{ijt} increases in models including the effects of the main explanatory variables, while the random effects related to dyads are estimated at zero. This probably indicates that the additional independent variables included in models 3 and 4, such as own past and reciprocity, mainly explain variance at the level of the dyads and that, due to the reduction in the unexplained variance at the dyadic level, the estimation process has difficulties in disentangling random effects at the dyadic level from the residual at the observation level.

In models 3 and 4, the main effects concerning learning through dyadic embeddedness (own past and reciprocity), as well as network embeddedness (positive and negative information) are significant in the expected direction. Dyadic embeddedness has a positive

effect, indicating that Ego's current trusting attitude towards Alter is strongly influenced by positive experience, as captured by both Ego's trust in Alter in the past and Alter's trust in Ego in the past. Reciprocity, in fact, also has a positive effect. Actors prefer to trust others who have trusted them and prefer to distrust others who have distrusted them. Positive information about Alter has a positive effect on Ego's trust in Alter and negative information has a negative effect. Thus, hypotheses 5.1 through 5.4 are supported.

Hypothesis 5.5 on the difference between the effect of positive and negative information is also supported: given the size of the two coefficients and the relative standard errors in models 3 or 4, the effect of negative information is significantly larger than the effect of positive information. Conversely, hypothesis 5.6 concerning interaction effects between certainty and information is supported for neither positive information nor negative information. Both interaction effects have the opposite sign than what we hypothesized and the interaction effect between certainty and positive information is almost significant in the opposite direction. Moreover, the main effect of certainty is also unexpectedly negative and almost significant.

Although the main effect of certainty and the two interaction effects between certainty and information are not significant, it is puzzling that the coefficients of these three effects have the opposite sign than what we expected. Particularly, the negative effect of certainty suggests that, for any given dyad, the shorter the time Ego and Alter have been working together for, the more Ego is seemingly likely to trust Alter, or in other words, the more uncertain Ego is, the more likely she is to trust Alter. Speculating on this puzzling result, we offer the following explanation. During data collection, in addition to the quantitative data used in this analysis, we also conducted several interviews with various members of the dialysis department in order to achieve a certain degree of knowledge of the history of the department. These interviews suggested that the department has had a rather troublesome history. For a long time, it was divided in two groups characterized by mutually hostile relations. However, at the time of the research, several employees had left the department and many new students had joined, and some new students also joined during data collection. In the light of the history of the department, we think that since interpersonal relations in the department have been rather conflictual, the employees tend to have a positive attitude towards newcomers, because they hope that the quality of relations between colleagues might improve (for more information on the data, see Van de Bunt, 1999: ch. 3). The fixed effects for time in model 1 provide some indication that trust does indeed increase in the fourth measurement. In order to test this conjecture, we run the same model as model 4, replacing

Table 5.6 Random effects regression model including Alter's seniority

Hyp.	Dependent variable: Ego's trust in Alter Independent variables	Expected sign	Coefficients (standard errors)
	Constant (time 2)		.582**
			(.079)
	Constant (time 3)		.443**
			(.081)
	Constant (time 4)		.566**
			(.080)
5.1	Own past	+	.451**
			(.016)
5.2	Reciprocity	+	.154**
			(.014)
5.3	Positive information from third parties	+	.044**
			(.014)
5.4	Negative information from third parties	–	-.148**
			(.014)
	Alter seniority in years (ln)		-.049**
			(.011)
	Control variables		
	Ego is a man		-.081
			(.070)
	Alter is a man		.063**
			(.024)
	Ego is higher		-.141**
			(.032)
	Alter is higher		.033
			(.029)
	Same age		-.003
			(.022)
	Same function		.035
			(.023)
	Model statistics		
	Random effect at the Ego level		.032
			(.008)
	Random effect at the undirected dyad level		.000
			(.000)
	Random effect at the directed dyad level		.000
			(.000)
	Random effect at the observation level		.267
			(.007)
	Number of observations		3,266
	Number of subjects		40
	Maximum likelihood		5038.71

**, * Indicate two-sided significance levels of $p < 0.01$, $p < 0.05$, respectively.

our certainty variable (natural logarithm of the time Ego and Alter have been colleagues in years) with the natural logarithm of Alter's seniority in years and removing the two interaction effects between certainty and third-party information. This model is shown in table 5.6.

Alter's seniority has a significantly negative effect on the extent to which Ego trusts Alter. This implies that newcomers are indeed trusted more than senior employees. A general

improvement of the working environment is also evident from the descriptive analyses which show that, on average, interpersonal trust increases from the first to the fourth observation (see table 5.1) Moreover, since the variables *certainty* and *Ego is higher* are significantly correlated with each other, the effect of *certainty* is probably overestimated. In fact, the size of the coefficient of *certainty* decreases if *Ego is higher* is removed from the model.[12]

The explanation offered above can also help us to understand why our hypotheses on interaction effects are not supported. In fact, given the troublesome history of the dialysis department, it seems that there is a positive bias towards newcomers in terms of trust. This implies that the length of Ego and Alter's common past is not a good measure for Ego's uncertainty about Alter's trustworthiness. Consequently, we may not observe any mitigating effect of uncertainty on positive and negative information about Alter, since uncertainty is poorly measured.

Turning to the control variables, few have a significant effect on trust and, moreover, these results are rather unstable across models. Also note the small size of our population, which is a problem, particularly for these control variables since they vary only between subjects. Only the effects of hierarchical relations and function homophily are significant in all models. Ego trusts Alter less when Ego occupies a higher position than Alter in the hierarchy of the organization, and Ego trusts Alter more when they are both nurses or both not nurses. The only other significant effect is an effect of gender. Men seem to be slightly more trusted than women, although this effect is only statistically significant in models 3 and 4. None of the other control variables are significant in any of the models.

5.5 Conclusions and discussion

In this chapter, we study the effect of information circulating in a network on the evolution of interpersonal trust relations among members of the network. The network consists of forty employees of a dialysis department of a Dutch hospital. The data consist of four measurements of the complete networks of interpersonal trust and communication at work, taken every three months between June 1995 and June 1996. Using both network variables, we constructed an individual measure for every node (Ego) of both positive and negative information about every other node (Alter) available to Ego through third parties at every time point. Then, we used the measures at a given time point to predict interpersonal trust from any

[12] The correlation between *certainty* and *Ego is higher* is intuitive: employees occupying higher positions are typically seniors, while most of the employees occupying the lower positions are students completing their practical training, who, of course, had only entered the organization recently.

Ego to any Alter at the subsequent time point. The hypotheses are based on learning models through dyadic and network embeddedness and theories about the effects of information stemming from social networks on interpersonal trust relations.

Results show that both dyadic and network embeddedness are important. Actors learn to trust from their own past experiences and prefer to reciprocate pre-existing relations. Positive information about Alter, available to Ego in the past, makes it more likely that Ego trusts Alter in the present, while negative information about Alter, available to Ego in the past, makes it less likely that Ego trusts Alter in the present. However, the hypothesis about changes in the effects of positive and negative information due to varying uncertainty was not supported by the data. Moreover, our analyses yielded a puzzling result concerning uncertainty, indicating that Ego is more likely to trust Alter when she is more uncertain about Alter. We offered and tested a possible explanation for this anomaly. This explanation emerged from information based on qualitative interviews concerning the department's history which were conducted during the data collection. Since the results indicate that newcomers into the department are trusted more than people who have been working there longer, and since interpersonal relations in the department had been quite troublesome in the past, it seems likely that this greater trust in newcomers is caused by the hope that new employees might improve the atmosphere at work. For this reason, we conjecture that the hypothesis concerning an interaction effect between uncertainty and information originating from network embeddedness was not supported.

Some issues concerning our analyses merit discussion. First, the communication network variable consists of the complete network of frequency of communication at work between the forty employees, measured at four time points. However, all we know about the content of this informal communication is that it should be "more than the transmission of a simple message or a greeting", as specified in the question (see appendix D). Thus, the analyses and results are based on the assumption that colleagues who talk with each other at work more often are more likely to release information about which other colleagues they do and do not trust. Furthermore, it is assumed that Ego takes information coming from persons she herself trusts more seriously. This assumption overtly contradicts the assumptions on which other analyses are based (Burt and Knez, 1995; Burt, 2001); Burt and Knez argue that, due to etiquette, informal conversations among colleagues only produce a reinforcement of pre-existing beliefs and do not provide actors with any new information about others from which they could learn. Nevertheless, the results we found cannot be explained by the mechanism hypothesized in these studies. Moreover, as stated by Burt (2001: 61), his findings

are typical of medium to large networks, such as the networks of managers and bankers used by Burt and Knez (1995) and Burt (2001) in their analyses. By contrast, our conclusions are based on analyses of a rather small network. This difference is important, because the members of the network are colleagues working in the same department of one organization, who meet regularly, and therefore probably also have a denser network, characterized by less superficial relations, for which etiquette is presumably not so important.[13] Since there is empirical evidence for two contrasting mechanisms, existing theories could be developed toward specifying circumstances under which these different mechanisms operate. Subsequently, an appropriate research project could be designed to observe these mechanisms empirically.

Second, experimental evidence shows that imitation effects are also important (see chapter 2 and 3). However, the data used for the analyses presented in this chapter do not allow to study separately effects of learning and imitation; this distinction bears, in fact, on the content of the information that is communicated to Ego, but the data only include information on the frequency of communication between respondents and not on the content of these communications. If Ego knows from Tertius that Alter is not trustworthy – e.g., because Alter abused Tertius' trust in the past – then Ego learns to distrust Alter. Conversely, if Ego knows that Tertius does not trust Alter, but does not know why, then she can only imitate Tertius. However, since we study a small network whose members all know each other, it seems realistic to assume that, if Tertius talks to Ego very often and Ego trusts Tertius, Tertius will provide Ego with complete information, thus including information on Alter's trustworthiness. Therefore, we describe these effects as learning effects. In order to distinguish empirically between learning and imitation, specific data need to be collected in which the content of informal conversation among colleagues is observed.

Third, we study a population of forty people and the relations of trust and communication existing among them by looking at four snapshots taken at three month intervals. By doing this, we implicitly assume that the relations observed at time 1 coincide with the origin of this network and we ignore everything that happened to these forty people before we started observing them. However, the unexpectedly negative effect of uncertainty, which we discuss in the results section, shows that problems can occur when large parts of the history of the relations that are studied lie outside the data. This point could be addressed by

[13] We cannot compare our network with those analyzed by Burt in terms of density, because we analyzed the complete network, measured with a round-robin design in which everybody responded about everybody else, whereas the data utilized by Burt were collected using name generators.

observing a complete network from its origin, for example, a network of students at the beginning of their first grade of high school. However, analyzing such a network from the origin implies that all actors are equally uncertain about each other. Therefore such data would not be suitable to test hypothesis 5.6, on the interaction effect between information and uncertainty.

Fourth, analyzing four snapshots, we ignore what happened in the three months elapsing between each of them. This problem could be better addressed by applying statistical models for the evolution of networks to analyze our data (Snijders, 2001, 2005). These models, which assume that networks evolve continuously through time, are designed to model unobserved network changes. Therefore, they are more suitable, in principle, to analyze these data. However, at the current state of the art, the statistical package for the analyses of these models, SIENA, cannot be used to model the co-evolution of two networks changing simultaneously (trust and communication), as we have in the data analyzed here. Further developments in this line of research could profit from both the availability of more sophisticated statistical tools to analyze such dynamic data as well as from the collection of new dynamic network data by means of surveys specifically designed to test these hypotheses.

Chapter 6

Summary and conclusions

6.1 Introduction

In this book we study the effects of information stemming from dyadic and network embeddedness on the behavior of actors in trust problems. Furthermore, we investigate how subjects react to the various types of information available under different conditions of uncertainty. In chapter 1, we introduce the concepts and terminology used throughout the book, we offer a typology of the kinds of information analyzed in the different empirical chapters, and we present our research questions. Chapters 2 through 5 contain four empirical studies, each applying a different research design. In this final chapter, we discuss our results and offer our conclusions. In the remainder of this section, we summarize the research problems, our typology of information available in embedded situations, and the various settings of the empirical chapters. Subsequently, the empirical findings are summarized in section 6.2, ordered by type of information. In section 6.3, we summarize our findings concerning uncertainty. Finally, in section 6.4, we discuss the implications of our findings and address some suggestions for future research.

6.2 Theoretical framework

Trust problems are situations involving two interdependent actors. One actor, (Ego) has the possibility to place some resources at the disposal of the other actor (Alter) who, in turn, has the possibility to honor or abuse Ego's trust. Ego gains from placing trust if her trust is honored, but she suffers a loss if Alter abuses trust. Conversely, Alter gains from abusing trust if Ego places trust, but he would prefer the situation in which trust is placed and honored to the situation in which trust is not placed. There is no binding agreement protecting Ego from the possibility of Alter abusing trust. Ego and Alter's decisions are not simultaneous: Ego decides first whether to place trust and, subsequently, if Ego places trust, Alter chooses whether to honor or abuse Ego's trust (Coleman, 1990: ch. 5). This type of situation is

captured by the Trust Game (Camerer and Weigelt, 1988; Dasgupta, 1988; Kreps, 1990) and the Investment Game (Berg et al., 1995). These are game-theoretic formalizations of strategic situations involving two actors, characterized by mixed motives. That is, both players prefer the situation in which trust is placed and honored over the situation in which trust is not placed. However, if the two players act on the base of individual self-interested rationality – and assume the other player does the same – no trust is placed and both players earn a lower payoff than what they would have earned if trust had been placed and honored.

It is generally assumed that Ego's decision whether to trust Alter depends on Ego's subjective probability that Alter will honor trust, if trust is placed (Gambetta, 1988; Coleman, 1990). In isolated encounters, standard economic rationality dictates that trust is never placed, because Ego expects Alter to always abuse trust. However, most trust problems typically occur in embedded settings (Granovetter, 1985). In embedded settings, Ego and Alter might have a common past or a common future, or they might have common relations to third parties. The former situation is referred to as dyadic embeddedness, the latter as network embeddedness (Raub, 1997; Buskens and Raub, 2002; Buskens, 2002). In embedded settings, more information is available to Ego to assess Alter's trustworthiness. Furthermore, there is empirical evidence that social embeddedness promotes trust (Wechsberg, 1966; Lorenz, 1988; Larson, 1992; Gulati, 1995a, 1995b; Uzzi, 1996, 1997). Particularly, two mechanisms accounting for the effects of dyadic and network embeddedness in trust problems have been identified: *learning* and *control* (Raub, 1997; Buskens, 2002; Buskens and Raub, 2002; see also Yamagishi and Yamagishi, 1994: 138-139). Learning indicates the mechanism through which information concerning Alter's behavior in previous trust problems reaches Ego via dyadic and network embeddedness. Control refers to the possibility, for Ego, to sanction or reward Alter through dyadic embeddedness – e.g. placing or withholding trust in future trust problems with Alter – or through network embeddedness – e.g. spreading information about Alter's behavior to third parties, who will sanction or reward Alter when they have a trust problem with him.

This book focuses on Ego's behavior in situations resembling a trust problem in embedded settings. More precisely, we investigate how the information that is available to Ego from dyadic and network embeddedness influences her decision whether to place trust. A trust problem essentially consists of three elements: the focal actor, Ego, who is confronted with the decision whether to place trust; the person to be trusted, Alter; and the focal trust problem, what Ego can trust Alter to do (cf. Hardin, 2002: 9). Thus, useful information that Ego receives from dyadic and network embeddedness can include information about Alter

and about the focal trust problem. In chapter 1, we offer a typology concerning the kinds of information that Ego can receive from social embeddedness. This information can vary on two dimensions. First, concerning Alter, information can be *Alter-specific* or *Alter-unspecific*. We maintain that the information Ego receives is Alter-specific when it regards Alter, the very same actor with whom Ego has a trust problem. By contrast, information is Alter-unspecific when it concerns a different person than Alter, the actor with whom Ego has a trust problem. Alter-specific or Alter-unspecific information can be available to Ego via dyadic embeddedness and network embeddedness. Second, concerning the focal trust problem, information can *be transaction-specific* or *transaction-unspecific*. Information is transaction-specific when it concerns a similar trust problem, and it is transaction-unspecific when it concerns another type of interaction different from the focal trust problem. For example, a similar trust problem could be another interaction resembling a Trust Game or an Investment Game involving Ego and Alter in the same roles and implying a risk for Ego comparable to the risk associated to the focal trust problem. Conversely, another type of interaction could be a different trust problem involving a much bigger or smaller risk for Ego, or it could be a different interaction with different moves and different payoffs. However, we only investigate one specific situation in which transaction-unspecific information is available to Ego; this is done in chapter 4. We provide more information on this type of transaction when summarizing the laboratory experiment presented in chapter 4.

The typology of information available to Ego in embedded settings is summarized in table 6.1. Every cell corresponding to a different type of information contains one example. This typology is not intended to be exhaustive of all possible types of information that can affect trust problems, but we use it to systematically organize the topics treated in previous chapters and to summarize our empirical results. Moreover, we do not analyze all the types of information indicated by every cell in table 1. More precisely, concerning dyadic embeddedness, we focus on Alter-specific information. Thus, only the types of information indicated by cells 1 and 3 are investigated and the types of information indicated by cells 2 and 4 are neglected. Concerning network embeddedness, we focus our summary on the types of information indicated by cells 1, 2, and 3 and we neglect the type of information indicated by cell 4. We limit ourselves to focusing on these types, because we expect the types of information that we do not cover extensively to be mostly irrelevant in terms of what Ego can gain if she takes this information into account when deciding whether to place trust in Alter.

Table 6.1 Typology of information available to Ego in embedded settings

			Information about the transaction	
			specific	unspecific
Dyadic embeddedness	Information about Alter	specific	**1**: Ego has had the same trust problem with Alter in the past	**3**: Ego has had other interactions, different from the focal trust problem, with Alter in the past
		unspecific	**2**: Ego has had the same trust problem with a different partner in the past	**4**: Ego has had other interactions, different from the focal trust problem, with a different partner in the past
Network embeddedness	Information about Alter	specific	**1**: Ego has a relation with at least one Third Party who has had the same trust problem with Alter in the past	**3**: Ego has a relation with at least one Third Party who has had other interactions, different from the focal trust problem, with Alter in the past
		unspecific	**2**: Ego has a relation with at least one Third Party who has had the same trust problem with a different partner in the past	**4**: Ego has a relation with at least one Third Party who has had other interactions, different from the focal trust problem, with a different partner in the past

Furthermore, we investigate how the different types of information affect Ego's decision under different conditions with respect to uncertainty. We conceive uncertainty broadly. The conceptualization of uncertainty covers various sources of uncertainty, including Alter's preferences, e.g. for equal outcomes, his abilities, but also exogenous sources independent from Alter. More precisely, in chapters 2, 3, and 5, we study interaction effects between the extent to which Ego is uncertain about some aspects of the trust problem and the information available to her. In chapter 4, we study whether transaction-unspecific information that might reveal Alter's preferences for equal outcomes to Ego affects Ego's behavior in the Investment Game.

In this book we derive new, often game-theoretically inspired, hypotheses from existing theories about the effects of information in embedded trust problems, and test them using different methods concerning both data collection and data analysis. In chapters 2 and 3, we investigate the effects of Alter-specific and Alter-unspecific, but transaction-specific information. In chapter 4, we analyze the effects of Alter-specific, transaction-unspecific information. Finally, in chapter 5, we focus on transaction-specific and Alter-specific information. Before summarizing our empirical findings we provide a brief description of the type of analyses conducted in every chapter.

In chapter 2, we discuss the specific content of Alter-specific and Alter-unspecific information available to Ego from network embeddedness. The information that Ego receives from network embeddedness comes from third parties who have had trust problems with Alter or with a different trustee, or from third parties who might have a trust problem with Alter or with a different trustee in the future. Information about trust problems that occurred in the past might include specific information about the trustworthiness of Alter (or of a different trustee), or it might simply include an indication that third parties trusted Alter in the past, but no information on Alter's trustworthiness. Thus, in the first case Ego can *learn* about Alter's trustworthiness, while in the second case she can only *imitate* the trusting behavior of third parties vis-á-vis Alter. Furthermore, information about potential future trust problems involving third parties and Alter can induce effects of *control*, because Ego has the possibility to sanction or reward Alter, depending on his behavior in the past, by informing third parties of Alter's behavior.

In chapter 2, we test hypotheses about the effects of learning, imitation, and control, as well as hypotheses about interaction effects between uncertainty and learning and between uncertainty and imitation. We do this by means of a vignette experiment in which variables that operationalize various types of information are implemented as characteristics of the situation sketched in the vignette. We apply the method of paired comparison, that is, subjects participating in the experiment are asked to compare pairs of vignettes that describe a specific trust problem and differ with respect to some characteristics concerning the information available to Ego. Experimental subjects are required to express a preference for one vignette within every pair. Subsequently, we estimate a probit model in which the subject's choice is the dependent variable and the various characteristics described in the vignettes are the predictors.

Like chapter 2, chapter 3 also deals with Alter-specific and Alter-unspecific, but transaction-specific information, but it applies a different research method. In chapter 3, we discuss a laboratory experiment in which subjects play a finitely repeated Investment Game while exchanging information with each other. More precisely, all subjects in the role of Ego exchange information with two other subjects in the role of Ego, one playing with the same Alter and one playing with a different trustee. Moreover, in line with the distinction introduced in chapter 2, we vary the content of the information that subjects transmit to each other. In one of the experimental conditions, all subjects in the role of Ego receive information about both the choice of another actor in the role of Ego and that of Alter, while in another condition, subjects in the role of Ego only receive information about the choice of

another actor in the role of Ego, but not about Alter's choice. Using these experimental data, we test hypotheses about the effects of learning, imitation, and control, as well as hypotheses about interaction effects between some of these effects and uncertainty. The hypotheses are tested by regressing Ego's choice in the Investment Game on the variables that operationalize the different types of information available to Ego.

Chapter 4 focuses on transaction-unspecific information from dyadic and network embeddedness. In principle, transaction-unspecific information includes all information available to Ego about other past transactions, different from a trust problem. However, we only analyze one specific situation in which actors face a trust problem after they have experienced a number of negotiated exchanges embedded in small exchange networks. Negotiated exchanges are modeled using the division of a fixed pool of resources to represent the exchange. Particularly, actors involved in negotiated exchanges bargain over the division of a pool of resources until they reach an agreement (e.g., Willer, 1999). Experimental research on negotiated exchanges has investigated the role of the structure in determining the parties involved and the terms of the exchange. Exchange structures are networks of exchange relations in which the number of potential partners per every actors varies, determining differences in bargaining power. Formal theories have been developed to predict, given the exchange network, which actor exchanges with which other actor as well as the point of agreement concerning the division of the pool of resources between the two actors completing the exchange (e.g., see Skvoretz and Willer, 1993 or the special issues of *Social Networks* 14, No.3-4). In chapter 4, we report an experiment in which the standard experimental procedure adopted by network exchange theorists is used to generate a common experience of a transaction that does not involve trust between our experimental subjects. Subsequently, the subjects play two one-shot Investment Games, first in the role of Ego and then in the role of Alter, with one of the actors with whom they have had previous negotiated exchanges. Then, we observe how the experience of previous exchanges, not involving a trust problem, influences the decisions of the subjects in trust problems. The experiment presented in chapter 4 differs from the experiments presented in chapters 2 and 3 in two important aspects. First, in the experiment discussed in chapter 4 we do not manipulate uncertainty. Second, we do not only focus on Ego's behavior, but we also analyze the effects of transaction-unspecific information on Alter's behavior. The hypotheses discussed in chapter 4 are based on two types of theories. On the one hand, we test hypotheses on the effects of learning about the social preferences of the exchange partner. These hypotheses are based on economic models of actors incorporating non-standard preferences, such as *fairness* (Rabin, 1993) and *equity* or

inequality-aversion (Fehr and Schmidt, 1999; Bolton and Ochenfels, 2000). On the other hand, we discuss and test hypotheses based on *relational cohesion theory* (Lawler and Yoon, 1993, 1996, 1998; see also Lawler, 2001). According to this theory, actors experience emotions during repeated exchanges; these emotions induce an affective commitment to the exchange relations as well as interpersonal trust between the actors involved in the exchange. The hypotheses presented in chapter 4 are tested using regression models in which information about the negotiated exchanges in the first part of the experiment are used to predict Ego and Alter's choices in the subsequent Investment Games.

Finally, chapter 5 differs from the rest of the book with respect to two important aspects. First, while chapters 2 through 4 deal with experimental research, in chapter 5 we examine survey data including trust relations among colleagues within the department of a specific organization. We test some of the same hypotheses discussed in previous chapters using survey data in order to check the robustness of our results, and possibly to improve their external validity. Second, since there is evidence that social embeddedness promotes trust (e.g., Wechsberg, 1966; Lorenz, 1988; Larson, 1992; Gulati, 1995a, 1995b; Uzzi, 1996, 1997), individuals have an incentive to invest in social relations, because social relations constitute social capital for the actors (Flap, 2004). Therefore, research on the effects of social embeddedness should also examine situations in which social networks are not exogenously determined. In chapter 5, we do precisely this. We analyze the effects of information available from dyadic and network embeddedness in a context in which actors are allowed to form and dissolve relations with others. More precisely, in chapter 5, we present analyses based on longitudinal data in which relations of trust and informal communication are observed at four different points in time and we use the information available to the actors to predict the formation and dynamics of trust relations. Since these data do not include information on the behavior of the respondents in trust problems nor Alter-unspecific or transaction-unspecific information, we focus on the effects of learning only, and discuss only Alter-specific and transaction-specific information. As the data are longitudinal, we use the network of informal communication to construct measures that account for the amount of positive and negative information about Alter available to Ego at a given point in time. Then we tested our hypotheses using these measures to predict the formation of a trust relation from Ego to Alter at the subsequent time point.

6.3 Empirical findings

In the next three subsections, we discuss the main findings of our empirical research. We order our results according to the cells in table 1. Particularly, we discuss the effects of Alter-specific and transaction-specific information (cell 1) in section 6.3.1. We discuss the effects of Alter-unspecific information (cell 2) in section 6.3.2. Finally, we discuss the effects of transaction-unspecific information (cell 3) in section 6.3.3. Moreover, within every subsection, the effects of information stemming from dyadic embeddedness are discussed first, and the effects of information stemming from network embeddedness second.

6.3.1 Effects of Alter-specific and transaction-specific information

Clearly, Alter-specific and transaction-specific information from dyadic embeddedness is the most comprehensive information an actor in the role of Ego can have when facing a trust problem. Therefore, this type of information is studied extensively throughout the book (chapters 2, 3, and, to some extent, 5). Transaction-specific, Alter-specific information from dyadic embeddedness consists of what Ego knows about possible future trust problems with Alter and of what Ego knows about Alter from previous trust problems that occurred between them in the past. These two types of information induce effects of control and learning, respectively. Throughout the book, we show that hypotheses concerning these two effects for dyadic embeddedness are strongly supported in various empirical settings, which employ different research methods. This is the most robust result presented in this book.

Given the results of earlier research, we expected learning effects through dyadic embeddedness to be very prevalent (cf. Buskens, 2002: ch. 5 and 6; Gautschi, 2002: ch. 2 through 4). Thus, we do not analyze these effects in chapter 2, but instead focus on the effects of network embeddedness which are more difficult to capture. The effects of learning through dyadic embeddedness from Alter-specific and transaction-specific information are only discussed in chapters 3 and 5. In the experiment presented in chapter 3, we find that our experimental subjects' decisions to place trust in a given round of a finitely repeated Investment Game are influenced by Alter's behavior in the previous games. Moreover, in the analyses reported in chapter 3, we estimate discount parameters that apply to all information concerning games played in the past. Generally speaking, it appears that subjects playing repeated games are quite forgetful. Both Alter-specific and Alter-unspecific information from network embeddedness is, in fact, remembered for one round only, and directly forgotten afterwards. However, Alter-specific and transaction-specific information from dyadic embeddedness is remembered quite well, the discount parameter for this type of information

being very high. In chapter 5, the effects of Alter-specific information are investigated using survey data collected in a dialysis department of a Dutch hospital. Once more, the effects of learning through dyadic embeddedness are supported. More specifically, Ego's trusting attitude towards Alter in the present is influenced by their common past, as captured both by Ego's own attitude towards Alter in the past and by Alter's attitude towards Ego in the past.

Control represents Ego's possibility to sanction or reward Alter for his behavior in the current trust problem by withholding or placing trust, respectively, in (potential) future trust problems. This possibility depends on the likelihood of future interactions (dyadic embeddedness). In the analyses reported in chapters 2 and 3, we find that Ego is more likely to trust Alter if the probability of future encounters is high. In chapter 2, where we report analyses of data from a vignette experiment, actors show a preference for trusting an Alter with whom they expect to have a longer future. Conversely, in chapter 3, where we discuss findings of a laboratory experiment, the empirical evidence shows that, ceteris paribus, Egos trust their Alters considerably more in the beginning of the game. The level of trust then progressively diminishes towards the end of the game, and drops sharply in the very last game.

The effects of Alter-specific and transaction-specific information are also important concerning network embeddedness. Depending on the specific content of the information available to Ego, this information can induce effects of learning, imitation, and control. These effects are discussed in chapters 2, 3, and 5. In the vignette experiment presented in chapter 2, only the hypotheses on the effects of learning and control are supported, and not the hypothesis on the effects of imitation: Ego is more likely to trust Alter if she knows that Alter has honored trust placed by others in the past (learning); Ego is more likely to trust Alter if she and Alter have friends in common and, to a smaller extent, if they are embedded in a dense network (control); by contrast, Ego is not more likely to trust Alter if she only knows that others have trusted Alter, but not whether trust was honored (imitation).

Conversely, in the laboratory experiment presented in chapter 3, the hypotheses on the effects of imitation and, to a smaller extent, learning through network embeddedness are supported, but the hypotheses on the effects of control are not. These discrepancies between the results of chapters 2 and 3 could be due to the experimental design. On the one hand, in the vignette experiment presented in chapter 2, subjects are requested to make a simple choice between two situations described in a pair of vignettes differing with respect to, at most, six characteristics. On the other hand, in the laboratory experiment presented in chapter 3, subjects are provided with all different types of information simultaneously and need to

choose a specific level of trust. Therefore, the strong empirical support found for imitation, as opposed to the weak support found for learning through network embeddedness in the analyses discussed in chapter 3, could be due to the complexity of the task in the laboratory experiment. More precisely, being required to handle much information simultaneously, the subjects participating in the laboratory experiment might choose simply to do what others in the same role (Ego) are doing, instead of trying to elaborate more information in order to learn whether Alter could be trusted. It is consistent with this conjecture that the hypotheses on the effects of learning are supported in the first part of the experiment discussed in chapter 3, but are not supported in subsequent phases of the experiment, where subjects receive more information simultaneously.

Finally, in chapter 5, we focus on the effects of learning from Alter-specific and transaction-specific information. Our results show that this information significantly affects Ego's trusting attitude towards Alter. More precisely, concerning network embeddedness, trust between Ego and Alter becomes more likely if Ego receives more information from third parties who trust Alter. By contrast, trust becomes less likely if Ego receives more information from third parties who do not trust Alter.

6.3.2 Effects of Alter-unspecific and transaction-specific information

The effects of Alter-unspecific and transaction-specific information are investigated in chapters 2 and 3. More precisely, these two chapters deal with the comparison of Alter-specific and Alter-unspecific information. Since dyadic embeddedness refers specifically to the relation between Ego and Alter, Alter-unspecific information reaches Ego mostly through network embeddedness. In principle, Alter-unspecific information through dyadic embeddedness refers to Ego's experience in previous trust problems involving a different actor in the role of Alter. However, situations in which Ego has subsequent trust problems with different trustees are addressed only very marginally in chapter 3. Therefore, we start summarizing our results directly for network embeddedness. Transaction-specific and Alter-unspecific information can induce effects of learning and imitation. Since the effects of control depend on Ego's sanction (reward) potential with respect to Alter, control is not defined for Alter-unspecific information. In other words, the possibility for Ego to sanction another trustee for an abuse of trust committed by Alter is useless in terms of control, because Alter would not anticipate sanctions that hurt somebody else.

In the experiment discussed in chapter 2, the hypotheses on the effects of both learning and imitation are supported. Ego is more likely to trust Alter if she knows that other trustees,

different from Alter, have honored trust placed by other actors in the role of Ego (learning). Additionally, Ego is more likely to trust Alter if she knows that other actors in the role of Ego have trusted other trustees (imitation). Therefore, the comparison between Alter-specific (discussed in the previous section) and Alter-unspecific information in chapter 2 yields a puzzling result: while the hypotheses on learning effects are supported for both types of information, the hypotheses on imitation effects are only supported for Alter-unspecific information. This implies that Ego imitates the behavior of other actors who place or withhold trust in a different trustee, but does not imitate the behavior of other actors who place or withhold trust in Alter, the same actor with whom Ego herself has a trust problem. This result could be due to the specific formulation of the information variables applied in the vignette experiment. However, the results of the analyses presented in chapter 2 also indicate that Alter-specific information is important for Ego, but only if she is uncertain about Alter's capability to honor trust.

By contrast, in the analyses presented in chapter 3, only the hypotheses on the effects of imitation are partially supported, but not the hypotheses on the effects of learning. As we state in the previous section, when describing the effects of transaction-specific and Alter-specific information, this could be due to the complexity of the task that subjects perform in the experiment described in chapter 3. Moreover, for Alter-unspecific information, the hypotheses on the effects of imitation are supported precisely in the experimental phase in which Alter-specific information was not available to Ego. This result has intuitive implications: looking at whether other actors facing a similar trust problem in the role of Ego place trust in a different trustee makes sense when Ego does not have access to Alter-specific information.

6.3.3 Effects of transaction-unspecific and Alter-specific information

The effects of transaction-unspecific information are investigated in the laboratory experiment presented in chapter 4. In this chapter, the distinction between dyadic and network embeddedness is somewhat less salient. In fact, due to the experimental design, 50% of the subjects participating in the experiment only have information from dyadic embeddedness. More precisely, 50% have a trust problem with the same partner with whom they have had previous negotiated exchanges under different exchange conditions. 25% participate in the control treatment and have had no previous exchange before the Investment Game and no social embeddedness. For the remaining 25%, there is no dyadic embeddedness. However, these subjects have a trust problem with another actor who has previously been part of the

same exchange network, although he did not exchange directly with them. For this reason, 25% of the subjects in this experiment only have transaction-unspecific information only from network embeddedness.

In chapter 4, we investigate two mechanisms for the effects of transaction-unspecific information: a learning mechanism and an emotional response to previous interactions with the same partner. Learning is based on the assumption that Ego can learn from transaction-unspecific information about Alter's social preferences and hence about the probability that he will honor trust. Conversely, the other mechanism represents Ego's emotional reaction to Alter's behavior in previous negotiated exchanges. The hypotheses on both these effects receive some empirical support. Ego is more likely to trust Alter if Alter showed a certain extent of "altruism" in previous exchanges, thus giving Ego the possibility to learn that he prefers transaction outcomes that are relatively fair to both parties. Moreover, Ego is more likely to trust Alter if she earned a satisfactory outcome in previous exchanges with Alter and thus developed positive feelings towards him. However, the results of our experiment do not allow us to clearly estimate which of the two mechanisms is more important. We can conclude though that the hypotheses on the effects of the emotional response are only supported for dyadic embeddedness. In other words, Ego only responds emotionally if the outcomes of the previous transactions depended directly on Alter's behavior, i.e., if Ego and Alter exchanged with each other. Furthermore, in chapter 4 we also investigate the effects of transaction-unspecific information on Alter's trustworthiness. According to our results, transaction non-specific information has no effect on trustworthiness.

6.4 The uncertain role of uncertainty

Nothing is more certain than the prevalence of uncertainty about the consequences of any economic decision.

– Hammond (1990: 280)

Studying the effects of information from social embeddedness on Ego's behavior in trust problems we investigate throughout this book how these effects vary depending on whether Ego is more, or less uncertain. The role of uncertainty is explored in chapters 2, 3, and 5. However, in every chapter we look at different sources of uncertainty. In chapter 2, we distinguish uncertainty about Alter's competence to provide Ego with the desired outcome from uncertainty about external contingencies possibly affecting Alter's performance. Then, we investigate how these two different forms of uncertainty affect the relative importance that

Ego attaches to the information that she receives through social embeddedness. Moreover, in chapter 2 we also analyze the direct effect of Ego's uncertainty about Alter on her trust in Alter, while in the other two chapters in which we investigate uncertainty, we only analyze how the various forms of Ego's uncertainty affect the importance she attaches to the information available to her. In other words, in chapter 2 we analyze the main effect of uncertainty as well as the interaction effects between uncertainty and various types of information, whereas in chapters 3 and 5 we only analyze the interaction effects between uncertainty and information, and not the main effect of uncertainty. In chapter 3, we investigate uncertainty about external contingencies, independent from Alter's incentives or competence and we focus especially on how uncertainty affects the information that Ego receives from network embeddedness. More precisely, if external contingencies can determine a bigger or smaller profit for Alter, who, in turn, can share this profit more, or less generously with Ego, all information concerning previous trust problems involving Alter and a different Ego is, to some extent, ambiguous. For example, if Ego receives information that another actor in the role of Ego trusted Alter, but Alter abused this actor's trust, Ego cannot know whether the abuse of trust was due to adverse contingencies or to Alter's maliciousness. In chapter 5, we discusse yet another form of uncertainty, namely uncertainty about Alter, including both Alter's incentives and Alter's capability to honor trust. More precisely, since the analyses in chapter 5 are conducted using survey data on interpersonal trust relations among colleagues, we look at how long Ego and Alter have been colleagues as a measure of Ego's uncertainty about Alter.

Our analyses of the effects of uncertainty give a rather consistent message: uncertainty does not affect Ego's decision in trust problems. In general, our hypotheses concerning uncertainty are not supported by the data, neither by experimental data using different methods, nor by survey data. Exceptions to this empirical regularity are the following results. In chapter 2, we find some support for the (main) effect of uncertainty about Alter's competence, and some (weak) support for the relative importance of Alter-specific, transaction-specific information under uncertainty about Alter's competence. The first of these two results indicates that Ego is less likely to trust Alter if she is uncertain about Alter's capability to honor trust. The second result indicates that the effect of imitation induced by Alter-specific information is significant only if Ego's uncertainty about Alter's competence is high.

The lack of empirical support for the hypotheses on the effects of uncertainty could be partly due to methodological problems. For example, in chapter 5, the variable we use to

Table 6.2 Overview of the results

			Information about the transaction	
			specific	unspecific
Dyadic embeddedness	Information about Alter	specific	Learning 👍 Control 👍	Learning 👍 Control NT
		unspecific	No hypotheses for this type of information have been tested	No hypotheses for this type of information have been tested
Network embeddedness	Information about Alter	specific	Learning 👍 Control 👍👎 Imitation 👍	Learning 👍 Control NT Imitation NT
		unspecific	Learning 👍👎 Control NT Imitation 👍	No hypotheses for this type of information have been tested

👍: supported; 👍👎: mixed evidence ; NT: not tested.

operationalize uncertainty proves to be a poor measure. However, since this result is consistent through the different chapters and robust under the different types of research methods, we cannot dismiss it. Uncertainty has very little effect, and it matters only if it is specifically concerning Alter's ability to supply Ego with a positive return, provided he wants to do so. However, uncertainty does not affect the relative importance that Ego attaches to information available from social embeddedness.

6.5 Conclusion and suggestions for future research

In this section we briefly discuss the implications of our empirical findings and give some suggestions for further research. In table 6.2, our empirical results are ordered according to the different mechanisms we identify for the different types of information stemming from both dyadic and network embeddedness. Table 6.2 reproduces our typology of the kinds of information Ego can obtain from social embeddedness. Within each cell, we list the mechanisms that are investigated in this book, specifying for every mechanism whether our hypotheses are consistently supported (👍), to some extent supported (👍👎), or not tested (NT).

Looking at the results, there is strong empirical evidence for learning and imitation, both with respect to information from dyadic embeddedness and with respect to information from network embeddedness. The effects of learning are prevalent, but the hypotheses on the effects of imitation are also widely supported. More specifically, actors mostly learn from dyadic embeddedness, but they also learn from network embeddedness when they receive enough information and when the information is not too complex to handle. Conversely, they use the information they receive from network embeddedness to imitate others when this

information is not sufficient to properly learn or when the information seems to require calculations that are too complex. Concerning control, our results show that control is important especially for dyadic embeddedness. It appears that actors take the expected length of their common future with Alter into account. However, they mostly do not anticipate future sanctions or rewards via network embeddedness, except in the vignette experiment in chapter 2.

The results summarized in table 6.2 provide answers to the research questions that are presented at the beginning of the book, in figure 1.3. We order these answers according to the various cells in table 6.2. Alter-specific and transaction-specific information induces effects of learning and control through dyadic embeddedness and effects of learning and imitation through network embeddedness. In chapter 2, we also report some effects of control via network embeddedness, but this result was not confirmed in the experiment presented in chapter 3. These findings provide answers to research questions 2.1 and 3.1. The hypotheses on the effects of learning from Alter-specific and transaction-specific information through both dyadic and network embeddedness are also supported by the survey data discussed in chapter 5, where the same hypotheses are tested in a dynamic setting. By contrast, the hypotheses on the effects of imitation and control for this type of information are not tested in a setting in which networks are endogenous. Thus, the answer to research question 5.1 is that only the effects of learning are supported in a setting in which networks are endogenous.

The effects of Alter-unspecific and transaction-specific information are only investigated for network embeddedness and not for dyadic embeddedness. The answer to research questions 2.2 and 3.2 is that that this type of information induces effects of learning and imitation, while no hypothesis has been tested concerning the effects of control.

Concerning the effects of Alter-specific and transaction-unspecific information, we only test hypotheses on the effects of learning through both dyadic and learning embeddedness. Thus, the answer to research question 4.1 is that this type of information does indeed induce effects of learning.

Furthermore, we are able to provide one consistent answer to research questions 2.3, 3.3, and 5.2 concerning the effects of information under different conditions with respect to uncertainty. Throughout the book, we discuss and test several hypotheses about the interaction effects between uncertainty and learning or imitation; none of these hypotheses are supported. Therefore, the answer to research questions 2.3, 3.3, and 5.2 is that, generally, the effects of learning and imitation do not vary under different uncertainty conditions.

Given the results that we just summarized, this book contributes to improve our

understanding of the mechanisms through which information available to the actors influences the solution of trust problems in several aspects. First, we provide a systematic analysis for types of information that are usually neglected. In fact, while existing research focuses only on Alter-specific and transaction-specific information, we also investigate the effects of Alter-unspecific as well as transaction-unspecific information. Second, while existing literature on this topic deals extensively with the effects of learning and control, in this book, other relatively new types of effects, such as imitation, are also identified and discussed. Third, most studies on the effects of social embeddedness on trust problems focus generally on either dyadic or network embeddedness. Conversely, in this book these two types of embeddedness are addressed simultaneously. Fourth, although we do not introduce any new method to collect or analyze empirical data, we present empirical tests of the same hypotheses, conducted using a rather unique combination of different, but complementary research methods, such as two laboratory experiments, a vignette experiment, and a survey. As far as the results are consistent, the use of different research methods leads to more confidence in the internal as well as external validity and robustness of these results. By contrast, concerning the information effects for which we do not find consistent results in all settings, the use of different research methods allow us to give some indications of the conditions under which these effects are more likely to occur. For example, the effects of imitation are generally prevalent when the information that subjects have to handle before making a decision is particularly complex.

Finally, we address some suggestions for future research with respect to theory building, new research problems, and new methods. First, our hypotheses are based on different theoretical models relying, to some extent, on different assumptions concerning the rationality of the actors as well as their computational abilities. The development of a model capable of integrating the mechanisms investigated in this book, and of specifying conditions under which the different mechanisms operate, certainly constitutes a major challenge for further research. Second, although most definitions of trust – especially those that conceive trust as a choice behavior – state that Ego's decision to trust Alter depends on Ego's assessment of Alter's trustworthiness, the determinants of Alter's trustworthiness are still poorly understood. For example, we analyze trustworthiness only in the experiment presented in chapter 4, but none of our experimental variables has any significant effect in predicting trustworthiness. According to our results, trustworthiness only depends on personal characteristics. However, we believe that trustworthiness could be better understood by developing new, specific theoretical models to predict Alter's behavior and testing them by

applying embedded games, such as, for example, the experiment presented in chapter 3. Third, we do not find support for control via network embeddedness using experimental data in which Ego and Alter's actual behavior is observed, although we do find some support in chapter 2 where we use a vignette experiment. However, there is evidence that this mechanism operates in real-life situations (examples include the diamond merchants in Wechsberg, 1966, and the Maghribi traders in Greif, 1989). Therefore, new experiments or surveys should be designed specifically in order to empirically capture the effects of control. Fourth, the large support found for the hypotheses on the effects of imitation, perhaps, constitutes the most interesting result of this book, because it has interesting implications. For example, if imitation is also so prevalent in an organizational context, a trusting environment is very important for the integration of newcomers. Therefore, the distinction between learning and imitation should be further explored in order to better understand the conditions determining the prevalence of one or the other effect, particularly inside organizations. We do analyze organizational survey data in chapter 5, but, unfortunately, the data does not allow for a clear distinction between learning and imitation. Fifth, we find very little support for the hypotheses on the effects of uncertainty. Perhaps, the role of uncertainty could be better understood using laboratory experiments specifically designed to investigate trust problems with uncertainty. Sixth, in all chapters except for chapter 5 we analyze the effects of information in situations in which the network of information exchange is exogenously fixed. However, in real life, networks of social relations are intrinsically dynamic. We tackle this problem in chapter 5, where we analyze dynamic survey data, but, although we find support for the effects of learning, the analyses are limited by the multiple dependencies of the data. Since statistical methods specifically designed to analyze this kind of data are rapidly developing (e.g., Snijders, 2001, 2005), the study of the evolution of trust relations using longitudinal data is certainly a promising direction for future research.

Appendix A

English Translation of the Instructions for the Vignette Experiment of Chapter 2

Thanks that you agreed to participate in this experiment. As a reward for your cooperation you will receive €5 afterwards. This experiment is part of a research project on human decision-making. It is very important that you answer all questions carefully.

Read the instructions carefully. In the first part of the experiment, you are asked to imagine yourself in a hypothetical situation. You have to imagine that you want to ask someone to invest your money at the stock market. First, you will get a general description of this situation: The Scenario. Try to imagine that you are really in this situation. Thereafter, you have to choose between two persons whom you would preferably let invest your money.

We want to stress that we want **your opinion**. There are no "correct" or "wrong" answers in this part of the experiment.

The second part of the experiment contains some questions about you. In principle, you can complete the experiment at your own. Nevertheless, if you still have question, please ask the experiment leader.

THE SCENARIO

- Recently, you got the idea to start a small e-business. You discovered a niche in the market and you want to jump into it quickly. Due to the very fast developments in this market, this has to happen fast otherwise the idea will probably become irrelevant.
- The bank where you try to obtain a loan for the execution of the idea asks for a starting capital of €5000. You have only €3000 and just with your student allowance, you will not be able to obtain the €5000.
- You parents are not prepared to give you a loan for the rest of the money. They find the investment too risky and they are afraid that this business plan will distract you from your study.
- Within your year group you know two fellow students named "Jansen" and "De

Vries" who invest in the stock market themselves, and it seems that they are doing fairly well. You do not have enough knowledge about the stock market to do the investments yourself.

- After asking Jansen and De Vries, they said that you have a good chance to increase your money from €3000 to €5000 if one of them would invest the money at the stock market. The both ask 10% of the profit if the investments turn out to be profitable.
- Jansen and De Vries both indicate that there are of course risks related to these kinds of investments and that unfortunately they cannot share in the losses if for whatever reasons the investments are not profitable.
- Although Jansen and De Vries are members of your year group, you do not know them very well and you did never do this kind of business with them before.

THE TASK

Imagine that, in spite of the risks involved, you decide to let Jansen or De Vries invest your money within the scenario given above. We provide you now with descriptions of Jansen and De Vries. For every pair of descriptions, we ask you to compare them and indicate which one you would prefer to do the deal. Even if the description does not match with your own situation, you have to try to imagine yourself in the situation as it is described. In addition, we ask you for every pair of descriptions to indicate how strong your preference is for the chosen fellow student. You can indicate your choices by marking the relevant boxes. These two questions will be asked to you for **ten** different pairs of descriptions. **The scenario given above applies to all pairs of descriptions.** Do not hesitate the read the scenario again if this helps to make your choices.

Appendix B

English Translation of the Instructions for the Experiment of Chapter 3

The following instructions refer to player A (Ego), treatment FPU (with full information between Ego and Ego 2, partial information between Ego and Ego 3, and uncertainty).

Introduction

Welcome at this experiment. In this experiment, you have the possibility to earn money depending on the choices you will make. Your earnings will be paid to you at the end of the experiment, privately and in cash. During the experiment you will earn points that will be later exchanged into money at the rate of 1 point = 1 eurocent. In this experiment, you have to make many decisions and you can earn a lot of points. Therefore, read the following instructions carefully and make your choices carefully. Irrespective of your earnings, you will receive an additional $5 for participating in the experiment.

These instructions contain all the information you need to complete the experiment. Therefore, you are kindly requested to keep silent and not to ask any questions, unless it is absolutely necessary. **From this moment on, you should not speak with anybody in this room and you should not look at the monitor of your neighbors. It is important for us that your decisions are completely independent and based only on the information that you receive from these instructions and on what you will see on the screen of your PC. There are no "right" or "wrong" choices.**

This experiment consists of three parts. In every part of the experiment, you will interact with a group if six people that we will name A1, A2, A3, A4, B1, and B2. The other five persons in your group will not be the same individuals in all parts of the experiment. You will not know the identity of the other persons in your group neither during nor after the experiment. **You are "A1".** You will make decisions in interaction with person B1. Person A2 will have exactly the same kind of interactions with B1. The two other persons A, A3 and A4, will have the same kind of interaction with the last person, B2. You will receive more or

less information about what happens between the other persons in your group, depending on which part of the experiment you are in. In every part of the experiment, you are requested to make similar decisions with respect to B1. On the next page, we will first describe the situation in which you have to make these decisions.

The choice

All three parts of the experiment consist of 15 periods. All persons A receive 10 points at the beginning of each period, while B1 and B2 receive each 20 points, that is, 10 for the choice with A1 or A3 and 10 for the choice with A2 or A4. The computer will then ask you how many of your ten points you want to send to B1. You are completely free to send 0, 10 or any number of points between 0 and 10 to B1. For every point that you send to B1, B1 will receive with 50% probability **two** points or, also with 50% probability, **four** points. **Therefore, you do not know for certain how many points B1 receives, but B1 knows exactly how many points you have sent.** Subsequently, the computer will ask B1 how many of the points that he or she has received from you, he or she wants to return to you. For example, if you send nothing to B1, both you and B1 will earn 10 points at the end of the period, because B1 will also not be able to return anything to you. If you send all your 10 points to B1, then B1 will receive 20 or 40 points on top of the initial 10 he or she already had. If B1 then decides to return 15 points to you, you will earn 15 points and B1 will earn 15 or 35 points at the end of the period. By contrast, if B1 decides to return nothing, you will get 0 points and B1 will have 30 or 50 points in this period.

Similarly, the computer will ask A2, A3, and A4 the same question. A2 will also send points to B1, whereas A3 and A4 will send their points to B2. Thus, in each part of the experiment, you will be requested to make a choice **15** times and during this time the composition of the group will remain the same. After every period, you get to know how many points B1 returns to you.

The total number of points that B1 receives for every point that you send **is determined again at the beginning of every period** by the computer. This number is also the same for the points that A2 sends to B1 within the same period. The total number of points that B2 receives for every point that A3 and A4 send is also specified for every period by the computer just like the number of points that B1 gets, but this number does not have to be the same for B1 and B2.

Depending on which part of the experiment you are in, you will also receive information about what happens between the other persons in your group. This information

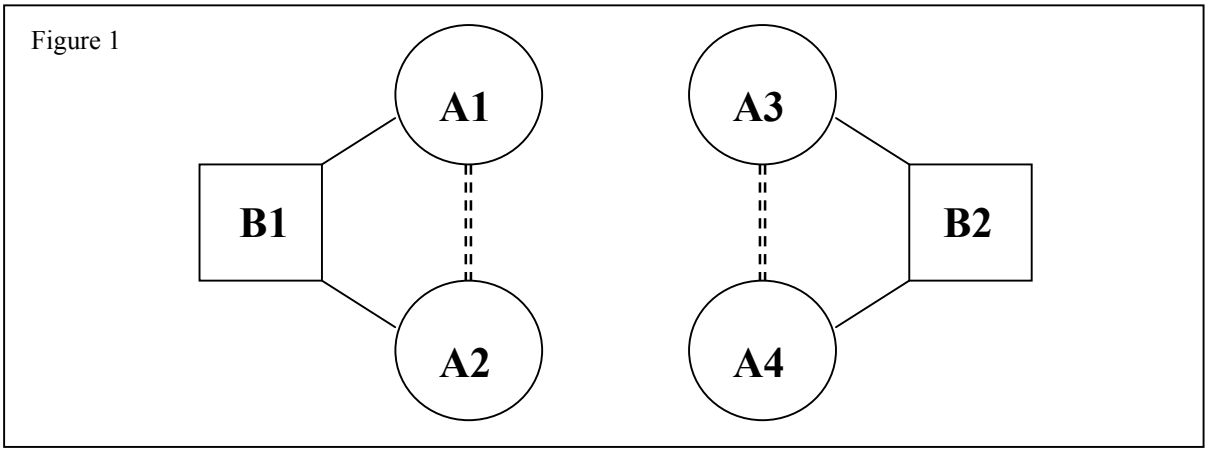
will be stored in a box that will be displayed in the lower part of your computer screen. It is important for you to realise that all persons in the group, therefore also B1, know what information is available to all the other persons in the group.

Now you will be required to answer some questions that will appear on the screen of your computer in order to check if you have understood the instructions so far. If these questions are not yet displayed on your screen, you must wait. The computer will also inform you when you can continue reading these instructions.

Part 1

In this part of the experiment, you will receive information not only about how many points B1 returned to you, but also about how many points A2 sent to B1 and how many points B1 returned to A1. The structure of the exchange of information is summarized in figure 1. In this figure, the straight lines indicate which A sends points to which B, whereas the double dotted lines indicate which A is informed about the choices of which other A and about the corresponding choices of B. Figure 1 appears in the instructions of all participants in your group. All information that you receive about your own choices as well as about choices of others remains available to you in the box displayed in the lower part of your computer screen for the entire duration of part 1. Persons B1 and B2 know only what they did with the persons A with whom they are matched, but they do not receive any information about what the other person B did.

Figure 1



After everybody has made a choice, the box containing information is updated and the following period begins. There will be 15 periods in which you will be requested to make a choice. At the end of this part, the computer will inform you that you can proceed reading part 2 of these instructions.

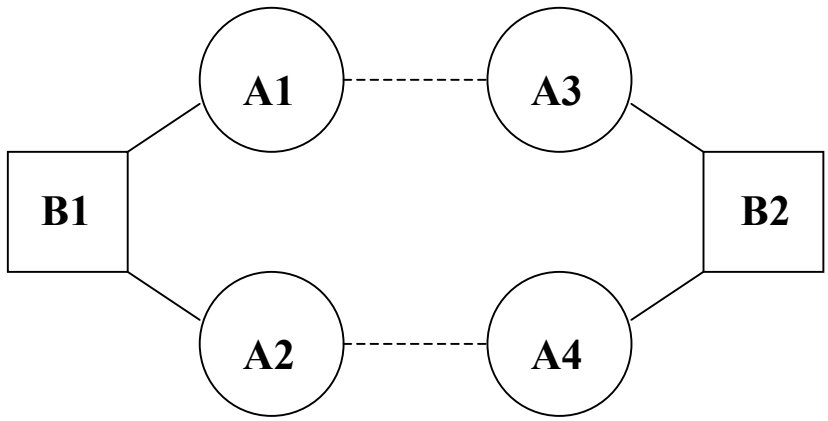
Before we begin with the real choices, you will practice for two periods. In these two periods, the computer will decide how many points B1 returns to you. This will be about one and a half times the number of points that you sent. After these two periods, the computer will match you with other participants and you will begin with the real choices. Now you can proceed answering the questions that will be displayed on your screen.

Part 2

In the second part of the experiment, you will be matched with different participants than in the first period. In particular, B1 and A2 will not be the same persons they were in part 1. The only difference with part 1 is that you will not receive information about A2, but about A3. You will know how many points A3 sent to B2, but not how many points B2 returned to A3 (see Figure 2). A2 will know how many points A4 sent to B2, and A3 and A4 will know respectively how many points you and A2 sent to B1. This is represented in figure 2 by the dotted lines. The information that you will receive during part 2 of the experiment will again be stored in the box displayed in the lower part of your screen.

As in the first part, figure 2 appears in the instructions of all participants in your group, just like figure 1. There will again be 15 periods of choices to be made. At the end of this part, the computer will inform you that you can proceed reading part 3 of these instructions. Now you can proceed answering the questions that will be displayed on your screen.

Figure 2

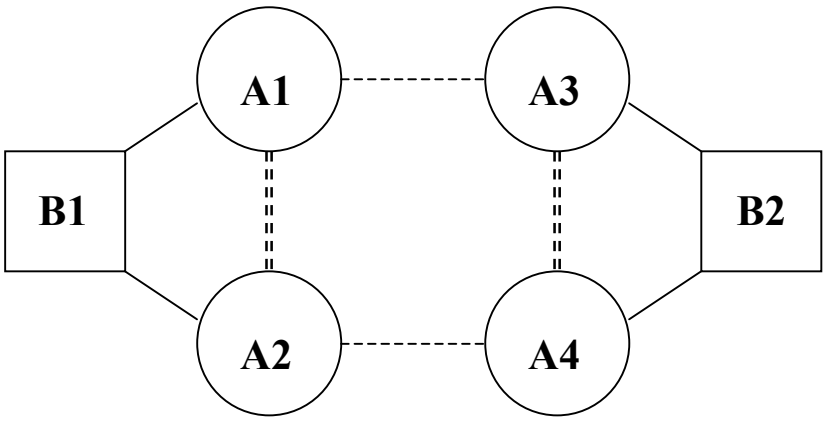


Part 3

In the third part of the experiment, you will be matched with different participants. In particular, B1, B2, A2, and A3 will not be the same persons they were in part 1 and 2. The information that you received in the first two parts of the experiment will now be combined.

Thus, you will know how many points A2 sent to B1, and how many points B1 returned to A2. You will also know how many points A3 sent to B2, but not how many points B2 returned to A3 (as represented by the dotted and double dotted lines in figure 3). Also A2, A3, and A4 receive now the combination of the information that they received in the first two parts of the experiment. The information that you will receive during this part of the experiment will again be stored in the box displayed in the lower part of your screen.

Figure 3



As in the previous part, figure 3 appears in the instructions of all participants in your group, just as figure 1 and 2. Again, there will be 15 periods of choices to be made. After 15 periods, you will receive a short questionnaire that will be displayed at the computer. At the end of the experiment, the experimenter will ask you one by one to come for the payment of the money you earned during the three parts of the experiment. Now you can proceed answering the questions that will be displayed on your screen.

Appendix C

Instructions for Phase 2 of the Experiment of Chapter 4

The following instructions refer to the second phase of the experiment, in which subjects played two one-shot Investment Games, first in the role of Ego and then in the role of Alter. In the first phase of the experiment, subjects negotiated the division of a pool of resources under different exchange conditions. The first phase of the experiment was computer-based, and was run using the software Exnet III. Instructions of phase 1 were administered to the subjects in form of a tutorial. Therefore, this appendix only includes instructions for the second phase of the experiment. The instructions refer to the treatment with equal-power exchange relations in phase 1.

Game 1

The exchange phase of the study is now complete and we are now beginning a new phase. In this phase you will answer directly on this paper. You will use the computer to inform the lab assistant that you have completed your task. During the first phase, you earned points that will be converted into money at the rate of 1 point = 2 cents. In this second phase, the choices you will make are in dollars and cents. At the conclusion of this phase, your earnings will be paid in cash for this and the earlier phase. Please read the following instructions carefully and then make your choices thoughtfully. In addition to your earnings, you will also receive $5.00 for participating in this study.

In this phase, you will be paired with the same person who was B in the first phase. Because it is the same person, we continue to call that person 'B.' **Importantly, you will not come to know the identity of B now or after the study -- nor will B come to know your identity. Both you and B will be allocated $2.50 as a 'starting capital.' You can decide to send some, none, or all of your starting capital to B in any multiple of 50 cents. The money**

that you will send to B will be tripled; that is, for every 50 cents that you send, B will receive $1.50.

Importantly, B decides how much of the received money will be returned to you -- and how much B will keep. Two conditions bear on B's choice. First, B cannot return to you any of B's $2.50 starting capital. Second, the amount that B returns to you is not tripled. For example, if you send nothing to B, both you and B will earn $2.50, because B will not be able to return anything to you. If you send all your $2.50 to B, then B will actually receive $7.50 ($2.50 x 3 = $7.50). If B then decides to return $5.00 to you, you both will have $5.00. (B's $5.00 = $2.50 starting capital + $2.50 kept from you). By contrast, if B decides to return nothing, you will earn nothing and B will earn $10.00.

Please write the amount you will send to B: _____

(Remember that this amount should be between 0 and $2.50 in any multiple of 50 cents -- as in 0 cents, .50 cents, $1.00, $1.50, $2.00, or $2.50.)

When you have made your decision, please press "next" on your computer and wait for the lab assistant with the instructions for the following part of the study.

Game 2

The second part of this study, while similar to the first, is completely independent from it. Once again you have the opportunity to to earn money, but now B can send you some of B's money. Then you decide to return all, some or none of the money back to B. Once again you and B receive $2.50 as a starting capital. B will decide to send some, none or all of B's money to you. As before, this amount will be a multiple of 50 cents. The amount B sends you is tripled -- that is, for every 50 cents that B sends, you actually receive $1.50.

You will soon decide how much of the sent money to return -- and how much to keep. The amount that you decide to return should also be a multiple of 50 cents. As before there are two conditions. First, you cannot return to B any of your starting capital $2.50. Second, the amount that you decide to return to B is not tripled. Now B is deciding. To facilitate the completion of the study, please indicate now the amounts you are willing to return to B for each amount of money that B sends you.

If B sends **$0,** you receive **$0.** The amount you want to return to B is **$0**

If B sends **$0.50,** you receive **$1.50.** The amount you want to return to B is _____

If B sends **$1.00,** you receive **$3.00.** The amount you want to return to B is _____

If B sends **$1.50,** you receive **$4.50.** The amount you want to return to B is _____

If B sends **$2.00,** you receive **$6.00.** The amount you want to return to B is _____

If B sends **$2.50,** you receive **$7.50.** The amount you want to return to B is _____

(Please remember your numbers, can be zero or in multiples of 50 cents. The total cannot be more than the amount received.)

The study is now finished, before we pay you the money that you have earned we ask you to complete a short questionnaire. When you have made your decisions, please press “next” on your computer.

Appendix D

Network Questions Used to Collect the Data Analyzed in Chapter 5

The variables used for the statistical analyses discussed in chapter 5 are constructed using the following two network questions, which are part of a questionnaire administered to all members of a dialysis department of a Dutch hospital between June 1995 and June 1996 (see Van de Bunt 1997, 1999 for a detailed description of the research design). For both questions, respondents were asked about every other member of the department.

Trust network:

We all feel closer to particular people than to others. By 'close' we mean how much you trust somebody. For example, whom do you confide personal information. This can include both private and work-related issues. Please tell me now on the following list, which of these five descriptions of your relationship to the individual colleagues fits best.

1) "virtually unknown"
2) "distant (would not take into confidence this colleague even for unimportant matters)"
3) "neutral (don't know this colleague well enough to take him into confidence for personal matters)"
4) "strong (take into confidence for personal matters that are relatively important for you)"
5) "very strong (take into confidence for matters that are very important for you)."

Communication network:

During the past three months, how frequently did you talk during work time to your colleagues? It doesn't matter what you were talking about or where the conversation took place. However, the conversation should have been more than the transmission of a simple message or a greeting.

1) “never”
2) “less than once a month”
3) “1-3 times a month”
4) “1-3 times a week”
5) “daily”;
6) “several times a day.”

The answers to the trust questions were recoded as follows: “virtually unknown” = missing; “distant” = –1; “neutral” = 0; “strong” and “very strong” = 1. The answers to the communication question were not recoded. Therefore, the numbering of the answering categories from 1 to 6 corresponds to the numeric values of the variable used in the analyses.

Samenvatting

1 Introductie

In dit boek bestuderen we de effecten van informatie die afkomstig is van dyadische en netwerkinbedding op het gedrag van actoren in vertrouwensproblemen. Verder onderzoeken we hoe mensen reageren op de diverse soorten informatie die beschikbaar zijn onder verschillende condities met onzekerheid. In hoofdstuk 1 introduceren we de terminologie die in het hele boek gebruikt wordt, we geven een typologie van de soorten informatie die geanalyseerd worden in de verschillende empirische hoofdstukken en we presenteren onze onderzoeksvragen. Hoofdstuk 2 tot en met 5 bevatten vier empirische studies, elk met een verschillende onderzoeksmethode. In hoofdstuk 6 behandelen we onze resultaten en bespreken we de conclusies. Deze samenvatting is grotendeels een vertaling van hoofdstuk 6 en is als volgt opgebouwd. In paragraaf 2 vatten we de onderzoeksproblemen samen, beschrijven onze typologie van informatie in ingebedde situaties en geven de context van de empirische hoofdstukken. Vervolgens zijn de empirische bevindingen samengevat in paragraaf 3, geordend naar soort informatie. In paragraaf 4 vatten we onze bevindingen met betrekking tot onzekerheid samen. Ten slotte, behandelen we in paragraaf 5 de implicaties van onze bevindingen en doen we een aantal suggesties voor verder onderzoek.

2 Het theoretische kader

Vertrouwensproblemen zijn situaties waarbij twee actoren betrokken zijn. Eén actor (Ego) heeft de mogelijkheid om wel of niet de andere actor (Alter) te vertrouwen. Alter heeft op zijn beurt de mogelijkheid om Ego's vertrouwen te honoreren of te misbruiken. Ego is beter af als zij vertrouwen geeft en dit vertrouwen gehonoreerd wordt dan wanneer ze geen vertrouwen zou geven, maar ze is slechter af als Alter misbruik maakt van haar vertrouwen.[1] Omgekeerd is het voor Alter voordeliger om vertrouwen te misbruiken dan te honoreren als Ego haar vertrouwen schenkt. Wel geeft Alter de voorkeur aan een situatie waarin vertrouwen is gegeven en wordt gehonoreerd boven een situatie waarin er geen vertrouwen is gegeven. Er is

[1] Om het onderscheid tussen Ego en Alter te vergemakkelijken, gebruiken we vrouwelijke voornaamwoorden voor Ego en mannelijke voornaamwoorden voor Alter.

geen bindende overeenkomst die Ego beschermt tegen de mogelijkheid dat Alter haar vertrouwen misbruikt. De beslissingen van Ego en Alter worden niet gelijktijdig gemaakt: Ego besluit eerst of zij haar vertrouwen schenkt en als zij dit doet, kiest Alter ervoor of hij Ego's vertrouwen honoreert of misbruikt (Coleman, 1990: hoofdstuk 5).

Dit soort situaties kunnen weergegeven worden in het zogenaamde Vertrouwensspel (Camerer en Weigelt, 1988; Dasgupta, 1988; Kreps, 1990) of het Investeringsspel (Berg e.a., 1995). Dit zijn speltheoretische modellen van strategische situaties waarbij twee actoren betrokken zijn en waarbij gemengde motieven een rol spelen. Dat wil zeggen, beide actoren geven de voorkeur aan een situatie waarin vertrouwen wordt gegeven en gehonoreerd boven een situatie waarin geen vertrouwen wordt geschonken. Als de twee actoren echter op basis van individuele, egoïstische rationaliteit handelen – en veronderstellen dat de andere actor hetzelfde doet – dan wordt er geen vertrouwen gegeven en verdienen beide actoren een lagere beloning dan ze verdiend zouden hebben als vertrouwen gegeven en gehonoreerd zou zijn.

Over het algemeen wordt verondersteld dat Ego's beslissing om Alter te vertrouwen afhankelijk is van hoe waarschijnlijk Ego het acht dat Alter het vertrouwen zal honoreren als het vertrouwen gegeven wordt (Gambetta, 1988; Coleman, 1990). In geïsoleerde situaties schrijft standaard economische rationaliteit voor dat er nooit vertrouwen gegeven wordt omdat Ego verwacht dat Alter het vertrouwen altijd misbruikt. De meeste vertrouwensproblemen vinden echter in "ingebedde" situaties plaats (Granovetter, 1985). In ingebedde situaties kunnen Ego en Alter een gemeenschappelijk verleden of een gemeenschappelijke toekomst hebben. Naar dit soort inbedding wordt vaak verwezen als dyadische inbedding. Ook kunnen Ego en Alter gemeenschappelijke relaties met derden hebben. Hiernaar wordt verwezen met de term netwerkinbedding (Raub, 1997; Buskens en Raub, 2002; Buskens, 2002). In ingebedde situaties beschikt Ego over meer informatie om Alters betrouwbaarheid in te schatten. Daarnaast is er empirisch bewijs dat sociale inbedding vertrouwen bevordert (Wechsberg, 1966; Lorenz, 1988; Larson, 1992; Gulati, 1995a, 1995b; Uzzi, 1996, 1997). Twee mechanismen die de effecten van dyadische en netwerkinbedding bij vertrouwensproblemen verklaren zijn *leren* en *controle* (Raub, 1997; Buskens, 2002; Buskens en Raub, 2002; zie ook Yamagishi en Yamagishi, 1994: 138-139). Leren duidt het mechanisme aan waardoor informatie met betrekking tot het gedrag van Alter bij vorige vertrouwensproblemen Ego bereikt via dyadische en netwerkinbedding. Controle verwijst naar de mogelijkheid voor Ego om Alter te bestraffen of te belonen via dyadische inbedding – bijvoorbeeld al dan niet vertrouwen geven in toekomstige vertrouwensproblemen met Alter – of via netwerkinbedding – bijvoorbeeld het verspreiden van informatie over het gedrag van

Alter aan derden, die Alter zullen bestraffen of belonen als ze een vertrouwensprobleem met Alter hebben.

Dit boek concentreert zich op het gedrag van Ego in vertrouwensproblemen in ingebedde situaties. Meer specifiek onderzoeken we hoe informatie die Ego kan hebben als gevolg van dyadische en netwerkinbedding haar beslissing om vertrouwen te geven beïnvloedt. Een vertrouwensprobleem bestaat uit drie elementen: de centrale actor, Ego, die geconfronteerd wordt met de beslissing om wel of niet vertrouwen te geven; de persoon die vertrouwd kan worden, Alter; en het vertrouwensprobleem, datgene wat Ego aan Alter kan toevertrouwen (vergelijk Hardin, 2002: 9). Nuttige informatie die Ego door dyadische en netwerkinbedding heeft, kan dus informatie over Alter en over het vertrouwensprobleem in kwestie omvatten. In hoofdstuk 1 geven we een typologie met betrekking tot de soorten informatie die Ego kan gebruiken via sociale inbedding. Deze informatie kan op twee aspecten variëren. Ten eerste kan informatie met betrekking tot Alter *Alterspecifiek* of *niet-Alterspecifiek* zijn. We stellen dat de informatie die Ego heeft Alterspecifiek is wanneer het betrekking heeft op Alter, dezelfde actor met wie Ego een vertrouwensprobleem heeft. In tegenstelling hiermee is informatie niet-Alterspecifiek als het om een ander persoon gaat, en niet Alter, de actor met wie Ego een vertrouwensprobleem heeft. Alterspecifieke of niet-Alterspecifieke informatie kan Ego gebruiken via dyadische en netwerkinbedding. Ten tweede kan informatie *transactiespecifiek* of *niet-transactiespecifiek* zijn. Informatie is transactiespecifiek als het om een gelijksoortige vertrouwensprobleem gaat als het vertrouwensprobleem in kwestie en het is niet-transactiespecifiek als het betrekking heeft op een andersoortige interactie. Een gelijksoortig vertrouwensprobleem zou bijvoorbeeld een andere interactie kunnen zijn die lijkt op een Vertrouwensspel of een Investeringsspel, waar Ego en Alter in dezelfde rol bij betrokken zijn en die een risico voor Ego inhoudt vergelijkbaar met het risico dat geassocieerd wordt met het vertrouwensprobleem in kwestie. Andersom zou een andersoortige interactie een ander vertrouwensprobleem kunnen zijn dat een veel groter of kleiner risico voor Ego inhoudt of het zou een andere interactie met andere keuzes en andere beloningen kunnen zijn. We onderzoeken echter maar één soort situatie waarin Ego niet-transactiespecifieke informatie heeft. Dit doen we in hoofdstuk 4. We zullen hierover meer informatie geven wanneer we het laboratoriumexperiment samenvatten dat in hoofdstuk 4 gepresenteerd is.

Tabel 1 De typologie van informatie die Ego kan hebben in ingebedde situaties

			Informatie over de transactie	
			specifiek	niet-specifiek
Dyadische inbedding	Informatie over Alter	specifiek	**1**: Ego heeft gelijksoortige vertrouwensproblemen met Alter gehad in het verleden	**3**: Ego heeft andersoortige interacties gehad met Alter in het verleden
		niet-specifiek	**2**: Ego heeft gelijksoortige vertrouwensproblemen met een andere partner gehad in het verleden	**4**: Ego heeft andersoortige interacties gehad met een andere partner in het verleden
Netwerk-inbedding	Informatie over Alter	specifiek	**1**: Ego heeft een relatie met tenminste één derde partij die gelijksoortige vertrouwensproblemen met Alter in het verleden heeft gehad	**3**: Ego heeft een relatie met tenminste één derde partij die andersoortige interacties met Alter in het verleden heeft gehad
		niet-specifiek	**2**: Ego heeft een relatie met tenminste één derde partij die gelijksoortige vertrouwensproblemen met een andere partner in het verleden heeft gehad	**4**: Ego heeft een relatie met tenminste één derde partij die andersoortige interacties met een andere partner in het verleden heeft gehad

De typologie van informatie die Ego kan hebben in ingebedde situaties is samengevat in tabel 1. Elke cel bevat een voorbeeld van het soort informatie waar deze cel over gaat. Deze typologie bevat niet alle mogelijke soorten informatie die vertrouwensproblemen beïnvloeden, maar we gebruiken het om de onderwerpen die in dit boek behandeld worden systematisch te ordenen en om onze empirische resultaten samen te vatten. Bovendien analyseren we niet alle soorten informatie die in tabel 1 aangeduid worden. We concentreren ons met betrekking tot dyadische inbedding op Alterspecifieke informatie. Alleen de soorten informatie in cel 1 en 3 worden voor dyadische inbedding onderzocht en de soorten informatie in cel 2 en 4 worden genegeerd. Met betrekking tot netwerkinbedding concentreren we ons in onze samenvatting op de soorten informatie in cel 1, 2 en 3 en we negeren het soort informatie in cel 4. We beperken ons op deze manier omdat we verwachten dat de soorten informatie die we niet behandelen minder relevant zijn met betrekking tot Ego's beslissing om Alter te vertrouwen.

Verder onderzoeken we hoe de verschillende soorten informatie het besluit van Ego onder verschillende omstandigheden met onzekerheid beïnvloeden. We vatten onzekerheid in ruime zin op. Ons idee van onzekerheid omvat onzekerheid over Alters voorkeuren, bijvoorbeeld voor gelijke uitkomsten, en Alters capaciteiten, maar ook onzekerheid over exogene factoren onafhankelijk van Alter. Meer specifiek bestuderen we in hoofdstuk 2, 3 en 5 interactie-effecten tussen de mate waarin Ego onzeker is over bepaalde aspecten van het vertrouwensprobleem en de informatie waar zij beschikking over heeft. In hoofdstuk 4

bestuderen we of niet-transactiespecifieke informatie die Alters voorkeur voor gelijke uitkomsten zou kunnen onthullen een effect heeft op Ego's gedrag in een Investeringsspel.

In dit boek leiden we nieuwe, vaak speltheoretisch geïnspireerde theorieën af van bestaande theorieën over de effecten van informatie in ingebedde vertrouwensproblemen en toetsen ze door gebruik te maken van verschillende methoden van dataverzameling en data-analyse. In hoofdstuk 2 en 3 onderzoeken we de effecten van Alterspecifieke en niet-Alterspecifieke, transactiespecifieke informatie. In hoofdstuk 4 analyseren we de effecten van Alterspecifieke niet-transactiespecifieke informatie. Ten slotte concentreren we ons in hoofdstuk 5 op transactiespecifieke en Alterspecifieke informatie. Voordat we onze empirische bevindingen samenvatten, geven we een korte beschrijving van elk hoofdstuk.

In hoofdstuk 2 behandelen we Alterspecifieke en niet-Alterspecifieke informatie die Ego heeft via netwerkinbedding. De informatie die Ego ontvangt door netwerkinbedding is afkomstig van derden die in vertrouwenssituaties zijn geweest met Alter of met een andere vertrouwenspersoon. Informatie over vertrouwensproblemen die in het verleden plaats hebben gevonden, zou informatie over de betrouwbaarheid van Alter (of een ander vertrouwenspersoon) kunnen bevatten, of het zou simpelweg een indicatie kunnen bevatten dat derden Alter in het verleden vertrouwd hebben zonder informatie over Alters betrouwbaarheid. In het eerste geval kan Ego dus *leren* over Alters betrouwbaarheid, terwijl zij in het tweede geval het geven van vertrouwen door derden tegenover Alter slechts kan *imiteren*. Voorts kunnen potentiële toekomstige vertrouwensproblemen waar derden en Alter bij betrokken zijn tot effecten van *controle* leiden, omdat Ego de mogelijkheid heeft om Alter te bestraffen of te belonen, afhankelijk van zijn gedrag in het verleden, door derden informatie te geven over Alters gedrag.

In hoofdstuk 2 toetsen we hypothesen over de effecten van leren, imitatie en controle, evenals hypothesen over de interactie-effecten tussen onzekerheid en leren en tussen onzekerheid en imitatie. We doen dit door een vignetonderzoek waarin variabelen die diverse soorten informatie implementeren te gebruiken als kenmerken van de situatie die geschetst wordt op het vignet. Hierbij passen we de methode van paarsgewijze vergelijking toe. Dat wil zeggen dat de proefpersonen gevraagd worden om paren van vignetten te vergelijken die vertrouwensproblemen beschrijven en verschillen met betrekking tot bepaalde kenmerken betreffende informatie die Ego heeft. De proefpersonen moeten voor elk paar vignetten hun voorkeur aangeven. Daarna schatten we een probitmodel waarin de keuze van de proefpersoon de afhankelijke variabele is en de diverse kenmerken die in de vignetten beschreven zijn de voorspellers zijn.

Net als hoofdstuk 2, gaat hoofdstuk 3 over Alterspecifieke en niet-Alterspecifieke, transactiespecifieke informatie, maar er wordt een andere onderzoeksmethode toegepast. In hoofdstuk 3 behandelen we een laboratoriumexperiment waarin proefpersonen een eindig herhaald Investeringsspel spelen terwijl ze informatie met elkaar uitwisselen. Preciezer gezegd: alle proefpersonen wisselen in de rol van Ego informatie uit met twee andere proefpersonen in de rol van Ego, waarvan de één met dezelfde Alter en de ander met een andere vertrouwenspersoon speelt. Bovendien variëren we, in lijn met het onderscheid dat we in hoofdstuk 2 introduceren, de inhoud van de informatie die proefpersonen aan elkaar doorgeven. In één van de experimentele situaties ontvangen alle proefpersonen in de rol van Ego informatie over de keuzes van een andere actor in de rol van Ego *en* de keuzes van Alter, terwijl in een andere situatie, proefpersonen in de rol van Ego *alleen* informatie ontvangen over de keuzes van een andere actor in de rol van Ego, *maar niet* over de keuzes van Alter. Door deze experimentele gegevens te gebruiken toetsen we hypothesen over de effecten van leren, imitatie en controle, als ook hypothesen betreffende de interactie-effecten tussen sommige van deze effecten en onzekerheid. De hypothesen worden getoetst door Ego's keuze in het Investeringsspel te voorspellen met de variabelen die de verschillende soorten informatie die Ego heeft samenvatten.

Hoofdstuk 4 legt de focus op niet-transactiespecifieke informatie afkomstig van dyadische en netwerkinbedding. In principe omvat niet-transactiespecifieke informatie alle informatie uit andere transacties uit het verleden, verschillend van het vertrouwensprobleem in kwestie. We analyseren echter slechts één situatie waarin actoren met een vertrouwensprobleem te maken krijgen nadat ze een bepaald aantal ruilmogelijkheden ingebed in kleine ruilnetwerken hebben gehad. Deze ruilmogelijkheden worden geïmplementeerd via de verdeling van een gemeenschappelijk goed. Actoren die betrokken zijn bij een ruil onderhandelen over de verdeling van het gemeenschappelijke goed totdat ze een overeenkomst hebben bereikt (zie Willer, 1999). Experimenteel onderzoek naar dit soort ruil heeft de rol onderzocht van het ruilnetwerk bij het vaststellen wie ruilen en wie hoeveel krijgt. Ruilnetwerken bestaan uit potentiële ruilrelaties waarin het aantal potentiële partners per actor varieert. Dit bepaalt de verschillen in onderhandelingsmacht. Formele theorieën zijn ontwikkeld om, met als uitgangspunt het ruilnetwerk, te voorspellen welke actor met welke andere actor onderhandelt, als ook het punt van overeenkomst betreffende de verdeling van het gemeenschappelijke goed (zie Skvoretz en Willer, 1993 of de speciale uitgaven van *Social Networks* 14, No. 3-4). In hoofdstuk 4 beschrijven we een experiment waarin de standaard experimentele procedure overgenomen van theoretici die zich bezig houden met

ruilnetwerken gebruikt wordt om een gemeenschappelijke ervaring op te wekken van een transactie anders dan een vertrouwensprobleem. Vervolgens spelen de proefpersonen twee eenmalige Investeringsspellen, eerst in de rol van Ego en dan in de rol van Alter, met één van de actoren met wie zij eerder ruilmogelijkheden hebben gehad. Daarna observeren we hoe de ervaring van deze onderhandelingen, de beslissingen van de proefpersonen in de vertrouwensproblemen beïnvloedt. Het experiment dat in hoofdstuk 4 gepresenteerd wordt, verschilt op twee belangrijke aspecten van de experimenten in hoofdstuk 2 en 3. Ten eerste manipuleren we in het experiment besproken in hoofdstuk 4 geen onzekerheid. Ten tweede concentreren we ons niet alleen op het gedrag van Ego, maar analyseren we ook de effecten van niet-transactiespecifieke informatie op het gedrag van Alter. De hypothesen die besproken worden in hoofdstuk 4 zijn gebaseerd op twee soorten theorieën. Aan de ene kant toetsen we hypothesen over de effecten van leren over sociale voorkeuren van de ruilpartner. Deze hypothesen zijn gebaseerd op economische modellen van actoren die niet-standaard voorkeuren bevatten, zoals *eerlijkheid* (Rabin, 1993) en *rechtvaardigheid* of *aversie tegen ongelijkheid* (Fehr en Schmidt, 1999; Bolton en Ochenfels, 2000). Aan de andere kant behandelen en toetsen we hypothesen die gebaseerd zijn op de *relationele cohesietheorie* (Lawler en Yoon, 1993, 1996, 1998; zie ook Lawler, 2001). Volgens deze theorie, ervaren actoren gedurende het herhaalde ruilen emoties. Deze emoties brengen een affectieve betrokkenheid teweeg bij de ruilrelaties als ook vertrouwen tussen de actoren die betrokken zijn bij de ruil. De hypothesen die gepresenteerd zijn in hoofdstuk 4 zijn getoetst met behulp van regressiemodellen waarin informatie over de ruilen in het eerste deel van het experiment gebruikt wordt om Ego's en Alters keuzes in de daaropvolgende Investeringsspellen te voorspellen.

Hoofdstuk 5 verschilt van de rest van het boek met betrekking tot twee belangrijke aspecten. Ten eerste, onderzoeken we in hoofdstuk 5 onderzoeksgegevens over vertrouwensrelaties tussen collega's op een afdeling van een organisatie terwijl hoofdstuk 2 tot en met 4 over experimenteel onderzoek gaan. Ten tweede, aangezien er bewijs is dat sociale inbedding vertrouwen bevordert (bijvoorbeeld Wechsberg, 1966; Lorenz, 1988; Larson, 1992; Gulati, 1995a, 1995b; Uzzi, 1996, 1997), hebben individuen een stimulans om in sociale relaties te investeren, omdat sociale relaties sociaal kapitaal voor de actoren vormen (Flap, 2004). Daarom zou onderzoek naar de effecten van sociale inbedding ook situaties moeten onderzoeken waarin sociale netwerken niet exogeen bepaald zijn. Dit is precies wat we in hoofdstuk 5 doen. We analyseren de effecten van informatie afkomstig van dyadische en netwerkinbedding in een context waarin het actoren toegestaan is om relaties met anderen

te vormen en af te breken. Meer specifiek presenteren we in hoofdstuk 5 analyses die gebaseerd zijn op longitudinale data waarin vertrouwensrelaties en informele communicatie op vier verschillende momenten geobserveerd worden en we gebruiken de informatie die de actoren hebben om de vorming en dynamiek van vertrouwensrelaties te voorspellen. Aangezien deze gegevens geen informatie over het gedrag van respondenten bij vertrouwensproblemen noch niet-Alterspecifieke of niet-transactiespecifieke informatie bevatten, concentreren we ons op de effecten van leren en behandelen we alleen Alterspecifieke en transactiespecifieke informatie. Omdat de gegevens longitudinaal zijn, gebruiken we het netwerk van informele communicatie op elk meetmoment om maten te construeren die de hoeveelheid positieve en negatieve informatie die Ego over Alter heeft meten. Daarna hebben we onze hypothesen getoetst door deze maten te gebruiken om de vorming van een vertrouwensrelatie van Ego naar Alter op het daarop volgende meetmoment te voorspellen.

Ondanks de verschillen met andere hoofdstukken is het goed om op te merken dat we een aantal dezelfde hypothesen die in de voorgaande hoofdstukken besproken worden in dit hoofdstuk opnieuw toetsen. Door gebruik te maken van onderzoeksgegevens uit een organisatie controleren we de robuustheid van onze resultaten en bekijken de externe geldigheid van de experimentele bevindingen.

In figuur 1 zijn de belangrijkste onderzoeksvragen van dit boek per hoofdstuk kort samengevat.

3 Empirische bevindingen

In de volgende drie subparagrafen behandelen we de belangrijkste bevindingen van ons empirisch onderzoek. We ordenen onze bespreking volgens de cellen in tabel 1. We bespreken de effecten van Alterspecifieke en transactiespecifieke informatie (cel 1) in paragraaf 3.1. We behandelen de effecten van niet-Alterspecifieke informatie (cel 2) in paragraaf 3.2. Tot slot behandelen we de effecten van niet-transactiespecifieke informatie (cel 3) in paragraaf 3.3. Bovendien worden in elke paragraaf de effecten van informatie gerelateerd aan dyadische inbedding eerst behandeld en de effecten van informatie met betrekking tot netwerkinbedding daarna.

Figuur 1 Onderzoeksvragen

Hoofdstuk 2:

2.1 Wat zijn de effecten van *transactiespecifieke* en *Alterspecifieke* informatie afkomstig van netwerkinbedding op het besluit van Ego om Alter te vertrouwen?

2.2 Wat zijn de effecten van *transactiespecifieke* en *niet-Alterspecifieke* informatie afkomstig van netwerkinbedding op het besluit van Ego om Alter te vertrouwen?

2.3 Hoe verschillen de effecten van *Alterspecifieke* and *niet-Alterspecifieke* informatie afkomstig van netwerkinbedding *onder verschillende onzekere omstandigheden*?

Hoofdstuk 3:

3.1 Wat zijn de effecten van *transactiespecifieke* and *Alterspecifieke* informatie afkomstig van zowel dyadische als netwerkinbedding op Ego's beslissing om Alter te vertrouwen?

3.2 Wat zijn de effecten van *transactiespecifieke* and *niet-Alterspecifieke* informatie afkomstig van zowel dyadische als netwerkinbedding op Ego's beslissing om Alter te vertrouwen?

3.3 Hoe verschillen de effecten van *Alterspecifieke* and *niet-Alterspecifieke* informatie afkomstig van zowel dyadische als netwerkinbedding *onder verschillende onzekere omstandigheden*?

Hoofdstuk 4:

4.1 Wat zijn de effecten of *Alterspecifieke* en *niet-transactiespecifieke* informatie van zowel dyadische als netwerkinbedding op Ego's beslissing om Alter te vertrouwen?

Hoofdstuk 5:

5.1 Wat zijn de effecten van *transactiespecifieke* en *Alterspecifieke* informatie van zowel dyadische als netwerkinbedding op Ego's beslissing om Alter te vertrouwen in een omgeving waarin netwerken endogeen zijn?

5.2 Hoe variëren de effecten van *Alterspecifieke* and *transactiespecifieke* informatie op Ego's beslissing om Alter al dan niet te vertrouwen *onder verschillende onzekere omstandigheden*?

3.1 De effecten van Alterspecifieke en transactiespecifieke informatie

Het is duidelijk dat Alterspecifieke en transactiespecifieke informatie van dyadische inbedding de meest directe informatie is die een actor in de rol van Ego kan hebben in het geval van vertrouwensproblemen. Daarom wordt dit soort informatie door het hele boek uitgebreid bestudeerd (namelijk in hoofdstuk 2, 3 en 5). Transactiespecifieke, Alterspecifieke informatie van dyadische inbedding is wat Ego weet van Alter na voorgaande vertrouwensproblemen en welke vertrouwensproblemen hij met Alter in de toekomst verwacht. Deze twee soorten informatie leiden tot effecten van respectievelijk leren en controle. Door het hele boek heen laten we zien dat hypothesen over deze twee effecten van dyadische inbedding in verschillende empirische omgevingen, waarin verschillende onderzoeksmethoden gebruikt worden, sterk ondersteund worden. Dit is een robuust resultaat in dit boek.

Gegeven de resultaten van eerder onderzoek hadden we verwacht dat de effecten van leren via dyadische inbedding erg overheersend zouden zijn (vergelijk Buskens, 2002: hoofdstuk 5 en 6; Gautschi, 2002: hoofdstuk 2 tot en met 4). Daarom hebben we deze effecten niet geanalyseerd in hoofdstuk 2 om ons te kunnen concentreren op de effecten van netwerkinbedding die moeilijker vast te stellen zijn. De effecten van leren via dyadische inbedding van Alterspecifieke en transactiespecifieke informatie worden alleen in hoofdstuk 3 en 5 behandeld. In het experiment dat in hoofdstuk 3 gepresenteerd wordt, vinden we dat de beslissingen van onze proefpersonen om vertrouwen te geven in een bepaalde ronde van een eindig herhaald Investeringsspel beïnvloed worden door het gedrag van Alter in de voorafgaande rondes. Bovendien maken we in de analyses die in hoofdstuk 3 beschreven worden een schatting van hoe snel informatie uit rondes die in het verleden gespeeld zijn vergeten wordt. Over het algemeen gesproken blijkt dat proefpersonen in die herhaalde spellen spelen nogal vergeetachtig zijn. Zowel Alterspecifieke als niet-Alterspecifieke informatie van netwerkinbedding wordt maar gedurende één ronde onthouden en daarna meteen vergeten. Alterspecifieke en transactiespecifieke informatie van dyadische inbedding wordt echter vrij goed onthouden, aangezien die informatie meerdere rondes van belang is. In hoofdstuk 5 worden de effecten van Alterspecifieke informatie onderzocht door gebruik te maken van onderzoeksdata die verzameld zijn in een dialyse afdeling van een Nederlands ziekenhuis. Wederom worden de effecten van leren via dyadische inbedding ondersteund. Meer specifiek wordt Ego's vertrouwensgedrag tegenover Alter in het heden beïnvloed door hun gemeenschappelijke verleden, vastgelegd door zowel Ego's eigen gedrag ten opzichte van Alter in het verleden als door Alters gedrag ten opzichte van Ego in het verleden.

Controle representeert de mogelijkheid voor Ego om Alter voor zijn gedrag bij het huidige vertrouwensprobleem te bestraffen of te belonen, door vertrouwen respectievelijk te onthouden of te schenken in (potentiële) toekomstige vertrouwensproblemen. Deze mogelijkheid is afhankelijk van de waarschijnlijkheid van toekomstige interacties (dyadische inbedding). In de analyses die in hoofdstuk 2 en 3 beschreven worden, ontdekken we dat er meer kans is dat Ego Alter vertrouwt als de waarschijnlijkheid van toekomstige ontmoetingen hoog is. In hoofdstuk 2 waarin we analyses van data van een vignetexperiment beschrijven, laten actoren een voorkeur zien voor het vertrouwen van een Alter waarmee ze een langere toekomst verwachten. Andersom laten de empirische bevindingen in hoofdstuk 3 zien dat, onder overigens gelijke omstandigheden, Ego's hun Alters aanzienlijk meer vertrouwen aan het begin van het spel. Daarna vermindert het niveau van vertrouwen gestaag richting het einde van het spel en daalt sterk in de allerlaatste ronde.

De effecten van Alterspecifieke en transactiespecifieke informatie zijn ook belangrijk met betrekking tot netwerkinbedding. Afhankelijk van de specifieke inhoud van de informatie die Ego heeft, kan deze informatie leiden tot effecten van leren, imitatie en controle. Deze effecten worden behandeld in hoofdstuk 2, 3 en 5. In het vignetexperiment dat in hoofdstuk 2 gepresenteerd is, worden alleen hypothesen over de effecten van leren en controle ondersteund en niet de hypothesen over de effecten van imitatie: het is meer waarschijnlijk dat Ego Alter zal vertrouwen als zij weet dat Alter in het verleden vertrouwen, dat door anderen is geschonken, heeft gehonoreerd (leren); het is meer waarschijnlijk dat Ego Alter zal vertrouwen als Ego en Alter gemeenschappelijke vrienden hebben en in kleinere mate als ze ingebed zijn in een dicht netwerk (controle); het is echter niet waarschijnlijker dat Ego Alter zal vertrouwen als Ego slechts weet dat anderen Alter vertrouwd hebben maar niet of dat vertrouwen gehonoreerd werd (imitatie).

Omgekeerd worden in het laboratoriumexperiment, dat in hoofdstuk 3 gepresenteerd wordt, de hypothesen over de effecten van imitatie en, in mindere mate, leren via netwerkinbedding ondersteund, maar de hypothesen over de effecten van controle niet. Deze discrepanties tussen de resultaten van hoofdstuk 2 en 3 kunnen toegeschreven worden aan het experimentele ontwerp. Aan de ene kant worden de proefpersonen in het vignetexperiment, gepresenteerd in hoofdstuk 2, gevraagd om een simpele keuze te maken tussen twee concrete situaties, die op zijn hoogst in zes kenmerken van elkaar verschilden. Aan de andere kant krijgen de proefpersonen in het laboratoriumexperiment, gepresenteerd in hoofdstuk 3, gelijktijdig de beschikking over allemaal verschillende soorten informatie en moeten ze een specifiek niveau van vertrouwen kiezen. Daarom zou de sterke empirische steun voor imitatie,

tegenover de zwakke steun voor leren via netwerkinbedding in de analyses behandeld in hoofdstuk 3, toe te schrijven kunnen zijn aan de complexiteit van de taak in het laboratoriumexperiment. In andere woorden, aangezien de proefpersonen in het laboratoriumexperiment veel informatie gelijktijdig moeten verwerken, zou het kunnen dat ze simpelweg kiezen om te doen wat anderen in dezelfde rol (Ego) doen, in plaats van meer informatie uitvoerig te behandelen om erachter te komen of Alter te vertrouwen is. Dit is consistent met de bevinding dat hypothesen over de effecten van leren in het eerste deel van het experiment uit hoofdstuk 3, ondersteund worden, maar dat ze in de daaropvolgende fasen van het experiment, waarin de participanten gelijktijdig meer informatie ontvangen, niet ondersteund worden.

Tot slot concentreren we ons in hoofdstuk 5 op de effecten van leren van Alterspecifieke en transactiespecifieke informatie. Onze resultaten tonen aan dat deze informatie Ego's vertrouwensgedrag tegenover Alter aanzienlijk beïnvloedt. Meer specifiek wordt, met betrekking tot netwerkinbedding, vertrouwen tussen Ego en Alter waarschijnlijker als Ego meer informatie van derden die Alter vertrouwen ontvangt. Daarnaast wordt vertrouwen onwaarschijnlijker als Ego meer informatie ontvangt van derden die Alter niet vertrouwen.

3.2 Effecten van niet-Alterspecifieke en transactiespecifieke informatie

De effecten van niet-Alterspecifieke en transactiespecifieke informatie worden in hoofdstuk 2 en 3 onderzocht. Preciezer gezegd behandelen deze twee hoofdstukken de vergelijking van Alterspecifieke en niet-Alterspecifieke gegevens. Aangezien dyadische inbedding naar de relatie tussen Ego en Alter verwijst, bereikt niet-Alterspecifieke informatie Ego meestal via netwerkinbedding. In principe verwijst niet-Alterspecifieke informatie via dyadische inbedding naar Ego's ervaring in voorafgaande vertrouwensproblemen met een andere actor in de rol van Alter. Situaties waarin Ego opeenvolgende vertrouwensproblemen met verschillende vertrouwenspersonen heeft, worden echter in hoofdstuk 3 slechts minimaal behandeld. Daarom vatten we direct onze resultaten met betrekking tot netwerkinbedding samen. Transactiespecifieke en niet-Alterspecifieke informatie kan tot leer- en imitatie-effecten leiden. Aangezien de gevolgen van controle afhangen van Ego's straf- of beloningsmogelijkheden ten aanzien van Alter, zijn controle-effecten voor niet-Alterspecifieke informatie niet van toepassing omdat het onwaarschijnlijk is dat straf- of beloningsmogelijkheden richting derden een effect hebben op de relatie tussen Ego en Alter.

In het experiment dat in hoofdstuk 2 behandeld is, worden hypothesen over het effect van zowel leren als imitatie ondersteund. Ego zal Alter eerder vertrouwen als zij weet dat andere vertrouwenspersonen dan Alter, vertrouwen gegeven door andere actoren in de rol van Ego, gehonoreerd hebben (leren). Ook zal Ego Alter eerder vertrouwen als zij weet dat andere actoren in de rol van Ego andere vertrouwenspersonen vertrouwd hebben (imitatie). Daarom levert de vergelijking tussen Alterspecifieke (behandeld in de vorige paragraaf) en niet-Alterspecifieke informatie in hoofdstuk 2 een raadselachtig resultaat op: terwijl de hypothesen over leereffecten voor beiden soorten informatie ondersteund worden, worden de hypothesen over imitatie-effecten alleen met betrekking tot niet-Alterspecifieke informatie ondersteund. Dit houdt in dat Ego het gedrag van andere actoren imiteert die al dan niet een andere vertrouwenspersoon vertrouwen, maar niet het gedrag van andere actoren nabootst, die wel of niet Alter vertrouwen, dezelfde actor met wie Ego zelf vertrouwensproblemen heeft. Dit resultaat zou te wijten kunnen zijn aan de specifieke formuleringswijze van de informatievariabelen die in het vignetexperiment gebruikt zijn. De resultaten van de analyses die in hoofdstuk 2 gepresenteerd worden, wijzen er ook op dat Alterspecifieke informatie wel belangrijk is voor Ego, maar alleen als Ego onzeker is over Alters capaciteiten om haar vertrouwen te honoreren.

In tegenstelling hiermee worden in de analyses die in hoofdstuk 3 gepresenteerd zijn, enkel de hypothesen over de effecten van imitatie gedeeltelijk gesteund, maar de hypothesen over de leereffecten niet. Zoals we in de vorige paragraaf beweren bij de beschrijving van de effecten van transactiespecifieke en Alterspecifieke informatie, zou dit te wijten kunnen zijn aan de complexiteit van de taak die de proefpersonen uitvoeren in het experiment dat beschreven wordt in hoofdstuk 3. Bovendien worden met betrekking tot niet-Alterspecifieke informatie, de hypothesen over de effecten van imitatie juist in de experimentele fase ondersteund, waarin Ego geen Alterspecifieke informatie heeft. Dit resultaat heeft intuïtieve implicaties: het kijken naar of andere actoren, die te maken hebben met een vergelijkbaar vertrouwensprobleem in de rol van Ego, vertrouwen geven aan een andere vertrouwenspersoon, is zinvol als Ego geen toegang heeft tot Alterspecifieke informatie.

3.3 De effecten van niet-transactiespecifieke en Alterspecifieke informatie

De effecten van niet-transactiespecifieke informatie worden onderzocht in het laboratoriumexperiment dat in hoofdstuk 4 besproken wordt. In dit hoofdstuk is het verschil tussen dyadische en netwerkinbedding wat minder opvallend. Vanwege het soort experiment heeft zelfs 50% van de proefpersonen die aan het experiment deelnamen alleen informatie via

dyadische inbedding. Feitelijk heeft 50% een vertrouwensprobleem met dezelfde partner met wie zij eerder ruilmogelijkheden hadden. 25% neemt deel aan de controlebehandeling die alleen bestaat uit het Investeringsspel. Voor de overige 25% is er geen dyadische inbedding. Deze proefpersonen hebben echter een vertrouwensprobleem met een andere actor die eerder deel heeft uitgemaakt van hetzelfde ruilnetwerk, ofschoon hij niet rechtstreeks met hen ruilde. Daarom heeft 25% van de proefpersonen in dit experiment niet-transactiespecifieke informatie alleen via netwerkinbedding.

In hoofdstuk 4 onderzoeken we twee mechanismen voor de effecten van niet-transactiespecifieke informatie: een leermechanisme en een emotionele band als gevolg van voorgaande interacties met dezelfde partner. Leren is gebaseerd op de veronderstelling dat Ego, via niet-transactiespecifieke informatie, leert over de sociale voorkeuren van Alter en daardoor over de mogelijkheid dat hij vertrouwen zal honoreren. Het andere mechanisme gaat er vanuit dat tijdens de eerdere onderhandelingen Ego en Alter een zekere emotionele band met elkaar opbouwen. De hypothesen over deze beide effecten worden empirisch ondersteund. Ego zal Alter eerder vertrouwen als Alter een zekere mate van “altruïsme” bij eerdere onderhandelingen liet zien en Ego er dus kennis van kon nemen dat Alter een voorkeur heeft voor interacties waarbij de uitkomsten relatief eerlijk zijn voor beide partijen. Bovendien zal Ego Alter eerder vertrouwen als zij tot een tevreden resultaat bij het ruilen met Alter kwam en dus positieve gevoelens ten opzichte van Alter ontwikkelde. De resultaten van ons experiment staan ons echter niet toe om een duidelijke inschatting te maken over het relatieve belang van de twee mechanismen. Toch kunnen we concluderen dat de hypothesen over de effecten van de emotionele band alleen door dyadische inbedding ondersteund worden. Met andere woorden, Ego reageert alleen emotioneel als de uitkomsten van de vorige transacties rechtstreeks van Alters gedrag afhingen, dat wil zeggen als Ego en Alter met elkaar ruilden.

Verder hebben we in hoofdstuk 4 ook de effecten van niet-transactiespecifieke informatie op Alters betrouwbaarheid onderzocht. Volgens onze resultaten heeft niet-transactiespecifieke informatie geen effect op de betrouwbaarheid van Alter.

4 De onzekere rol van onzekerheid

Terwijl we de gevolgen van informatie met betrekking tot sociale inbedding op Ego’s gedrag bij vertrouwensproblemen bestuderen, onderzoeken we in het gehele boek hoe deze effecten verschillen afhankelijk van hoe onzeker Ego is. De rol van onzekerheid wordt in hoofdstuk 2, 3 en 5 onderzocht. In elk hoofdstuk kijken we naar verschillende bronnen van onzekerheid. In hoofdstuk 2 onderscheiden we onzekerheid over Alters bekwaamheid om Ego te voorzien van

de gewenste uitkomst en onzekerheid over externe onzekere factoren die mogelijk het optreden van Alter beïnvloeden. Vervolgens onderzoeken we hoe deze twee verschillende vormen van onzekerheid invloed hebben op het relatieve belang voor Ego van de informatie die ze via sociale inbedding ontvangt. Bovendien analyseren we in hoofdstuk 2 ook het directe effect van Ego's onzekerheid over Alter op haar vertrouwen in Alter, terwijl we in de andere 2 hoofdstukken waarin we onzekerheid onderzochten alleen analyseren hoe de diverse vormen van Ego's onzekerheid het belang voor haar van de beschikbare informatie beïnvloeden. Met andere woorden: we analyseren in hoofdstuk 2 het hoofdeffect van onzekerheid, als ook interactie-effecten tussen onzekerheden en verschillende soorten informatie, terwijl we in hoofdstuk 3 en 5 alleen de interactie-effecten tussen onzekerheid en informatie analyseren, maar niet het hoofdeffect van onzekerheid. In hoofdstuk 3 onderzoeken we onzekerheid over externe onzekere factoren, onafhankelijk van Alters drijfveren of bekwaamheden en richten we er ons vooral op hoe onzekerheid de informatie beïnvloedt die Ego via netwerkinbedding ontvangt. Als externe onzekere factoren een grotere of kleinere opbrengst voor Alter kunnen bepalen, die op zijn beurt deze opbrengst meer of minder genereus met Ego kan delen, is alle informatie over wat Ego krijgt ambigu omdat het onduidelijk is hoeveel Alter te verdelen had. Bijvoorbeeld wanneer Ego informatie ontvangt dat een andere actor in de rol van Ego Alter vertrouwd heeft, maar dat Alter misbruik maakte van dit vertrouwen, dan kan Ego niet weten of het vertrouwensmisbruik te wijten is aan nadelige onzekere factoren of aan Alters kwaadwilligheid. In hoofdstuk 5 behandelen we nog een andere vorm van onzekerheid, namelijk de onzekerheid over Alter, inclusief Alters motieven en Alters capaciteiten om vertrouwen te honoreren. Meer specifiek, aangezien de analyses in hoofdstuk 5 uitgevoerd zijn door gebruik te maken van onderzoeksgegevens over vertrouwensrelaties tussen collega's, keken we naar hoe lang Ego en Alter collega's geweest zijn als maatstaf voor Ego's onzekerheid over Alter.

Onze analyses van de effecten van onzekerheid zijn behoorlijk consistent: onzekerheid heeft geen invloed op Ego's gebruik van informatie bij haar besluitvorming in vertrouwensproblemen. Over het algemeen worden onze hypothesen met betrekking tot onzekerheid niet door de data gesteund, noch door experimentele data waarbij we verschillende methoden gebruikt hebben, noch door de data over collega's. Uitzonderingen op deze empirische regelmatigheid vormen de volgende resultaten. In hoofdstuk 2 vinden we enige steun voor het (hoofd)effect van onzekerheid over Alters competentie en een zwak interactie-effect van Alterspecifieke, transactiespecifieke informatie en onzekerheid over Alters competentie. De eerste van deze twee resultaten geeft aan dat Ego Alter minder snel zal

vertrouwen als zij onzeker is over Alters bekwaamheid om vertrouwen te honoreren. Het tweede resultaat geeft aan dat de effecten van imitatie veroorzaakt door Alterspecifieke informatie alleen significant zijn wanneer Ego erg onzeker is over Alters competentie.

Het gebrek aan empirische steun voor de hypothesen over de effecten van onzekerheid kan gedeeltelijk te wijten zijn aan methodologische problemen. In hoofdstuk 5 bleek bijvoorbeeld de gebruikte variabele een gebrekkige meting te vertegenwoordigen. Omdat het gebrek aan effect van onzekerheid echter door de verschillende hoofdstukken heen consistent is en overeind blijft onder verschillende soorten onderzoeksmethoden, kunnen we het niet zomaar van tafel vegen. Onzekerheid heeft erg weinig effect en doet er alleen toe als het toegespitst is op Alters mogelijkheid om Ego van positief resultaat te voorzien, mits hij dit zou willen. Onzekerheid heeft echter geen invloed op het relatieve belang, voor Ego, van informatie die Ego heeft via sociale inbedding.

5 Conclusie en suggesties voor toekomstig onderzoek

In deze paragraaf bespreken we kort de implicaties van onze empirische bevindingen en geven suggesties voor verder onderzoek. In tabel 2 zijn onze empirische resultaten geordend volgens de verschillende mechanismen die we bekijken voor de verschillende soorten informatie die afkomstig is van zowel dyadische als netwerkinbedding. Tabel 2 geeft onze typologie weer van de soorten informatie die Ego vanuit sociale inbedding kan hebben. Binnen iedere cel maken we een lijst van mechanismen die onderzocht worden en specificeren we voor elk mechanisme of onze hypothesen consistent ondersteund worden (👍), tot op zekere hoogte ondersteund worden (👍👎), of niet getoetst worden (NG).

Tabel 2 Overzicht van de resultaten

			Informatie over de transactie	
			specifiek	niet-specifiek
Dyadische inbedding	Informatie over Alter	specifiek	Leren 👍 Controle 👍	Leren 👍 Controle NG
		niet-specifiek	Er worden geen hypothesen voor dit soort informatie getoetst	Er worden geen hypothesen voor dit soort informatie getoetst
Netwerk-inbedding	Informatie over Alter	specifiek	Leren 👍 Controle 👍👎 Imitatie 👍	Leren 👍 Controle NG Imitatie NG
		niet-specifiek	Leren 👍👎 Controle NG Imitatie 👍	Er worden geen hypothesen voor dit soort informatie getoetst

👍: bewijs wordt ondersteund; 👍👎: gemengd bewijs; NG: niet getoetst.

Als we naar de resultaten kijken, zien we een sterk empirisch bewijs voor leren en imitatie, beiden met betrekking tot informatie afkomstig van dyadische inbedding en met betrekking tot informatie afkomstig van netwerkinbedding. De effecten van leren zijn overheersend, maar ook de hypothesen over de effecten van imitatie worden breed gesteund. Preciezer gesteld leren actoren vooral door dyadische inbedding, maar worden ook via netwerkinbedding geïnformeerd, als zij genoeg informatie ontvangen en als de informatie niet te ingewikkeld te hanteren is. Omgekeerd gebruiken ze de informatie die ze van netwerkinbedding verkrijgen om anderen te imiteren als ze geen informatie krijgen die voldoende is om van te leren of als de informatie erg ingewikkeld is. Wat betreft controle laten onze effecten zien dat controle vooral voor dyadische inbedding belangrijk is. Het lijkt erop dat actoren rekening houden met de verwachte duur van hun gemeenschappelijke toekomst met Alter. Meestal houden ze echter geen rekening met toekomstige sancties of beloningen via netwerkinbedding, behalve bij het vignetexperiment in hoofdstuk 2.

De resultaten die in tabel 2 samengevat zijn, geven antwoorden op de onderzoeksvragen die in figuur 1 gepresenteerd worden. We ordenen deze antwoorden volgens de diverse cellen in tabel 2. Alterspecifieke en transactiespecifieke informatie leiden tot effecten van leren en controle via dyadische inbedding en effecten van leren en imitatie via netwerkinbedding. In hoofdstuk 2 hebben we enkele effecten van controle via netwerkinbedding gevonden, maar dit resultaat wordt niet bevestigd in het experiment dat in hoofdstuk 3 gepresenteerd wordt. Deze bevindingen geven antwoorden op de onderzoeksvragen 2.1 en 3.1. De hypothesen over de leereffecten van Alterspecifieke en transactiespecifieke informatie via zowel dyadische als netwerkinbedding worden ook gesteund door de onderzoeksgegevens die in hoofdstuk 5 behandeld zijn, waar dezelfde hypothesen in een dynamische omgeving getoetst zijn met betrekking tot leren. Helaas zijn deze gegevens niet toereikend om hypothesen over imitatie en controle te toetsen. Wat betreft onderzoeksvraag 5.1 hebben we dus alleen voor de effecten van leren ondersteuning gevonden in een omgeving met endogene netwerken.

De effecten van niet-Alterspecifieke en transactiespecifieke informatie worden alleen met betrekking tot dyadische inbedding onderzocht. Het antwoord op onderzoeksvragen 2.2 en 3.2 is dat dit soort informatie tot effecten van leren en imitatie leidt. Er zijn geen hypothesen getoetst over de effecten van controle.

Wat betreft de effecten van Alterspecifieke en niet-transactiespecifieke informatie toetsen we hypothesen over de effecten van leren via dyadische en netwerkinbedding. Het antwoord op onderzoeksvraag 4.1 is dat dit soort informatie inderdaad tot leereffecten leidt.

Verder zijn we in staat om één consistent antwoord op onderzoeksvragen 2.3, 3.3 en 5.2 te geven met betrekking tot de effecten van informatie onder verschillende omstandigheden met onzekerheid. Door het hele boek behandelen en toetsen we verscheidene hypothesen over interactie-effecten tussen onzekerheid en leren of imitatie. Geen van deze hypothesen worden ondersteund. Daarom is het antwoord op de onderzoeksvragen 2.3, 3.3 en 5.2 dat, over het algemeen, de effecten van leren en imitatie onder verschillende onzekere omstandigheden niet variëren.

Gegeven de resultaten die we zojuist samengevat hebben, draagt dit boek bij aan een beter begrip over de mechanismen via welke informatie van actoren de oplossing van vertrouwensproblemen beïnvloedt. Allereerst verschaffen we een systematische analyse van de soorten informatie waarvan een aantal eerder nauwelijks onderzocht zijn. Terwijl bestaand onderzoek zich alleen op Alterspecifieke en transactiespecifieke informatie richt, onderzoeken wij ook de effecten van niet-Alterspecifieke en niet-transactiespecifieke informatie. Ten tweede, terwijl bestaande literatuur over dit onderwerp zich uitvoerig met de effecten van leren en controle bezighoudt, worden in dit boek ook betrekkelijk nieuwe soorten effecten, zoals imitatie, vastgesteld en besproken. Ten derde, concentreren de meeste studies over de effecten van sociale inbedding met betrekking tot vertrouwensproblemen zich op of dyadische of netwerkinbedding. Daarentegen worden in dit boek deze twee soorten inbedding tegelijkertijd onderzocht. Ten vierde presenteren we empirische toetsen van dezelfde hypothesen, waarbij we gebruik van een unieke combinatie van verschillende maar aanvullende onderzoeksmethodes, zoals twee laboratoriumexperimenten, een vignetexperiment en een veldonderzoek. Voor zover de resultaten consistent zijn leidt het gebruik van verschillende onderzoeksmethodes tot meer vertrouwen in zowel de interne als externe geldigheid en robuustheid van deze resultaten. Omgekeerd, wat betreft de effecten van informatie waarvoor we geen consistente resultaten in alle omstandigheden vinden, staat het gebruik van verschillende onderzoeksmethodes ons toe om enige indicaties van de voorwaarden te geven, waaronder deze effecten zich met grotere waarschijnlijkheid zullen voordoen. De effecten van imitatie zijn bijvoorbeeld over het algemeen overheersend als de informatie die proefpersonen moeten hanteren voordat zij een beslissing nemen ingewikkeld is.

Tot slot behandelen we een aantal voorstellen voor toekomstig onderzoek ten aanzien van de theoretische opbouw, nieuwe onderzoeksproblemen en nieuwe methoden. Ten eerste zijn onze hypothesen op verschillende theoretische modellen gebaseerd, die tot op zekere hoogte uit gaan van verschillende veronderstellingen wat betreft de rationaliteit van de

actoren alsook hun calculerende vaardigheden. De ontwikkeling van een model dat in staat is om de mechanismen die in dit boek onderzocht worden te integreren en dat voorwaarden specificeert waaronder de verschillende mechanismen werken, vormt een belangrijke uitdaging voor verder onderzoek.

Ten tweede, ofschoon de meeste definities van vertrouwen beweren dat Ego's beslissing om Alter te vertrouwen van Ego's beoordeling van Alters vertrouwenswaardigheid afhangt, worden de determinanten van Alters vertrouwenswaardigheid nog steeds slecht begrepen. We analyseren vertrouwenswaardigheid bijvoorbeeld alleen in het experiment dat in hoofdstuk 4 gepresenteerd wordt, maar geen van onze experimentele variabelen heeft enig opvallend effect met betrekking tot het voorspellen van vertrouwenswaardigheid. Volgens onze resultaten hangt vertrouwenswaardigheid alleen van persoonlijke kenmerken af. We geloven echter dat vertrouwenswaardigheid beter begrepen zou kunnen worden door nieuwe specifieke theoretische modellen om het gedrag van Alter te voorspellen te ontwikkelen en deze te toetsen door gebruik te maken van ingebedde spellen, zoals bijvoorbeeld het experiment dat in hoofdstuk 3 gepresenteerd is.

Ten derde vinden we geen ondersteuning voor controle via netwerkinbedding als we experimentele data gebruiken waarin feitelijk gedrag van Ego of Alter geobserveerd werd, ofschoon we enige steun hiervoor in hoofdstuk 2 vinden, waar we gebruik maken van een vignetexperiment. Toch is er bewijs dat dit mechanisme in bepaalde omstandigheden werkt (voorbeelden omvatten de diamantkooplieden in Wechsberg, 1966, en de Maghribi handelaren in Greif, 1989). Nieuwe experimenten of onderzoeken zouden daarom ontworpen moeten worden om de effecten van controle empirisch vast te leggen.

Ten vierde vormt de brede steun voor de hypothesen over de effecten van imitatie misschien het meest interessante resultaat van dit boek, omdat het interessante implicaties heeft. Als imitatie bijvoorbeeld net zo sterk aanwezig is in een organisatorische context, dan is een vertrouwenwekkende omgeving erg belangrijk voor het opnemen van nieuwkomers. Daarom zou vooral binnen organisaties het onderscheid tussen leren en imitatie verder onderzocht moeten worden, om de omstandigheden die de invloed van het ene of het andere effect bepalen beter te begrijpen. We analyseren organisatorische onderzoeksgegevens in hoofdstuk 5, maar de gegevens stellen ons helaas niet in staat om duidelijk onderscheid te maken tussen leren en imitatie.

Ten vijfde vinden we erg weinig steun voor de hypothesen over de effecten van onzekerheid. Misschien zou de rol van onzekerheid beter begrepen kunnen worden als we

gebruik maken van laboratoriumexperimenten die speciaal opgezet zijn om vertrouwensproblemen met betrekking tot onzekerheid te onderzoeken.

Ten zesde analyseren we in alle hoofdstukken, met als enige uitzondering hoofdstuk 5, de effecten van informatie in situaties waarin het netwerk van informatie-uitwisseling exogeen is. In werkelijkheid zijn netwerken van sociale relaties dynamisch. We pakken dit probleem in hoofdstuk 5 aan, waar we longitudinale netwerkgegevens analyseren, maar hoewel we steun voor de effecten van leren vinden, zijn de analyses beperkt door de meervoudige afhankelijkheden in de gegevens. Aangezien de statistische methoden die speciaal ontworpen zijn om dit soort gegevens te analyseren, snel ontwikkeld worden (bijvoorbeeld Snijders, 2001, 2005), vormt de studie van de ontwikkeling van vertrouwensrelaties door gebruik te maken van longitudinale data zeker een veelbelovende richting voor verder onderzoek.

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