PUTTING INCENTIVES IN CONTEXT: TRUST, TIME HORIZON AND THE EFFECTIVENESS OF PAYOFF MANIPULATIONS

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SUMMARY

This study examines how willingness to cooperate in repeated prisoner's dilemma games is shaped by the interaction between game parameters and context parameters. We hypothesize and test that the context parameters trust and time horizon jointly influence the effectiveness of manipulating the three PD-game parameters benefit, greed and fear in promoting cooperation. Benefit represents the gain from mutual cooperation over mutual non-cooperation. Greed represents the gain from opportunism relative to the payoff from mutual cooperation. Fear represents the loss from being cheated relative to the payoff from mutual non-cooperation.

That economic behavior is socially and temporally embedded - and therefore not just based on payoff incentives alone - has been recognized in the literature. In fact, the roles of payoff incentives, interpersonal dynamics and intertemporal dynamics in shaping cooperation have been extensively studied in a variety of disciplines. However, only recently, have the three aspects of any ongoing-social relationship been integrated into one framework. Hwang and Burgers (1999) proposed that the interpersonal aspect (trust) and the temporal aspect (time horizon) of a relationship systematically shape apprehension and temptation, which interact with the payoff incentives fear and greed, respectively. Apprehension is the inclination to avoid potential losses. Temptation is the inclination to reap opportunistic gains, respectively.

We aim to test the idea that different configurations of trust and time horizon evoke different perceptions of apprehension and temptation, which in turn influence the effect of payoff incentives on cooperation. Specifically, we first propose that different
combinations of trust and time horizon give rise to different relationships between apprehension and temptation, which characterize the relational context of an exchange relationship. We further propose that the effectiveness of reducing greed and fear in promoting cooperation is contingent upon the nature of this context. Specifically, we show that reducing greed is more effective than reducing fear in temptation-dominated contexts, while reducing fear is more effective in apprehension-dominated contexts.

We then present an experiment designed to test these propositions. Within the context of a prisoner’s dilemma game, we systematically vary payoffs that alter benefit, fear and greed and examine the impact of these payoff manipulations on willingness to cooperate in four distinct relational contexts. While most studies have explored the interpersonal aspect and the intertemporal aspect of the relational context in isolation, we consider their simultaneous impact. Furthermore, while most studies examine how interpersonal dynamics, intertemporal dynamics and payoffs shape cooperation, this paper examines how payoff manipulations most effectively promote cooperation given interpersonal and intertemporal dynamics.

Overall, our results support the predictions. First, there is a strong indication that apprehension and temptation are shaped by trust and time horizon collectively. Second, we find evidence that reducing opportunistic gains is more effective in motivating cooperation than reducing potential losses when temptation dominates over apprehension, and vice versa when apprehension dominates over temptation.
Our study provides empirical evidence for the interdependence of game and context parameters, and against a context-free utility model, which would predict the same effectiveness of payoff manipulations across relational contexts. This suggests that a holistic perspective incorporating both payoffs and context is needed to make sense of cooperative behavior in social dilemmas, and that the effectiveness of strategies altering payoff incentives must be gauged against the context of a relationship.
**Introduction**

Research on self-enforcing agreements suggests that incentive structures, which align self-interests, help sustain cooperation between independent parties. It has long been documented in the literature that changes in the payoff structure underlying mixed-motive interactions affect cooperative behavior. Changing one or more of the payoffs promotes or impedes cooperation, depending on how the composition of 'benefits from cooperation', 'gains from opportunistic behavior' and 'losses from being cheated' is altered (e.g., Schmidt et al., 2001; Rapoport and Eshed-Levy, 1989; Poppe and Utens, 1986; Coombs, 1973; Rapoport and Chammah, 1965).

In addition to incentive alignment, cooperation can also be fostered by improving the context of a relationship - along the interpersonal dimension (trust), the intertemporal dimension (time horizon), or along both. Studies focusing on the interpersonal dynamics have shown that those who trust their counterparts to cooperate are more likely to cooperate themselves (Dawes, 1980; Bornstein and Ben-Yossef, 1994; Yamagishi and Sato, 1986). Studies focusing on the intertemporal dynamics have shown that those who expect a continuing interaction with their counterparts are more likely to cooperate than those who do not. (e.g., Kreps, 1990; Telser, 1980).

While most studies have discussed interpersonal and intertemporal dynamics separately, Hwang and Burgers (1999) suggested that trust and time horizon collectively define the context of an exchange relationship. Specifically, they argued that the two constructs jointly determine apprehension as well as temptation, which they define as the inclination to avoid potential losses and the inclination to reap opportunistic gains, respectively. The more we trust the other party and the longer our
time horizon, the less apprehensive and the less tempted we will be.

There is no doubt that trust alleviates the concern of exploitation (e.g., Putnam, 1993; Fukuyama, 1995). But trust does more than that. It also reduces the tendency to behave opportunistically (e.g., Hwang & Burgers, 1997; Elangovan & Shapiro, 1998). This is because a relationship with a more trustworthy party is more predictable and the trustee hence more valuable as a partner, making the consequence of opportunistic behavior more severe. In short, the more we trust the more cooperative we will be because we become more confident that we will not be cheated and because the other party becomes more valuable to us as a partner. Greater confidence in the other party's cooperation makes us less apprehensive. Greater reliability of the other party makes us less tempted.

Time horizon promotes cooperation because a higher likelihood of future interactions constrains opportunism, as the temporary benefits from cheating today are more likely to be outweighed by losses to be suffered in the future (Kreps, 1985; Axelrod, 1984; Telser, 1980). Broken promises in the present will certainly decrease the likelihood of cooperation in the future. Therefore, more sever the consequences of opportunistic behavior make us less tempted. But just like a longer time horizon makes us think twice before an attempt to reap opportunistic gains, it also causes us to be more careful to defect out of concerns over potential losses. This is because we trade the risk of incurring potential losses against the risk of foregoing an attractive future of mutual cooperation when we defect. In other words, defection to avoid being taken advantage of might be a mistake should the other party cooperate. Therefore, more sever consequences of this possible mistake keep our apprehension in check. Whether we defect because we want to reap opportunistic gains or because be want to avoid
potential losses, defection will certainly decrease the likelihood of cooperation in the future. This is the more serious a consequence the longer the time horizon. Therefore, extending time horizon promotes cooperation by keeping both apprehension and temptation in check as the consequence of defection becomes more severe.

To know that temptation and apprehension rise when either time horizon shortens and/or trust deteriorates, however, is only the first step towards understanding cooperative behavior. Until we know how the relative standing of temptation and apprehension is affected by changes in time horizon and/or trust, we cannot know whether non-cooperation is more likely to be induced by intolerable fear, irresistible greed, or both. We argue that time horizon and trust influence the relative standing of apprehension and temptation in unique ways. Specifically, a shortening of time horizon may render either temptation or apprehension stronger, hinging on the level of trust. In contrast, the deterioration of trust always increases apprehension more than temptation, independent of time horizon. Depending on how trust and time horizon are configured, one may be more tempted than apprehensive at times and more apprehensive than tempted at others.

Since payoffs to an exchange are necessarily embedded in a specific relational context, an interesting question arises: *Does the relational context affect the impact of payoff manipulations (which alter benefit, opportunistic gains, and/or potential losses from being cheated) on cooperation?*

We expect that the effectiveness of payoff manipulations aiming to motivate cooperation varies systematically with the relational context. In a context in which temptation is stronger than apprehension, reducing the size of gains from opportunistic
behavior is expected to be more effective in motivating cooperation than reducing the size of potential losses from being cheated. In a context in which apprehension is stronger than temptation, however, the reverse is expected.

We test these propositions with the help of a prisoner’s dilemma game. We systematically vary incentives (by altering payoff outcomes) and examine the effectiveness of such manipulations under distinct trust-time horizon combinations. Our findings suggest that reducing opportunistic gains could be more or less effective than reducing potential losses, depending on how trust interacts with time horizon.

In the next section we review the literature on payoff incentives, trust, and time horizon and develop our hypotheses. In section two we describe the experimental design and procedures. Section three presents our results. Section four concludes.
1. Game Parameters and Context Parameters

1.1 Game Parameters: Benefit, Greed and Fear

It has long been documented in the literature that three payoff incentives underlie mixed-motive interactions: benefit from cooperation, gains from opportunism and potential losses from being cheated (see Rapoport and Chammah, 1965; Schmidt et al., 2001). These incentives can be illustrated with the help of prisoner’s dilemma (PD) games.

A prisoner's dilemma game is played by two players who each have the choice between cooperation (C) and non-cooperation (N). Each player’s payoff is a function of his and his opponent’s choice. We identify a player’s payoffs by payoff functions with two arguments, \( \pi(1,2) \), the first being the player’s own choice of action, the second being the other player’s choice. To be of PD type, a game’s payoff matrix must have the property \( \pi(N,C) > \pi(C,C) > \pi(N,N) > \pi(C,N) \). If both players choose to cooperate they receive their Pareto-efficient payoff \( \pi(C,C) \). If one player chooses to cooperate and the other player defects, then the defector receives his temptation payoff \( \pi(N,C) \), and the other player receives the sucker payoff \( \pi(C,N) \). If both choose their dominant strategy and defect, they both end up with the second smallest payoff \( \pi(N,N) \), which is the unique Nash equilibrium. See Figure 1.
Table 1. 

<table>
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<tr>
<th></th>
<th>YOU</th>
<th>OTHER PERSON</th>
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<td>C</td>
<td>C</td>
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<tr>
<td>C</td>
<td>$\pi(C,C)$</td>
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<td>N</td>
<td>$\pi(C,N)$</td>
<td>$\pi(N,N)$</td>
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Rapoport and Chammah (1965) translated the PD-game structure into three incentives:

- Benefit, $\pi(C,C) - \pi(N,N)$
- Greed, $\pi(N,C) - \pi(C,C)$
- Fear, $\pi(N,N) - \pi(C,N)$

Greed, $\pi(N,C) - \pi(C,C)$, and fear, $\pi(N,N) - \pi(C,N)$, constitute incentives against cooperation while benefit, $\pi(C,C) - \pi(N,N)$, encourages cooperation in prospect of long-term rewards from cooperation (e.g., Rapoport, 1967; Rapoport and Eshed-Levy, 1989; Dawes et al., 1986; Poppe and Utens, 1986; Coombs, 1973; Hwang and Burgers, 1999; Schmidt et al., 2001).

Empirical studies have shown that greater benefit increases cooperation (Komorita et al., 1980), while greater fear and greed decrease cooperation (Rapoport and Chammah, 1965; Rapoport, 1988; Saijo and Nakamura, 1995; Schmidt et al., 2001; Clark and Sefton, 2001). These findings are robust in finitely repeated as well as one-shot PD games; despite the fact that non-cooperation is the theoretical Nash equilibrium for each player in one-shot interactions (Orbell & Dawes, 1993; Axelrod, 1984; Selten and Stoecker, 1986; Roth, 1988).
In summary the greater the payoff from cooperation, the lower the potential gain from defecting and the lower the potential loss from being cheated, the higher the levels of cooperation in mixed-motive interactions.

### 1.2 Context Parameters: Trust and Time Horizon

A growing body of literature suggests that human behavior in social interactions is based on other parameters than just game parameters alone (Arrow, 1974, Raub and Weesie, 1990). Economic behavior does not occur in a vacuum but is necessarily embedded in the context of specific interactions (Granovetter, 1985). It is widely accepted in the literature, that the context in which a social dilemma is embedded, influences people's willingness to cooperate. Social dilemmas have been studied in a variety of contexts, economic and social (See Allison et. al (1996) for a review), and the conclusion generally is that the context in which a social dilemma is embedded is a crucial determinant of human behavior. In the theoretical as well as empirical literature on social dilemmas, trust and time horizon, characterizing the interpersonal and the intertemporal dynamics of a relationship respectively, have emerged as two dominant areas of research.

The importance of trust and time horizon in cooperative relationships has been widely discussed across social science disciplines. While trust has traditionally been a popular topic in disciplines such as psychology, sociology, political science, and business, time horizon has taken a central role in game theory and economics.

Researchers generally agree that trust refers to a party’s beliefs about the likely behavior of the other party that matter to the trustor’s decision making (e.g. Hardin,
Gambetta (1988: p.217) maintains that trust is "the probability that one economic actor will make decisions and take actions that will be beneficial or at least not detrimental to another." Burt & Knez (1996) defined trust simply as "anticipated cooperation". Ross and LaCroix (1996) define trust as “one party’s willingness to risk increasing his or her vulnerability to another (or others) whose behavior is beyond one’s control; thus, the party is confident that the other will not exploit the party’s vulnerabilities.” As such trust has a strong bearing on one’s choice of action (Dasgupta, 1988). Arrow (1974) claims that an element of trust exists in every transaction and that without trust, there can be no cooperation. Similarly, scholars have argued that trust is essential to produce socially efficient outcomes and to avoid inefficient non-cooperative traps (Putnam, 1993; Fukuyama, 1995).

Trust may be based on the other’s payoff incentives, a belief in the predictability of the other’s behavior (e.g., Deutsch, 1958), the expectation of reciprocity (e.g., Ostrom, 1998) or a full internalization of the other’s desires and intentions (e.g., Rousseau et al., 1998). Whatever the motivation behind trust, ample evidence from laboratory studies supports that those who expect their counterparts to cooperate are more likely to cooperate themselves (Dawes, 1980; Bornstein and Ben-Yossef, 1994; Yamagishi and Sato, 1986; Glaeser et al., 2000).

How does trust promote cooperation? Trust researchers unanimously agree that trust alleviates the trustor's fear of being taken advantage of (e.g., Putnam, 1993; Fukuyama, 1995). In addition to easing concerns of being cheated, Hwang and Burgers (1997) recently argued that trust also contains the trustor's desire to reap opportunistic gains. This is because opportunism is likely to put an end to a relationship, causing the loss of a trustworthy partner (e.g., Axelrod; 1984; Kreps, 1990). In general, high trust suggests
that benefits from cooperation are more predictable, making the trustee hence more valuable as a partner (Nooteboom, Berger, and Noorderhaven, 1997; Whitener, Brodt, Korsgaard, & Werner, 1998). To the extent that loosing a trustworthy partner implies foregoing future beneficial interactions, one would be less prone to act opportunistically. In organization literature, Elangovan & Shapiro (1998) maintained that the more positive the assessment of the trustee’s cooperative propensity, the more we feel there is to be lost than gained by betrayal. Thus, trust not only eases the trustor's concern of being taken advantage of but also contains his/her desire to reap opportunistic gains.

Researchers also agree that the expectation of a continuing interaction shapes cooperation, too (e.g., Heide and Miner, 1992; Andreoni and Miller 1993; Murnighan and Roth, 1983; Kreps et al., 1982). Choice behavior in relation to future consequences that are spread out in time has been extensively studied in economics (Kreps, 1990). Several empirical studies confirm that the expectation of an on-going interaction is an important determinant of cooperation (e.g., Heide and Miner, 1992; Clark and Sefton, 2001; Murnighan and Roth, 1983). Andreoni and Miller (1993) and Palfrey and Rosenthal (1994) find evidence, that an expectation of future interactions with the same partner positively affects cooperation rates (see also Clark and Sefton, 2001). Murnighan and Roth (1983) show that the likelihood of a game terminating clearly is a major determinant of cooperation in mixed-motive interactions.

How does time horizon promote cooperation? When the likelihood of future interactions increases, temporary benefits from cheating today are more likely to be outweighed by retaliatory punishments delivered in the future (Kreps, 1990; Axelrod 1984). Telser (1980) argued that the expectation of gains from mutual cooperation in
the future casts a shadow back upon the present, affecting current behavior. The implicit assumption of these arguments is that forward-looking expectations of gains hold in check proclivity towards agreement violations. Put differently, the more sustained positive payoffs from mutual cooperation extend into the future, the more time horizon contains our desire to reap one-time opportunistic gains. In addition, time horizon, for similar reasons, also holds back our proclivity to defect out of fear of being taken advantage of. This is again because a longer time horizon implies a more valuable future. Just like we refrain from defecting in order not to trade the valuable future for one-time gains, we might also refrain in order not to jeopardize potential gains from mutual cooperation because we are afraid that we might suffer losses. We might expect the other party to defect, but unless trust is zero, there is a chance that he/she might actually cooperate. Should we choose non-cooperation in order to avoid losses from being taken advantage of, but the other party actually cooperates, we would lose the lucrative future stream of income that mutual cooperation would have resulted in. In this sense, defection is a risky option that we are less inclined to choose, when time horizon, and therefore the consequence of unilateral defection, increases. Intuitively, we are more inclined to give cooperation a try when the future casts a longer shadow onto the present. The longer the time horizon, the more our inclination to defect out of fear is kept in check. Thus, time horizon not only keeps in check one's desire for opportunistic gains but also one's tendency to defect because of concerns over potential losses.

Although for different reasons, trust and time horizon both promote cooperation by reducing the desire to reap opportunistic gains as well as that to avoid potential losses. Put differently, the more trust we have in the other party and the longer our time horizon, the less apprehensive and tempted we will be. We define apprehension as the
inclination to avoid potential losses and temptation as the inclination to reap opportunistic gains.

While trust alleviates apprehension by giving us confidence in the other party, time horizon keeps it in check, as we might not want to unilaterally defect and damage a valuable future income stream. And while disutility of losing a reliable partner lies behind why trust contains temptation, time horizon keeps temptation in check because opportunistic behavior is likely to entail more severe retaliatory punishment in the future. Therefore, improving either a decision-maker's trust or time horizon will reduce his/her apprehension as well as his/her temptation. Figure 2 summarizes how trust and time horizon promote cooperation through reducing apprehension and temptation.

**Figure 2. How Trust and Time Horizon Promote Cooperation Through Reducing Apprehension and Temptation**

<table>
<thead>
<tr>
<th>Effect on Temptation</th>
<th>More Trust</th>
<th>Longer Time Horizon</th>
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<td></td>
<td><strong>More reliable partner:</strong> An increase in trust reduces the decision-makers' (trustor's) temptation as the trustee becomes more valuable as a partner.</td>
<td><strong>More severe punishment:</strong> An increase in the decision-maker's time horizon reduces his/her temptation as the consequence of opportunism becomes more severe.</td>
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<tr>
<td>Effect on Apprehension</td>
<td><strong>Greater confidence in partner:</strong> An increase in trust reduces the decision-maker's (trustor's) apprehension as the trustee is less likely to take advantage of the decision maker.</td>
<td><strong>Greater willingness to give cooperation a try</strong> An increase in the decision maker's time horizon reduces his/her apprehension as the consequence of not giving cooperation a try becomes more severe.</td>
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Because trust and time horizon both foster cooperation through alleviating fear and containing greed, they collectively shape apprehension and temptation and form the
relational context (Hwang and Burgers, 1999). In other words, they mold the character of the relational context through apprehension and temptation (see Hwang and Burgers, 1999). We argue that different configurations of trust and time horizon will produce different characters of the relational context; in some we will be more apprehensive than tempted and vice versa in others.
1.3 Relational Context and the Impact of Game Parameters on Cooperation

Figure 3 shows how different combinations of trust and time horizon give rise to four unique relational contexts in which payoff incentives are embedded.

**Figure 3.** Variants of Relational Context

We first examine how the absolute intensities of the decision-maker's apprehension and temptation are shaped by his/her trust and time horizon. Figure 3 suggests that temptation and apprehension are both low when trust and time horizon are both high (scenario 1) and both high when trust and time horizon are both low (scenario 4), with scenarios 2 and 3 in between. Holding time horizon constant, Figure 3 suggests that apprehension and temptation rise when trust declines and vice versa. Similarly, holding trust constant, apprehension and temptation rise when time horizon declines and vice versa.
As trust and time horizon concurrently mold the character of the relational context, knowing only one of the two parameters is not enough to predict cooperation. Given a certain level of trust, shortening the trustor's time horizon will result in lower willingness to cooperate. Similarly, given a certain level of time horizon, reducing the decision maker's expectation that the other party will cooperate (trust) will also result in lower cooperation rates. We hypothesize that willingness to cooperate is highest in scenario 1, in which the decision-maker's trust and time horizon are both high, lowest in scenario 4, in which his/her trust and time horizon are both low, and in-between in scenarios 2 and 3. For a group of decision-maker we expect cooperation rates to vary accordingly across the four scenarios.

**Hypothesis 1: Cooperation rates are highest in scenario 1, lowest in scenario 4 and in-between in scenarios 2 and 3.**

We have argued that the decision-maker's apprehension and temptation will decline when his/her trust and/or time horizon increase. But how do trust and time horizon alter the relative standing of apprehension and temptation? Our discussion above suggests that reducing apprehension and temptation are the two common mechanisms through which trust and time horizon promote cooperation. To know that temptation and apprehension become stronger when either trust deteriorates and/or time horizon shortens, however, is only the first step towards understanding cooperative behavior. Until we know how the relative standing of apprehension and temptation is affected by changes in trust and/or time horizon, we cannot know whether non-cooperation is more likely to be hindered because the decision maker faces potential losses (fear) or because he/she is presented with opportunistic gains (greed). Remember that
apprehension represents the inclination to avoid potential losses while temptation that
to reap opportunistic gains.

We now compare the level of apprehension with that of temptation within each of the
four relational contexts. We argue that the decision-maker's trust in the other party and
his/her time horizon influence the relative standing of his/her apprehension and
temptation in unique ways: When he/she loses trust apprehension always increases
more than temptation, independent of how long his/her time horizon is. In contrast, if
his/her time horizon shortens either the increase in his/her temptation or that in his/her
apprehension will be stronger, hinging on the level of trust.

To see that apprehension relative to temptation grows when trust deteriorates, we
return to the PD payoff structure (see Figure 4). Assume the column player is the
decision-maker, whose trust in the row player is Q.

\[ Q = \text{probability that the row player chooses to cooperate (C)}. \]

The more the column player trusts the row player (the higher Q), the more likely it is
that he/she will obtain \( \pi(N,C) \) rather than \( \pi(N,N) \) should he/she choose non-
cooperation and $\pi(C,C)$ rather than $\pi(C,N)$ should he/she choose cooperation. In the extreme case, when the column player trusts the row player completely, a choice of non-cooperation is certain to yield $\pi(N,C)$ and a choice of cooperation is certain to yield $\pi(C,C)$. As opportunistic gains ($\pi(N,C) - \pi(C,C)$) become more certain while potential losses ($\pi(N,N) - \pi(C,N)$) more unlikely when the column player's trust in the row player increases, his/her temptation relative to apprehension grows. This is true for any level of time horizon. As opportunistic gains ($\pi(N,C) - \pi(C,C)$) are relatively certain while potential losses ($\pi(N,N) - \pi(C,N)$) unlikely when trust is high, temptation is expected to be stronger than apprehension in scenarios 1 and 2. We hypothesize that scenarios 1 and 2 are temptation dominant contexts.

**Hypothesis 2: Scenario 1 and scenario 2 are temptation dominant contexts.**

Conversely, the more the column player distrusts the row player, the more cooperation is unlikely to yield $\pi(C,C)$, and non-cooperation to yield $\pi(N,C)$. In the extreme case, when the column player has no trust in the row player at all, a choice of non-cooperation is certain to yield $\pi(N,N)$ and a choice of cooperation is certain to yield $\pi(C,N)$. As potential losses ($\pi(N,N) - \pi(C,N)$) become more certain while opportunistic gains ($\pi(N,C) - \pi(C,C)$) more unlikely when trust decreases, the column player's apprehension grows relative to his temptation. This again is the case for any level of time horizon. As potential losses ($\pi(N,N) - \pi(C,N)$) are relatively certain while opportunistic gains ($\pi(N,C) - \pi(C,C)$) unlikely when trust is low, apprehension is expected to be stronger than temptation in scenario 3 and 4. We hypothesize that scenarios 3 and 4 are apprehension dominant contexts.
Hypothesis 3: Scenario 3 and scenario 4 are apprehension dominant contexts.

To see how the level of trust affects whether apprehension or temptation grows more when time horizon shortens, consider that a shorter time horizon on one hand implies less severe consequences of acting opportunistically, while on the other hand less a incentive to give cooperation a try. While the former makes the decision-maker more tempted, the latter makes him/her more apprehensive. Which of these two effects has a stronger impact depends on the level of trust.

As opportunistic gains (\(\pi(N,C) - \pi(C,C)\)) are relatively certain while potential losses unlikely when trust is high, opportunism is attractive and being cheated not much of a concern. When, in this context, the other party’s ability to punish is increasingly constrained as time horizon shortens, opportunism becomes more attractive to the decision-maker, whereas his/her willingness to give cooperation a try is not much discouraged, implying that his/her temptation grows more than his/her apprehension. A moment of reflection suggests that opportunism is arguably most attractive when the opportunity to reap opportunistic gains presents itself (i.e., high trust) while the likelihood of "getting away with it" is high (i.e., short-time horizon) (e.g., Elangovan & Shapiro, 1998, see also Granovetter, 1985). Moreover, intuition suggests that, in the extreme case of a one-shot interaction with a completely trusted partner, there is no apprehension but only infinite temptation. We therefore expect temptation dominance to be more pronounced in scenario 2 where trust is high and time horizon short than in scenario 1 where trust and time horizon are both high.

Hypothesis 4: Temptation dominance is more pronounced in scenario 2 than in scenario 1.
In contrast, as potential losses ($\pi(N,N) - \pi(C,N)$) are relatively certain while opportunistic gains ($\pi(N,C) - \pi(C,C)$) unlikely when trust is low, getting cheated is of great concern and opportunism not very attractive. When, in this context, the possibility of a future stream of payoffs from mutual cooperation is increasingly constraint as time horizon shortens, his/her willingness to give cooperation a try is discouraged whereas opportunism becomes only a little more attractive to him/her, implying that apprehension grows more than temptation. We therefore expect apprehension dominance to be more pronounced in scenario 4 where trust is low and time horizon short than in scenario 3 where trust is low but time horizon long.

**Hypothesis 5: Apprehension dominance is more pronounced in scenario 4 than in scenario 3.**

In summary, we not only argue that temptation outweighs apprehension in scenarios 1 and 2 and apprehension temptation in scenarios 3 and 4, but also that temptation and apprehension dominance are more pronounced when time horizon is short (in scenarios 2 and 4). This is depicted in Figure 5.
Finally, we argue that neither game parameters nor context parameters alone, but the interaction of both determines willingness to cooperate. Specifically, the interpersonal context parameter trust and the intertemporal context parameter time horizon jointly form apprehension and temptation, which in turn interact with the game parameters fear and greed, respectively. Apprehension determines the impact of fear on willingness to cooperate and temptation that of greed. It follows that whether fear or greed is the primary threat to cooperation hinges not only on the size of greed and fear but also on the intensity of apprehension compared to that of temptation (Hwang and Burgers, 1999). It is the strength of these two forces combined, relative to benefit, which shapes cooperation. The Interaction between game and context parameters is summarized in Figure 6.
Figure 6. How Context Parameters and Game Parameters Interact to Shape Cooperation

Since non-cooperation implies that benefits from cooperation are not sufficient to overcome greed and fear, the underlying cause of non-cooperation could either be attributed to irresistible greed, intolerable fear, or both. When the amounts of greed and fear are equal, it is the strength of apprehension compared to that of temptation that determines whether fear or greed is the dominant incentive against cooperation. As the configuration of trust and time horizon holds the key to understanding the relationship between apprehension and temptation, it also holds the key to understanding how to best promote cooperation, given trust and time horizon.

This leads to the thesis of this study that payoff manipulations are expected to be differently effective in different relational contexts. Reducing greed and fear certainly increases willingness to cooperate, but we expect that the same amount of change will not have the same impact in the various contexts. To motivate cooperation, reducing
greed should be more effective than reducing fear when the decision-maker is more tempted than apprehensive - as greed is expected to have a greater impact on cooperation than fear under this circumstance. By the same token, when he/she is more apprehensive than tempted, reducing fear should be more effective than reducing greed.

We examine two pairs of payoff manipulations. We compare the effect of changing $\pi(N,C)$ with that of changing $\pi(C,N)$, and that of changing $\pi(C,C)$ with that of changing $\pi(N,N)$ on willingness to cooperate. As $\pi(N,C)$ affects greed and $\pi(C,N)$ affects fear, we hypothesize that changes in $\pi(N,C)$ and changes in $\pi(C,N)$ motivates/impede cooperation differently strongly in the different relational contexts. As $\pi(C,C)$ affects greed and $\pi(N,N)$ affects fear but both affect benefit, we expected the same to be true for changes in $\pi(C,C)$ and $\pi(N,N)$.

Specifically, we expect that decreasing $\pi(N,C)$, which reduces greed, should motivate cooperation more than increasing $\pi(C,N)$, which reduces fear, when the decision-maker is in temptation dominant contexts (scenarios 1 and 2) and vice versa when he/she is in apprehension dominant contexts (scenarios 3 and 4). Similarly increasing $\pi(N,C)$, which increases greed should impede cooperation more than decreasing $\pi(C,N)$, which increases fear in temptation dominant contexts (scenarios 1 and 2) and vice versa in apprehension dominant contexts (scenarios 3 and 4).

**Hypothesis 6:** In scenarios 1 and 2, changes in $\pi(N,C)$ have a greater impact on willingness to cooperate than equally large changes in $\pi(C,N)$. 
Hypothesis 7: In scenarios 3 and 4, changes in $\pi(N,C)$ have a smaller impact on willingness to cooperate than equally large changes in $\pi(C,N)$.

Similarly, increasing $\pi(C,C)$, which increases benefit and reduces greed, should motivate cooperation more than decreasing $\pi(N,N)$, which increases benefit and reduces fear, in temptation dominant contexts (scenarios 1 and 2), and vice versa in apprehension dominant contexts (scenarios 3 and 4). Similarly, decreasing $\pi(C,C)$, which decreases benefit and increases greed, should impede cooperation more than increasing $\pi(N,N)$, which decreases benefit and increases fear, in temptation dominant contexts (scenarios 1 and 2), and vice versa in apprehension dominant contexts (scenarios 3 and 4).

Hypothesis 8: In scenarios 1 and 2, changes in $\pi(C,C)$ have a greater impact on willingness to cooperate than equally large changes in $\pi(N,N)$.

Hypothesis 9: In scenarios 3 and 4, changes in $\pi(C,C)$ have a smaller impact on willingness to cooperate than equally large changes in $\pi(N,N)$.

Table 1 summarizes how the impact of payoff manipulations on willingness to cooperate hinges on the relational context.
**Table 1. Payoff Manipulations that Motivate/Impede Cooperation**

<table>
<thead>
<tr>
<th>Payoff Manipulation</th>
<th>Implication</th>
<th>Impact on Cooperation*</th>
</tr>
</thead>
<tbody>
<tr>
<td>decrease in (\pi(N,C)) vs. increase in (\pi(C,N))</td>
<td>gain less from cheating vs. lose less if cheated</td>
<td>more effective in TDC vs. more effective in ADC</td>
</tr>
<tr>
<td>increase in (\pi(C,C)) vs. decrease in (\pi(N,N))</td>
<td>benefit more from cooperation and gain less from cheating vs. benefit more from cooperation and lose less if cheated</td>
<td>more effective in TDC vs. more effective in ADC</td>
</tr>
<tr>
<td>increase in (\pi(N,C)) vs. decrease in (\pi(C,N))</td>
<td>gain more from cheating vs. lose more if cheated</td>
<td>more effective in TDC vs. more effective in ADC</td>
</tr>
<tr>
<td>decrease in (\pi(C,C)) vs. increase in (\pi(N,N))</td>
<td>benefit less from cooperation and gain more from cheating vs. benefit less from cooperation and lose more if cheated</td>
<td>more effective in TDC vs. more effective in ADC</td>
</tr>
</tbody>
</table>

*TDC = Temptation Dominant Context, ADC = Apprehension Dominant Context
2. Experimental Design and Procedure

The purpose of this study was to test the idea that different relational contexts will evoke different perceptions of apprehension and temptation, which in turn will shape the impact of payoff manipulations (which alter benefit, fear and greed) on cooperation. To achieve this we used prisoner's dilemma games. They are ideal for our purpose. Firstly, PD games provide incentives for both competitive and cooperative actions. Secondly, PD games allow the testing of context effects as they themselves are context-free.

We conducted an experiment to test the hypotheses developed under the previous section. 180 undergraduate business students from the National University of Singapore voluntarily took part in the experiment. Each participant played the PD-game shown in Figure 7 under the four scenarios depicted in Table 2.

Figure 7. Baseline Game

<table>
<thead>
<tr>
<th>YOU</th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option A</td>
<td>450</td>
<td>600</td>
</tr>
<tr>
<td>Option B</td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>
Table 2. Relational Contexts

<table>
<thead>
<tr>
<th>Relational Context</th>
<th>Time Horizon</th>
<th>Nature of Relational Context</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>90%</td>
<td>Low Temptation &gt; Low Apprehension</td>
</tr>
<tr>
<td>Scenario 2</td>
<td>90%</td>
<td>Mid Temptation &gt;&gt; Mid Apprehension</td>
</tr>
<tr>
<td>Scenario 3</td>
<td>10%</td>
<td>Mid Temptation &lt; Mid Apprehension</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>10%</td>
<td>High Temptation &lt;&lt; High Apprehension</td>
</tr>
</tbody>
</table>

Note that the amounts of fear (300-150) and greed (600-450) are the same in the PD-game across all scenarios. The scenarios are composed of different combinations of trust and time horizon, each expected to give rise to one of the different relational contexts suggested by Figure 5. We chose probabilities of 0.1 and 0.9 to represent low and high levels of trust and time horizon. We expect the combination of these rather extreme values to evoke clearly the four distinct relational contexts depicted in Figure 5.

Trust was operationalized as the probability that the other person would cooperate (choose Option A). All participants played the PD-game with the probability that the other person would cooperate varying from scenarios one and two to scenarios three and four. In scenarios 1 and 2, participants were informed that there was a 90% chance that the other person would choose Option A. In scenarios 3 and 4, participants were informed that there was a 10% chance that the other person would choose Option A.

Time horizon was operationalized as the probability that the PD-game would continue. All participants played the PD-game with the probability that the game would continue

\(^1\) In this paper, we are interested in the influence of trust on willingness to cooperate rather than the sources of trust. Operationalizing trust as the probability that the other party will cooperate allows us to study the impact of trust on cooperation without necessarily drawing on any particular motivation.
varying from one scenario to the next. In scenarios 1 and 3, participants were informed that there was a 90% chance that the game would have another round. In scenarios 2 and 4, participants were informed that there was a 10% chance that the game would have another round. While participants were told that the termination of the repeated PD-games would be determined probabilistically, participants in fact played six rounds in scenario 1, two rounds in scenario 2, seven rounds in scenario 3, and two rounds in scenario 4. Note that they did not know at any time, the exact number of rounds for each scenario.

We expect scenarios 1 and 2 to be temptation dominant contexts and scenarios 3 and 4 to be apprehension dominant contexts. Moreover, we expect temptation dominance to be more pronounced in scenario 2 than in scenario 1 and apprehension dominance to be more pronounced in scenario 4 than in scenario 3.

At the start of the experiment participants were informed that at the end of the experimental session they would receive S$10 for participation, and additional S$50 (two weeks later) if they were among the top-ten performers. The entire experiment was conducted by computer and lasted approximately 45 minutes. Subjects were told to maximize their own payoff without regard for the other party and they were assured that their decisions would remain anonymous throughout and after the experiment and that decisions would not carry moral implications.

\footnote{While it is not necessary to obtain data after the first round to test the hypotheses, a repeated game design however is instrumental to reflect the notion of time horizon.}
Subjects were first introduced to the PD-game payoff presentation. They saw their own payoffs only but knew that the other party also faced a PD payoff structure, the exact payoffs of which they however did not know. This is not only a more realistic assumption as the other party’s payoffs are rarely known in reality but also necessary as it reflects the idea that the level of trust already incorporates the expected influence of the other party’s payoffs on that party's behavior. A payoff structure more conducive to cooperation, for instance, would result in a higher trust level.

After having introduced the PD-payoff presentation, subjects were given written instructions (see Appendix A) introducing them to the notions of trust and time horizon and their task. Training rounds to familiarize them with the computer interface and our operationalization of trust and time horizon followed.

After this subjects were informed about the actual four scenarios under which they would play the PD-game. They were required to complete a quiz before they were able to proceed. The quiz consisted of four questions that could not be answered unless one understood the different nature of the scenarios. Most participants were able to complete the quiz with little difficulty.

Subjects then proceeded to actually play the repeated PD-game under the four scenarios. Previous research (Roth and Murnighan, 1978) indicated that the order of play had no effect on the player’s choices. Thus players played the four repeated games in the same order (see also Murnighan and Roth, 1983): first scenario 1, followed by scenario 2, scenario 3, and scenario 4. Subjects were told that they would
play against a different person in each scenario. They actually played against the computer, which played a tit-for-tat strategy.\(^3\)

After subjects had made their decision for the first round under each scenario and before knowing their partner's decision, we examined what motivated cooperative and non-cooperative action. We asked subjects who chose Option B (non-cooperation)\(^4\) to indicate (on a 7-point scale) to what extent they agreed with the statements:\(^5\):

'I choose Option B in an attempt to get 600 in this round.'
'I choose Option B because if I choose Option A I am afraid of getting only 150'.

We then examined to what extent changes to the payoff structure make subjects more willing to change their decision in favor of the other option. We administered two conditions. Under condition 1 we compared the impact of changing \(\pi(N,C)\) with that of changing \(\pi(C,N)\) on willingness to cooperate. Note that by changing \(\pi(NC)\) we change greed and by changing \(\pi(C,N)\) we change fear. Under condition 2 we compared the impact of changing \(\pi(C,C)\) with that of changing \(\pi(N,N)\) on willingness to cooperate. Note that by changing \(\pi(C,C)\) we change greed and benefit and by changing \(\pi(N,N)\) we change fear and benefit.

\(^3\) We could have used other strategies, but tit-for-tat reasonably simulates the continuous play of a human counterpart.
\(^4\) We do not examine reasons for cooperation as cooperators’ temptation and apprehension levels are necessarily low for cooperation to be possible. We therefore don’t expect to see the contrast between apprehension and temptation as in the case of non-cooperation. Moreover, as previous studies have indicated that the level of cooperation is generally low, we expect the overall number of cooperators to be lower than that of non-cooperators.
\(^5\) See Appendix B for the computer interface used.
We randomly assigned 90 subjects to condition 1 and 90 subjects to condition 2. Under condition 1 we colored $\pi(N,C)$ green and $\pi(C,N)$ red. We asked cooperators (those who chose Option A) to indicate (on a 7-point scale) to what extent they agreed with the following statements:

'With 700 in the green cell, I would probably have chosen the other option.'
'With 50 in the red cell, I would probably have chosen the other option.'

Note that these payoff manipulations increase greed and fear by 100 units relative to the baseline game (Figure 7) and are expected to reduce willingness to cooperate.

We asked non-cooperators (those who chose Option B) to indicate to what extent they agreed with the following statements:

'With 500 in the green cell, I would probably have chosen the other option.'
'With 250 in the red cell, I would probably have chosen the other option.'

Note that these payoff manipulations decrease greed and fear by 100 units relative to the baseline game (Figure 7) and are expected to increase willingness to cooperate.

Under condition 2 we colored $\pi(C,C)$ green and $\pi(N,N)$ red and asked cooperators (those who chose Option A) to indicate (on a 7-point scale) to what extent they agreed with the following statements:

---

6 See Appendix B for the computer interface used.
'With 350 in the green cell, I would probably have chosen the other option.'

'With 400 in the red cell, I would probably have chosen the other option.'

Note that these payoff manipulations increase greed and fear while at the same time decrease benefit by 100 units relative to the base line game and are expected to reduce willingness to cooperate.

We asked non-cooperators (those who chose Option B) to indicate to what extent they agreed with the following statements:

'With 550 in the green cell, I would probably have chosen the other option.'

'With 200 in the red cell, I would probably have chosen the other option.'

Note that these payoff manipulations decrease greed and fear while at the same time increase benefit by 100 units relative to the base line game and are expected to increase willingness to cooperate.

Our payoff manipulations aim at motivating cooperators to choose non-cooperation and non-cooperators to choose cooperation. Specifically, we motive non-cooperation by increasing greed and fear and cooperation by decreasing greed and fear. For each condition this allows us to compare the effectiveness of changing greed with that of changing fear in all four scenarios.⁷

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⁷ Since manipulations to π(C,C) and π(N,N) have the same impact on benefit from cooperation, and manipulations to π(C,N) and π(N,C) have no impact on benefit, changes in benefit from cooperation therefore do not affect this comparison.
Figure 8 depicts payoff manipulations associated with the subject’s choice between option A and option B and the implications of these manipulations on benefit, greed, and fear.

**Figure 8.** Payoff Manipulations and Their Effect on Incentives

**Condition 1**

<table>
<thead>
<tr>
<th>Subject’s Choice in Round 1</th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payoff Manipulations</td>
<td>$\pi(N,C) + 100$</td>
<td>$\pi(C,N) - 100$</td>
</tr>
<tr>
<td>Implication</td>
<td>Greed increases by 100</td>
<td>Fear increases by 100</td>
</tr>
<tr>
<td>Payoff Manipulations</td>
<td>$\pi(N,C) - 100$</td>
<td>$\pi(C,N) + 100$</td>
</tr>
<tr>
<td>Implication</td>
<td>Greed decreases by 100</td>
<td>Fear decreases by 100</td>
</tr>
</tbody>
</table>

**Condition 2**

<table>
<thead>
<tr>
<th>Subject’s Choice in Round 1</th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payoff Manipulations</td>
<td>$\pi(C,C) - 100$</td>
<td>$\pi(N,N) + 100$</td>
</tr>
<tr>
<td>Implication</td>
<td>Greed increases by 100 &amp; Benefit decreases by 100</td>
<td>Fear increases by 100 &amp; Benefit decreases by 100</td>
</tr>
<tr>
<td>Payoff Manipulations</td>
<td>$\pi(C,C) + 100$</td>
<td>$\pi(N,N) - 100$</td>
</tr>
<tr>
<td>Implication</td>
<td>Greed decreases by 100 &amp; Benefit increases by 100</td>
<td>Fear decreases by 100 &amp; Benefit increases by 100</td>
</tr>
</tbody>
</table>

After completing the questions, subjects were informed about the other person's action and continued to play until the termination point of the repeated PD-game in each scenario. No further questions were asked except for their decisions whether to cooperate or not after the first round. They then continued with the next scenario.
3. Results

3.1 Cooperation Rates

Table 3 shows that cooperation rates vary substantially across scenarios. First-round cooperation rates are highest in scenario 1, in which 89 out of the 180 subjects (49%) cooperated, lowest in scenario 4, in which only 22 subjects (12%) cooperated, and in between in scenarios 2 and 3, in which 39 and 40 subjects (22%) cooperated. One-tailed proportion Z-tests revealed that 22% is significantly lower than 49% (Z = 5.505, p < 0.001) and that 12% is significantly lower than 22% (Z = 2.513, p < 0.006). The results support hypothesis 1.

Table 3. Cooperation Rates

<table>
<thead>
<tr>
<th>Scenario</th>
<th>N</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
<th>Round 4</th>
<th>Round 5</th>
<th>Round 6</th>
<th>Round 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>180</td>
<td>49%</td>
<td>54%</td>
<td>56%</td>
<td>52%</td>
<td>51%</td>
<td>51%</td>
<td></td>
</tr>
<tr>
<td>Scenario 2</td>
<td>180</td>
<td>22%</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scenario 3</td>
<td>180</td>
<td>22%</td>
<td>36%</td>
<td>34%</td>
<td>29%</td>
<td>32%</td>
<td>25%</td>
<td>28%</td>
</tr>
<tr>
<td>Scenario 4</td>
<td>180</td>
<td>12%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18%</td>
</tr>
</tbody>
</table>

Sixty nine subjects did not cooperate in any of the four initial rounds while five subjects cooperated in all.
3.2 Apprehension Dominant versus Temptation Dominant Contexts

Figure 9 depicts non-cooperators’ perception of what motivates their non-cooperative action. There is no one reason behind non-cooperation that prevails in all four scenarios.

Figure 9. Temptation verses Apprehension as Motivators of Non-Cooperation

Whether greed or fear is the primary factor that causes benefits to be insufficient for cooperation to emerge depends not only on the amount of greed and fear but also on the relational context. Our findings suggest that subjects chose non-cooperation in an attempt to get the temptation payoff 600 rather than in order to avoid the sucker payoff 150 in scenarios 1 and 2. The difference in means is significant ($t_1 = 11.788, \alpha<0.001$;
\[ t_2 = 13.532, \alpha < 0.001 \). In scenarios three and four subjects choose non-cooperation in order to avoid the sucker payoff 150 rather than attempt to get the temptation payoff 600. The difference in means again is significant \((t_3 = -4.857, \alpha < 0.001; t_4 = -3.925, \alpha < 0.001)\). 

Given the equal amounts of greed and fear in the PD-game's payoff structure that we used in all four scenarios, variations in the reasons for non-cooperation can only be attributed to the different natures of the relational contexts. Specifically, the results suggest that temptation impedes cooperation more than apprehension in scenarios 1 and 2, but that apprehension impedes cooperation more than temptation in scenarios 3 and 4. This suggests that scenarios 1 and 2 are indeed temptation dominant contexts, and scenarios 3 and 4 apprehension dominant contexts.

That temptation for opportunistic gains rather than apprehension of potential losses is the stronger force against cooperation in scenarios 1 and 2 and that apprehension of potential losses rather than temptation for opportunistic gains is the stronger force against cooperation in scenarios 3 and 4, supports hypothesis 2 and 3.

T-tests did not reveal that temptation dominance is stronger in scenario 2 than 1 at a significance level of 0.1 \((t = 0.039, \text{ ns at 0.1 level})\). We suspect that since non-cooperators in scenario 1 are already too tempted to cooperate, the expected additional level of temptation above apprehension is therefore not observed in scenario 2. For the same reason, we do not observe the expected stronger desire to obtain the temptation payoff in scenario 2. T-tests also did not reveal that apprehension dominance is stronger in scenario 4 than 3 \((t = -1.316, \text{ ns at 0.1 level})\). We suspect that since non-
cooperators in scenario 3 are already too apprehensive to cooperate, the expected additional level of apprehension above temptation is therefore not observed in scenario 4.

It is however possible to infer the degree of temptation dominance and apprehension dominance from cooperation rates. As scenarios 1 and 2 are both temptation dominant contexts, a proportion test suggests that the lower cooperation rate for scenario 2 is indicative of stronger temptation dominance in scenario 2 ($Z = 5.505$, $\alpha < 0.001$). Similarly, as scenarios three and four are both apprehension dominant contexts, a lower cooperation rate for scenario 4 ($Z = 2.513$, $\alpha < 0.012$) suggests that apprehension dominance is stronger in scenario 4. This provides some support for hypotheses 4 and 5.

In order to investigate further hypotheses 3a and 3b, we decided to look into the responses from those subjects who cooperated in scenario 1 but not in scenario 2 and into those from subjects who cooperated in scenario 3 but not in scenario 4. As we expect greater temptation but not so much greater apprehension to discourages cooperation more in scenario 2 than in scenario 1, we expect that some of the cooperators, who can resist greed when time horizon is long (scenario 1), are no longer able to do so when it is short (scenario 2). Similarly, as we expect greater apprehension but not so much greater temptation to discourages cooperation more in scenario 4 than in scenario 3, we expect that some of the cooperators, who can tolerate fear when time horizon is long (scenario 3), are no longer able to do so when it is short (scenario 4).
Fifty subjects cooperated in scenario 1 but not in scenario 2, twenty five cooperated in scenario 3 but not in scenario 4. By looking at these subjects we found further indications that temptation grows more than apprehension when time horizon declines while trust is high. We however did not find further indications that apprehension grows more than temptation when time horizon declines while trust is low.

Subjects who cooperated when trust was high and time horizon long (scenario 1) but did not when time horizon was short (scenario 2) indicated that they chose non-cooperation more in an attempt to obtain the temptation payoff than because of the desire to avoid the sucker payoff \( (t = 8.580, \alpha < 0.001) \). This finding therefore provides an indication that temptation compared to apprehension grew when time horizon declined in the high trust context.

Subjects who cooperated in scenario 3 but did not in scenario 4 did not indicate that the desire to avoid the sucker payoff discouraged cooperation more than the desire to get the temptation payoff \( (t = 1.809, \text{ns at 0.1 level}) \). This therefore does not provide any indication that apprehension compared to temptation grew when time horizon declined in the low trust context. This might be because subjects of this group by nature are very tempted and not so much concerned about being cheated in the first round. In fact, nineteen of these subjects did not cooperate in scenarios 2, and 10 did not cooperate in scenario 1.

In summary, our results regarding the nature of the relational context show that non-cooperation can be attributed to temptation more than apprehension when trust is high (scenarios 1 and 2). Evidence from non-cooperators however does not indicate that a shorter time horizon renders temptation stronger compared to apprehension in scenario...
than scenario 1. Evidence from subjects who cooperated in scenario 1 but not in scenario 2 however, indicates that they changed more because greater temptation than because of greater apprehension.

Our results also indicate that non-cooperation is due more to apprehension than temptation when trust is low (scenario 3 and 4). Evidence from non-cooperators however does not suggest that a shorter time horizon renders apprehension stronger compared to temptation in scenario 4 than in scenario 3. Moreover, we did not find evidence that subjects, who cooperated in scenario 3 but not in scenario 4, choose non-cooperation in scenario 4 more because of greater apprehension than because of greater temptation. When both apprehension and temptation are high, subjects might not be able to distinguish which is the stronger incentive - note that this distinction is much easier to make in the other three contexts.
3.3 Impact of Payoff Manipulations on Willingness to Cooperate Across Scenarios

3.3.1 Impact of Changes to $\pi(C,N)$ and $\pi(N,C)$ on Willingness to Cooperate

Figure 10 presents the impact of changing $\pi(C,N)$ and $\pi(N,C)$ on willingness to cooperate\(^9\) across scenarios.

**Figure 10. Impact of Payoff Manipulations on Willingness to Cooperation**

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\(^9\) After subjects had decided on Option A or Option B, we manipulated the payoffs and asked them to indicate the extent to which they would probably have chosen the other option, given the manipulations. We therewith measure subjects’ willingness to change from cooperation to non-cooperation and vice versa. We refer to the influence of payoff manipulations on changing cooperative behavior as the impact on willingness to cooperate.
We found that changes in $\pi(N,C)$ do not have significantly greater impact on willingness to cooperate than changes in $\pi(C,N)$ in scenarios one and two ($t_1 = -0.376$, ns; $t_2 = 0.569$, ns at 0.1 level). Hypothesis 6 is not supported. Changes in $\pi(C,N)$, however, have significantly greater impact on willingness to cooperate than changes in $\pi(N,C)$ in scenarios three and four ($t_3 = -5.387, \alpha < 0.001$, $t_4 = -3.372, \alpha < 0.001$). Hypothesis 7 is supported.

We suspect that the insignificance of hypothesis 6 is due to the fact that the subjects respond more to $\pi(C,N)$ than to $\pi(N,C)$ because of asymmetric utility functions for gains and losses (Kahneman & Tversky, 1979; Rabin, 1998). Prospect theory argues that utility functions for losses are steeper than those for gains, therefore, the utility change caused by the manipulation of the fear element $\pi(C,N)$ probably is greater than that caused by manipulations of the greed element $\pi(N,C)$.

We tested whether subjects on average responded more to changes in $\pi(C,N)$ than $\pi(N,C)$ across scenarios. We found that there is a significant difference in means ($\mu_{CN}(3.514) > \mu_{NC}(3.947), t = 3.956, \alpha < 0.001$). We adjust each subject’s raw scores reflecting the impact of changes in $\pi(CN)$ by subtracting the mean of these raw scores.

We made the same adjustment for changes to $\pi(N,C)$. After the adjustment, changes in $\pi(N,C)$ have greater impact than changes in $\pi(C,N)$ in scenarios 1 ($t_1 = 1.793, \alpha < 0.038$) and 2 ($t_2 = 3.260, \alpha < 0.002$) while changes in $\pi(C,N)$ and $\pi(N,C)$ remain significantly different in scenarios 3 ($t_3 = -4.764, \alpha < 0.001$) and 4 ($t_4 = -1.740, \alpha < 0.001$).

---

10 We pooled the responses of subjects who we motivated to change from cooperation to non-cooperation with those of who we motivated to change from non-cooperation to cooperation. This is because we have no reason to believe that the nature of the responses from non-cooperators is different from that of responses from cooperators.

11 We draw an analogy between gains and losses and greed and fear, as greed represents opportunistic gains and fear potential losses.
α<0.043). Figure 11 presents the impact of changing \( \pi(C,N) \) and \( \pi(N,C) \) on willingness to cooperate across scenarios after the adjustment.

**Figure 11.** Impact of Payoff Manipulations on Willingness to Cooperation (After Adjusting for Differing Mean Responsiveness)
3.3.2 Impact of Changes to $\pi(C,C)$ and $\pi(N,N)$ on Willingness to Cooperate

Figure 12 presents the impact of changing $\pi(C,C)$ and $\pi(N,N)$ on willingness to cooperate across scenarios. As hypothesized, significant differences were found between manipulations of $\pi(C,C)$ and $\pi(N,N)$ in scenarios one, three and four ($t_1 = 1.883$, $\alpha<0.032$, $t_3 = -3.217$, $\alpha<0.001$, $t_4 = -1.929$, $\alpha<0.029$). However, no significant difference was found in scenario two ($t_2 = 1.049$, ns at 0.1 level).

**Figure 12.** Impact of Payoff Manipulations on Willingness to Cooperate

![Graph showing impact of manipulations on willingness to cooperate across scenarios.]

Because changes in $\pi(C,C)$ affect the greed element and changes in $\pi(N,N)$ affect the fear element, we tested whether subjects on average respond more to changes in $\pi(N,N)$
than in $\pi(C,C)$ across scenarios. No significant difference was found ($\mu_{CC}(3.725)$, $\mu_{NN}(3.825)$, $t=0.906$, ns at 0.1 level). These results support hypothesis 8 and provide some indications for hypothesis 9.

Given the positive direction in the mean difference though, we adjusted the raw scores by subtracting the means. We found that, after adjusting, changing $\pi(C,C)$ is significantly more effective than changing $\pi(N,N)$ in scenarios one and two ($t_1 = 3.025, \alpha<0.002; t_2 =1.867, \alpha<0.033$) and significantly less effective in scenarios three and four ($t_3 = -3.969, \alpha<0.001; t_4 = -1.910, \alpha<0.030$). Figure 13 presents the impact of changing $\pi(C,C)$ and $\pi(N,N)$ on willingness to cooperate across scenarios after the adjustment.

Our results regarding the effectiveness of payoff manipulations in motivating cooperation show that manipulating the payoffs that constitute greed is more effective in motivating cooperation than manipulation those that constitute fear when trust is high (scenarios 1 and 2). Our results also provide strong indications that manipulating the payoffs that constitute fear is more effective in motivating cooperation than manipulation those that constitute greed when trust is low (scenarios 3 and 4).
Figure 13. Impact of Payoff Manipulations on Willingness to Cooperate  
(After Adjusting for Differing Mean Responsiveness)

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Trust</th>
<th>Time Horizon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>90</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>90</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
<td>10</td>
</tr>
</tbody>
</table>

In summary, we first found that the level of trust determines whether the relational context is dominated by apprehension or temptation. Second, there are indications that time horizon determines the degree of apprehension and temptation dominance. Third, the findings strongly support that in temptation dominant contexts payoff manipulations affecting greed have greater impact on cooperation than those affecting fear. The opposite is found in apprehension dominant contexts. This supports the central idea behind this study that the impact of fear on cooperation is mediated by apprehension, whereas the impact of greed is mediated by temptation.
4. Discussion and Conclusion

This paper presented an experiment to test the idea that the effectiveness of payoff manipulations in influencing cooperation hinges on the relational context in which they are embedded. While most studies have explored the interpersonal aspect and the intertemporal aspect of the relational context in isolation, we consider their simultaneous impact. Furthermore, while most studies examine how interpersonal and intertemporal dynamics shape cooperation, this paper examines how payoff manipulations most effectively promote cooperation given interpersonal and intertemporal dynamics.

We first hypothesized and tested that different configurations of the interpersonal aspect (trust) and the intertemporal aspect (time horizon) of a relationship give rise to different relational contexts of apprehension and temptation. We then hypothesized and tested that the impact of payoff manipulations related to the concepts of benefit, greed and fear on willingness to cooperate depends systematically on the nature of the relational context. Our results broadly support the above hypotheses and provide strong evidence against a context-free utility model, which would predict the same effectiveness of payoff manipulations across relational contexts. Our research has strong implication for both theory and practice.

With respect to theory, we draw attention to the holistic understanding of the context in which ongoing-social exchanges are embedded. Both, trust and time horizon, have to be considered together to provide a full picture of this context. Moreover, we provide empirical support for the interdependence of payoff incentives and context parameters.
This suggests that a holistic perspective incorporating both payoffs and context is needed to make sense of cooperative behavior in social dilemmas.

With regard to practice, we provide two insights. First, managers need to be aware that trust alone does not foretell alliance success and distrust does not foreshadow alliance breakdown. Similarly, long time horizon alone does not ensure successful cooperation and short time horizon does not necessarily mean that alliances are doomed to fail. There are many examples in the business world that illustrate these points. For example, the alliance between Borden and Meiji Milk Products broke after twenty years of close collaboration and high trust. Taco Bell placed trust in jeopardy when it introduced Taco Bell Express which competed for business with its franchisees. Nonetheless, the franchisees continued to work with Taco Bell despite strong opposition to the newly introduced retail format. Moreover, abundant opportunities for future cooperation were not able to keep Renault and Volvo together in the 1990s. Lastly, it is not difficult to find cases that show short-term collaborations succeeding especially when much trust keeps parties together. Ultimately, trust working in the shadow of the future determines whether the context of a relationship is conducive to cooperation or not. Second, managers need to have the relational context in mind when they devise or alter the incentives. Incentives that alter potential losses (fear) should be given priority over those that alter opportunistic gains (greed) when apprehension dominates temptation, and vice versa. For example, alliance mangers should consider granting control when they face an apprehensive partner while asking for commitment when they deal with a tempted one.

Our research has limitations. Our sample consisted entirely of business undergraduate students and participants were given assessments about trust and time horizon which
they did not derive themselves. While this ensures a high degree of control and reliability, it reduces realism. Future research may consider the use of a more diverse sample and a design that allows subjects to derive expectations regarding trust and time horizon themselves.

Another limitation of our study is that it cannot be ruled out that some subjects might have based their decisions solely on trust, ignoring time horizon. The quiz that participants answered, reassured us that they understood the operationalization of time horizon, but it did not reveal to what extent they took time horizon into consideration when they made their decisions. Our results, especially those regarding the payoff manipulations, however, suggest that the majority of subjects did not ignore time horizon. Future studies might investigate to what extent people base their cooperative decision on trust and to what extent on time horizon. While it is unlikely that many subjects ignored time horizon, it is more likely that some might not have perceived a time horizon of 90% to be much longer than one of 10%. As a result, these subjects would still have felt very tempted when faced with a time horizon of 90%. This might explain the finding that scenario 1 is little different from scenario 2 and scenario 3 little different from scenario 4 in terms of apprehension and temptation. This in turn would suggest that people are not very sensitive to changes in time horizon.

While the within-subject design that the study employs ensures a high degree of consistency, it brings with it some drawbacks. As each subject played all four scenarios it cannot be ruled out that the first scenario might have fixated some subjects on either temptation or apprehension for the entire experiment. Specifically, as that scenario was characterized by 90% trust and a time horizon of 90%, some subjects might have been fixated on reaping opportunistic gains (temptation). That means our
results regarding payoff manipulations also have to be interpreted in the light of prior research on framing manipulations that selectively emphasize the probability of success (gain, or positive frame) versus emphasizing the probability of failure (loss, or negative frame). It has been argued that presenting the probability of a particular outcome of a risky option makes this outcome more salient and it has been demonstrated that salient stimuli have a disproportionate influence on people's attitudes and decisions (Taylor & Fiske, 1978; Slovic, Fischhoff, Lichtenstein, 1982; van der Pliet &Eiser, 1984; Kühberger, 1998).

If subjects were in a gain frame for the entire experiment, it is no surprise that they focused on opportunistic gains (temptation) rather than potential losses (apprehension), even if the probability of gains was smaller than that for losses. Interestingly, while subjects on average felt more tempted than apprehensive (be it because they have been fixated or time horizon was not long enough to contain their temptation), they on average did not respond more to changes in greed than fear. Our results suggest that manipulating fear on average was more effective in promoting cooperation than manipulating greed. This provides some indications that that people might be more sensitive to changes to potential losses than changes to opportunistic gains. Taking into account the possibility of different utility functions associated with greed, fear and benefit is an important area for future extension of this research.

Lastly, we only look at four extreme configurations of trust and time horizon. The natures of apprehension and temptation are certainly more intricate than what has been revealed by these four stylized context. Future studies may consider the full range of trust and time horizon to uncover more of the dynamics that govern the relational context.
REFERENCES


Appendix A. Instructions

<table>
<thead>
<tr>
<th>YOU</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option A</strong></td>
</tr>
<tr>
<td>Option A</td>
</tr>
<tr>
<td>Option B</td>
</tr>
</tbody>
</table>

You are going to play the above game for several rounds. The game is either likely to have many rounds or few rounds. The actual number of rounds depends on a chance event.

- When we say the game is *likely* to have many rounds, we mean that after each round there is a **90% chance** that the game continues.
- When we say the game is *not likely* to have many rounds, we mean that after each round there is only a **10% chance** that the game continues.

So you know the game will be over sooner or later, you just don't know in advance when it will be over.

In addition, you will know how likely the other person is to choose Option A.

- When we say the other person is *likely* to choose Option A, we mean that there is a **90% chance** that s/he will choose option A.
- When we say the other person is *not likely* to choose Option A, we mean that there is only a **10% chance** that s/he will choose Option A.

Since your decision will influence the other person's choice in future rounds, you don't know exactly how likely the other person will choose Option A in future rounds.

It may seem obvious to you that Option B is the better choice, but it can be reasonably expected that this action could bring about the same choice from the other person in the future. As a result, you may get only 300 rather than 400 many times. In a sense, a choice of Option B represents a non-cooperative move. While less risky, it could mean giving up long-term benefits for short-term gains. Conversely, a choice of Option A represents a cooperative move. While a bit risky (because the other person might choose Option B), it can be a good choice if you think the other person will reciprocate and you can get 400 many times.

It is your task to maximize your own payoff without concern for the other person. Please note that your choices have neither moral nor ethical implications. Return to the computer for training rounds.
Appendix B. Computer Interface used to Assess Impact of Changes in Fear and Greed on Willingness to Cooperate*

Scenario 1, Round 1

- the other person is LIKELY to choose OPTION A in this round
- the game is LIKELY to have MANY ROUNDS

<table>
<thead>
<tr>
<th></th>
<th>YOU</th>
<th>OTHER PERSON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Option A</strong></td>
<td>450</td>
<td>150</td>
</tr>
<tr>
<td><strong>Option B</strong></td>
<td>600</td>
<td>300</td>
</tr>
</tbody>
</table>

**What is your decision for Round 1?**

0      Option A  
0      Option B

To what extent do you agree with the following statements?**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I chose Option B in an attempt to get 600 in this round.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>I chose Option B because if I choose Option A I am afraid of getting only 150.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>With 500 in the green cell I would probably have chosen the other option.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>With 250 in the red cell I would probably have chosen the other option.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

* Shown here is the interface for condition 1 and scenario 1. The interface for condition 2 and other scenarios are not shown.
** Statements shown here as those following a choice of Option B. Statements following a choice of Option A are not shown.