Incomplete Information in Social Interactions

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Chapter 6
General Discussion

Humans are interdependent on one another. Behaviors influence others' well-being in many interpersonal relationships (e.g., friends or romantic partners), but even perfect strangers are sometimes interdependent (e.g., asking directions; giving a seat for an elderly person in a tram). Interdependent individuals may benefit or hurt each other by their behaviors. Especially diagnostic are situations that are characterized by a conflict of interest, because individuals must decide whether to pursue self-interest or other-interest in those situations.

Often people choose to cooperate—go beyond their self-interest to benefit another person or collective. Cooperation has been a major puzzle in social sciences, because forfeiting one's self-interest does not fit very well into classic economic theories of rational behavior. From the perspective of the dyad or collective the benefits of cooperation are quite evident: Mutual cooperation gives the best combined outcomes in the prisoner's dilemma; a group of hunters might benefit from sharing their preys with one another because one hunter might not be successful for long time and big animals would get spoiled anyways; colleagues would benefit from sharing their tasks according to expertise. But from the individual perspective cooperation is always costly: Defection gives the best individual outcomes in the prisoner's dilemma regardless what the other player does; a hunter would be better off individually without sharing his pray; helping colleagues costs time and potentially reduces time available for individual goals. Thus, from the perspective of the collective everybody should cooperate whenever it is mutually beneficial, but from the perspective of the individual people should not cooperate.

Evolutionary simulations, along with experimental data, show that human cooperation is conditional (Axelrod, 1984; Gouldner, 1960; Kollock, 1993; Komorita & Parks, 1995; Nowak & Sigmund, 1992, 2005; Trivers, 1971; Van Lange et al. 2002). People cooperate, and ought to cooperate, with those who cooperate with them. Conditional cooperation is clearly the best strategy in both worlds: It provides the best combined benefits with those who want to cooperate, but it also provides a protection against those who try to obtain the best individual outcomes by not cooperating. But this benefit comes with a cost: Compared to unconditional cooperation or unconditional noncooperation, conditional strategies require information about the partner's previous behaviors.

This dissertation is rooted in the idea that conditional cooperation is not always directly applicable. When people have only incomplete information about their partner's behaviors, they can no longer rely on simple conditional rules such as tit-for-tat alone. Before conditional cooperation can be applied, people need to fill-in the

blanks in information (e.g., estimate the partner's cooperation). Thus, cooperation in interactions with incomplete information is determined by behavioral strategies (e.g., tit-for-tat) as well as psychology relevant to inferring the partner's cooperation. As such, the present dissertation connects two major literatures: The one relevant to interpersonal strategies discussed before (e.g., tit-for-tat) and the other relevant to interpersonal beliefs, expectancies, and impressions (Miller & Ratner, 1996, 1998; see also Epley, Caruso, & Bazerman, 2006; Messick, Bloom, Boldizar, & Samuelson, 1985; Vorauer & Sasaki, 2009).

The first half of this dissertation tested the idea that people use their self-interest beliefs to predict and evaluate other people's behaviors under incompleteness of information. The second half of this dissertation examined how self-interest beliefs influence cooperation and impressions in repeated interactions. The first subchapter of this general discussion summarizes the key contributions of each empirical chapter. The second one discusses general implications of the dissertation and presents a model for understanding dyadic cooperation under incompleteness of information. The third one reviews other relevant literatures and the fourth one discusses limitations and suggestions for future research. Finally, the fifth subchapter arrives to the main conclusion of this dissertation.

Summary of the Empirical Findings

Chapter 2 assessed motives that underlie other people's social behavior. Previous literature suggests that people's own social decisions are influenced by self-interest, altruism, and egalitarianism (Van Lange, 1999), but it is not clear whether people think that these motives influence others' social behavior the same way or not. Building on previous literature showing that people tend to overestimate self-interest in others (Miller & Ratner, 1996, 1998), people may underestimate unselfish motives such as altruism and egalitarianism in others' social behavior. Experiment 2.1 separated the three social motives from choice behavior and revealed that people expect that egalitarianism has a smaller impact on others' social decisions than it has on own social decisions. Experiment 2.2 demonstrated that people expect others to rate equal or nearly equal allocations as less positive than they rate such allocations themselves. Hence, Chapter 2 revealed that people make errors in predicting others in situation in which egalitarianism shapes own behavior.

Chapter 3 focused on judgments that people make on others' overt behavior. In the absence of any concrete information, people overestimate others' selfish motives and underestimate unselfish ones, in particular, egalitarianism (Chapter2), but it is not clear whether this tendency holds when people observe and evaluate others' overt behavior. The key question is whether incomplete information on fair behavior corrects erroneous self-interest beliefs, or erroneous beliefs persist under incompleteness of

information. Experiments 3.1 and 3.3 revealed that under incompleteness of information, people use self-interest beliefs to predict the missing pieces of information. Self-interest guided judgments regarding others' present behavior (Experiments 3.1 and 3.3) and recall of past behavior (Experiment 3.3). Self-interest was assumed only for intentional behavior of other people. When people could not attribute intentionality or when allocations were made by a computer, no self-interest was assumed. Experiment 3.2 revealed that people indeed exhibit some degree of self-interest in their allocations, but the assumed level of self-interest is greater. Thus, people are somewhat accurate when they assume self-interest from others, but they overestimate the degree to which others actually behave according to self-interest.

Chapter 4 examined the role of self-interest beliefs in an interactional context. Chapter 3 demonstrated that people attribute too much self-interest to others, but it is not clear whether people respond with the same level of self-interest in return. Previous literature shows that people tend to cooperate conditionally (i.e., use tit-for-tat), but this pattern is demonstrated only when partners' have complete information on each other's behaviors. If partners have only incomplete information, they may fill-in the missing pieces of information with self-interest, and respond accordingly—in part based on their erroneous self-interest beliefs. Experiment 4.1 and 4.2 revealed that incompleteness of information leads to reduced estimations regarding the other's cooperation as well as lower levels of own cooperation. These detrimental effects of incomplete information were found when the other was programmed to behave in a fair manner (Experiment 4.1) or when the other followed tit-for-tat (Experiment 4.2). Complementary analyses revealed an explanation for this effect: Own cooperation was mediated by the partner's estimated cooperation, indicating that under incompleteness of information, people do not cooperate as much as the partner, but as much as they think that the partner has cooperated. Because perceived cooperation is less than actual cooperation, incomplete information reduces cooperation in dyadic interactions.

Chapter 5 first replicated the findings of Chapter 4. Two complementary incompleteness manipulations provided good support for the basic idea that with greater incompleteness of information, people cooperate less. Chapter 5 also extended this finding in two important ways. Experiments 5.1 and 5.2 manipulated the interaction partner's cooperation and revealed that the more cooperation the partner seeks to attain, the more incompleteness of information reduces participants' cooperation. This indicates that the detrimental effects of incomplete information cannot be compensated by generosity. Experiments 5.1 and 5.2 revealed that general impressions about the partner are also influenced by incompleteness of information: With greater incompleteness of information, participants formed less benign impression of their partner—the effect that was more pronounced for generous rather than stingy partners. Supplementary analyses revealed that the detrimental effects of incomplete information on cooperation were mediated by benign impressions of the

partner. These findings plausibly underscore the vulnerability of cooperation under incompleteness of information: If people erroneously perceive their partner's behavior as noncooperation, and form their impressions accordingly (e.g., she is unkind), and act upon it (e.g., I do not cooperate), the mere presence of incomplete information may have a long lasting detrimental effect on mutual cooperation.

Conditional Cooperation Revisited

Traditionally, experimental research on cooperation has relied on experimental games in which partners have complete information about each others' past behaviors and in which behaviors are always implemented without errors. General conclusions and existing models of cooperation reflect behavior under these conditions, but the validity of these conclusions in more realistic settings (e.g., including incompleteness of information or unintended errors) has not been addressed until the most recent research.

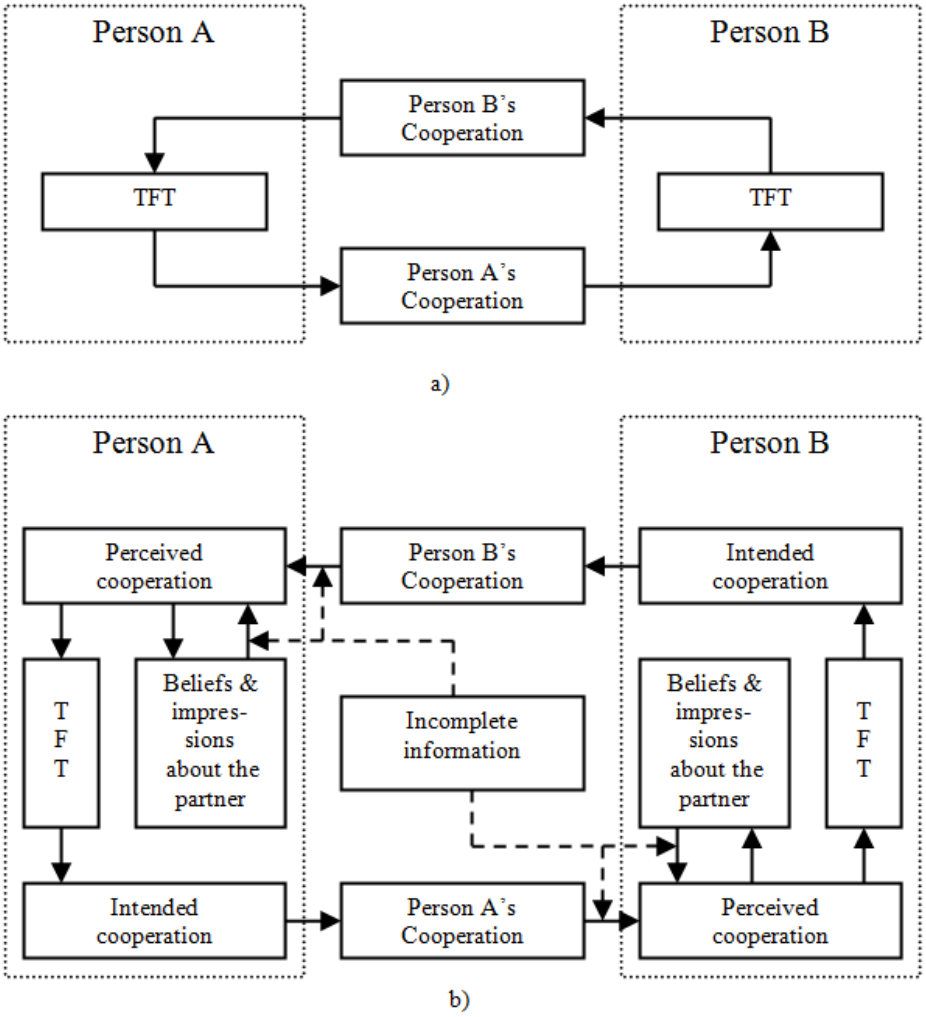
Figure 6.1a displays a dyadic interaction with two tit-for-tat partners—basic model that has been known for half of a century. Dashed boxed on left and right describe processes within two interdependent individual: Person A and Person B. The middle part describes measurable behavior between Person A and Person B. In this model, both partners' know each other's exact level of cooperation and respond accordingly (i.e., they use tit-for-tat). If Person A starts with cooperation, they will keep cooperating as long as the interaction continues.

The general implications of this dissertation do not contradict with this basic model supported in thousands of game theoretical experiments. Instead, they identify a boundary condition in which the model is valid. When people have only incomplete information on their partner's behaviors, they can no longer rely only on their partner's behavior and apply simple conditional rules such as tit-for-tat directly. Instead, beliefs and impressions about the partner also influence the way in which behaviors are evaluated and responded to.

Figure 6.1b displays the new model that explains cooperation with varying degrees of incompleteness of information. In comparison to the basic tit-for-tat model, people must first infer their partner's cooperation based on incomplete information and use their beliefs and impressions to fill-in the missing pieces of information (Chapters 2 and 3). Subsequently, people respond to others based on their inferred level of cooperation—people indeed use tit-for-tat but in the absence of complete information they rely on inferred rather than actual level of cooperation (Chapter 4). Finally, consistent with various attribution literatures (see fundamental attribution error; Ross 1977; correspondence bias; Jones, 1990), impressions about the partner are essentially determined by perceived cooperation (Chapter 5). This may have a long-lasting influence on mutual cooperation, because impressions may influence how subsequent

behaviors are perceived and responded to (e.g., behaviors of a person who is perceived as stingy might be evaluated even more self-interestingly).

Figure 6.1: The basic model for dyadic interaction with two tit-for-tat partners (a) and the corresponding model developed in this dissertation for explaining cooperation with varying degrees of incompleteness of information (b).



To conclude, the model developed in this dissertation is more general than previous models on conditional cooperation. The core aspect of the model is that the degree to which people have incomplete information about their partner's cooperation determines the extent to which behavior is based on actual information versus beliefs and impressions about the partner. This model highlights an important boundary

condition for conditional strategies: Self-interest beliefs influence perceived cooperation and own cooperation unless information is complete enough to override self-interest beliefs. Because many interactions in real life are characterized by incompleteness of information, the model is more ecologically valid and helps explaining reduced cooperation in situations in which mutual cooperation might be the preferred option.

Implications and Contributions

Besides general implications discussed before, this dissertation is connected to various lines of previous research. I will discuss these implications and contributions in this subchapter.

Noise

A closely related concept to incompleteness of information is noise—the discrepancy between intended and actual outcomes (Klapwijk & Van Lange, 2009; Van Lange et al, 2002). Sometimes behaviors do not come out as intended (e.g., arriving late to a meeting because of an unexpected traffic jam), and often people only have an access to the observed behavior, not necessarily to the intentions behind them (see Pronin, 2008). If people respond to the actual rather than intended cooperation, the level of cooperation is influenced by noise.

Noise is similar to incompleteness of information in that they both alter the link between intended and perceived cooperation. In particular, noise influences the link between intended and actual cooperation, whereas incompleteness of information alters the link between actual and perceived cooperation (see Figure 6.1b). Because of these similarities, it is not very surprising that noise reduces cooperation the same way as incompleteness of information does (Klapwijk & Van Lange, 2009; Van Lange et al, 2002).

There is also an important difference between the two constructs. When noise is present one knows the actual cooperation but does not know whether that level of cooperation was intended or not. When incompleteness of information is present one does not know the actual nor intended cooperation. Because intended cooperation cannot be accurately inferred without knowing the actual cooperation, intended cooperation is always influenced by incompleteness of information.

This difference may explain why generosity does not help for incompleteness of information, as demonstrated in this dissertation, but it does help for noise, as previous research has demonstrated (Klapwijk & Van Lange, 2009; Van Lange et al, 2002). The more generously one behaves under incompleteness of information the more self-interest beliefs reduce perceived cooperation and presumably perceived intentions as well. Noise, on the other hand, makes behaviors somewhat more or less cooperative

independently of the partner's level of cooperation. Thus, unlike incompleteness of information, incidents of noise do not intervene with communication of generous intentions and behaviors.

Interdependence Theory

Interdependence theory is a conceptual framework for understanding the basic features of social situations (Thibaut & Kelley, 1978; Rusbult & Van Lange, 1996, 2003). Originally, interdependence theory identifies four structural properties of interdependence: degree of dependence (i.e., independence vs. dependence), mutuality of dependence (i.e., equal vs. unequal dependence on one another), covariation of interest (i.e., corresponding vs. conflicting), and basis of dependence (i.e., cooperation vs. coordination). More recently, incompleteness of information has been incorporated to interdependence theory as one of its basic properties (Kelley et al, 2003).

Many ideas presented in this dissertation were initially introduced or at least inspired by Kelley et al (2003). However, the role of incomplete information, both conceptually and empirically, is examined more thoroughly in this dissertation. First, I identify that information regarding a specific social interaction can be incomplete in two distinct ways: People can have incomplete behavioral information (e.g., what did the partner exactly do) or incomplete situational information (e.g., what are my partner's outcomes associated with a particular behavior). In Chapter 5 I manipulate both types of incompleteness of information and arrive to the conclusion that they have similar detrimental effect on cooperation in social interactions.

Second, I demonstrate that people can have incomplete information about their partner's transformations (e.g., general tendencies towards cooperation vs. competition across social situations). Under incomplete behavioral or situational information, transformational information is almost always incomplete, and people have a tendency to attribute too much self-interest to others' transformations (i.e., self-interested behavioral attributions translate into self-interested dispositional attributions). This can have a long-lasting impact on cooperation, because self-interest beliefs about the partner's transformations may hamper even mutually preferred cooperation in subsequent interactions.

Trust

Trust is a psychological state comprising the intention to accept vulnerability based upon the positive expectations of the intentions or behavior of another (Rousseau, Sitkin, Burt, & Camerer, 1998). Generalized trust refers to trust in people in general and interpersonal trust refers to trust in a particular individual (Rotter, 1971).

In many ways, generalized trust and interpersonal trust are related to beliefs and impressions discussed in this dissertation. When people have no prior information, they must rely on generalized trust. Previous research has shown that people tend to

underestimate strangers' trustworthiness (Fetchenhauer & Dunning, 2009, 2010). This finding is closely related to the idea that people have self-interest beliefs about other people.

In repeated interactions people accumulate information on their partner's behavior. Now, with increasing amount of person-specific information people shift from generalized trust to interpersonal trust and cooperation is a key determinant in this process: Cooperative behaviors increase trustworthiness and vice versa (Klapwijk & Van Lange, 2009; Komorita & Parks, 1995; Van Lange et al, 2002). Previous research does not address trustworthiness evaluations under incompleteness of information, but it is quite possible that perceived cooperation is the key determinant rather than actual cooperation—similar to the finding that benign impressions are closely related to perceived rather than actual cooperation. If this is indeed the case, interpersonal trust may be difficult to build under incompleteness of information. In particular, very high levels of trust may not be possible to attain by generous behaviors.

Methodological Contributions

Paradigms used in this dissertation are either completely novel or significantly modified from existing ones. Experiment 2.1 used the ring measure of social values for disentangling self-interest, altruism and egalitarianism motives from choice behavior (Liebrand, Jansen, Rijken, & Suhre, 1986). In the present version of the paradigm participants made choices either on their own behalf, or on behalf of another person, which allowed comparing own and expected social motives.

Experiment 2.2 used the dictator game to compare own and expected social motives (Bolton, Katok, & Zwick, 1998). Instead of acting as allocators (i.e. dictators), participants evaluated the allocator's outcome allocations. This approach allowed to disentangle social motives from evaluative judgments and to compare own evaluations to the expected evaluations of others, similar to Experiment 2.1.

Experiments 3.1, 3.2, 3.3 and 5.1 used a novel paradigm—the dice rolling task—which measures expected cooperation under incompleteness of information. The core idea of the paradigm is that participants are given only partial information on the partner's behavior, and predictions regarding the missing pieces of information are conceptualized as a measure of expected cooperation. This is an indirect—albeit very straightforward—way of assessing beliefs that guide judgments of overt behavior. This paradigm can be used for studying beliefs in different interpersonal relationships (e.g., strangers vs. friends vs. relatives), organizational structures (e.g., bosses vs. subordinates), and group settings (e.g., ingroup vs. outgroup stereotyping).

Experiments 4.1, 4.2 and 5.2 used another novel paradigm—the coin task—which measures expected and actual cooperation in repeated interactions. For each trial participants are given a subset of information on their partner's cooperative vs. noncooperative behaviors. They estimate the partner's total cooperation and respond

with their own level of cooperation—the approach that allows measuring the link between estimated and actual cooperation at different levels of incompleteness of information. With this approach different partner strategies can be implemented (e.g., fairness in Experiment 4.1 and tit-for-tat in Experiments 4.2 and 5.2) and the game theoretical structure can be varied (i.e., an exchange game in Experiment 4.2 and the prisoner's dilemma in Experiment 5.2), similar to standard games used in social dilemma research. This paradigm can be used for studying cooperation in various interpersonal setting.

More broadly, incomplete information paradigms developed in this dissertation narrow the gap between traditional game theoretical paradigms and more real-life-like interactions. Game theoretical paradigms are essentially outcome transactions (e.g., money or point), but many cooperative behaviors in real life are favors. Previous research has shown that people engage in egocentric biases in favor evaluations—favor receivers focus on benefits and favor givers focus on costs (Zhang & Epley, 2009). Thus, favor-to-favor interactions are essentially interactions with situational incompleteness of information—information that is most incomplete with regard to the interaction partner's outcomes. Paradigms developed in this dissertation mimic such favor-like transactions in that they incorporate incompleteness of information while still providing, similar to game theoretical paradigms, quantifiable information on beliefs and cooperation.

Limitations and Suggestions for Future Research

Personality Variables and Different Interpersonal Relationships

Two major simplifications were made in this dissertation. First, conclusions were drawn for the average behavior without using individual difference variables as explanatory constructs. This was a deliberate choice, because the focus of this dissertation is on a situational variable (i.e., incompleteness of information) that explains human behavior in general. I suggest that future research would examine the role of individual difference variables (e.g., social value orientation, trust, regulatory focus) in incomplete information situations. Perhaps most interestingly, individual difference variables may interact with incompleteness of information. For example, people high in generalized trust may be less likely to make self-interest attributions and perhaps less likely to respond self-interestingly in return.

Second, all participants thought that they were interacting with another participant—essentially with a stranger. This was also a deliberate choice, because strangers do not have any dispositional information on one another and therefore they need to rely on their beliefs in other people in general. Future research in different types of interpersonal relationships would be particularly interesting, because people may use their past information and experiences for filling in the blanks in incomplete

information. For example in ongoing relationships people do not necessarily assume self-interest (e.g., in communal relationships, Clark & Mills, 1993; Rusbult & Van Lange, 2003). Conversely, even more self-interest might be assumed from groups, or from representatives of groups, as people think more positively about persons than about groups (e.g., Insko & Schopler, 1998; Sears, 1983). Another interesting line of future research would examine asymmetric interdependence. For example, people may attribute even more self-interest to others who have more power over their outcomes (e.g., politicians or bosses).

Functionality of Self-interest Beliefs – The Evolutionary Approach

Why people attribute too much self-interest to others behaviors? One explanation is that under incompleteness of information, people are bound to make errors in judging their partner's cooperation. Previous research has identified a strong bias called loss-aversion: People put more effort for avoiding losses than for obtaining gains of the same size (cf. prospect theory; see Kahneman & Tversky, 1979; see also Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Therefore, underestimation of cooperation is a safe strategy that avoids the possibility of getting exploited by the partner.

Risk-aversive attitudes may ultimately be rooted in survival thresholds (for a discussion, see McDermott, Fowler, & Smirnov, 2008). As previous simulations have shown, defectors and tit-for-taters are both sustainable sub-populations. Given that a population consists of both and people make mistakes in identifying the two, it may be less harmful to identify a tit-for-tater as a defector than a defector as a tit-for-tater. This of course calls for future research, because such evolutionary-based claims are highly speculative unless their success has been demonstrated in the evolutionary simulation framework.

Information Sharing in Social Dilemmas

This dissertation identified a boundary condition for cooperation—incompleteness of information—that is quite challenging to overcome. A lot of research effort has been devoted to increasing cooperation in social dilemmas and three types of solutions have been proposed: strategic, motivational, and structural (for reviews, see Kollock, 1998; Komorita & Parks, 1994; Van Lange & De Dreu, 2001; Van Lange, Liebrand, Messick, & Wilke, 1992; Weber et al., 2004).

This dissertation revealed that strategic and motivational solutions are largely ineffective. Even generosity—strategy that is efficient for noise for instance—does not overcome the detrimental effects of incomplete information. Motivational solutions are also ineffective, because cooperative transformations depend on the perception of the partner's cooperative transformations. Because such perception is susceptible for self-interest attributions, cooperation cannot easily be elicited or maintained under incompleteness of information.

The structural solutions—aim at removing or changing the dilemma—provide an interesting avenue for future research. Our findings indicate that the power of incomplete information is quite substantial, which suggests that people might be better off communicating even somewhat selfish behaviors. To what extent people, organizations, or politicians should communicate their selfish versus unselfish behaviors is a question that future research will provide some answers. Based on the present findings, it is quite possible that in many occasions, more information and more transparency would prevent people from making erroneous self-interest attributions and therefore would yield a higher level of mutual cooperation.

Concluding Remarks

Decades of research on the prisoner's dilemma and other experimental games have arrived at the main conclusion that tit-for-tat is the strategy that people follow and should follow. Our research indicates that this conclusion does not completely hold when people have only incomplete information about their partner's behaviors. Under incompleteness of information, tit-for-tat becomes accompanied by people's general belief that most other people are self-interested, which in turn undermines cooperation. Previous research has shown that the detrimental effects of some imperfections in social interactions (e.g., noise) can be overcome by generosity, but this dissertation reveals that generosity is a largely inefficient for interactions with incomplete information: The more generosity one seeks to communicate the more incompleteness of information undermines cooperation. The strongly held belief that other people are primarily self-interested seems to function as theory for people to rely on with strangers when they do not have complete information about the other's actions. As such, the belief in self-interest may become a self-fulfilling prophecy, as people tend to respond in mind (i.e., based on what they think others did) rather than respond in kind (i.e., based on what others actually did).