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# A PSYCHOLOGICAL GAME WITH INTERDEPENDENT PREFERENCE TYPES

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# A PSYCHOLOGICAL GAME WITH INTERDEPENDENT PREFERENCE TYPES

## Abstract

In psychological games, higher-order beliefs, emotions, and motives - in addition to actions - affect players' payoffs. Suppose you are invited to a party, movie, dinner, etc not because your company is desired but because the inviter would feel guilty if she did not invite you. In all of these cases, it is conceivable that the *intention* behind the action will matter and hence will affect your payoffs. I show that this social interaction is a psychological game. However, under certain conditions, it is a special case of games with interdependent preference types as studied in Gul and Pesendorfer (2005). I find a complex social interaction in this game. In particular, there exists a unique equilibrium in which a player may stick to a strategy of accepting every invitation with the goal of discouraging insincere invitations. This may lead one to *erroneously* infer that this player is eagerly waiting for an invitation, when indeed his behavior is driven more by strategic considerations than by an excessive desire for social acceptance. The discussion shows that while games with interdependent preference types can capture phenomena that psychological games seek to address, the intuition, motivation, or explanation for the *same* phenomenon may be *different*. I discuss how being tolerated but not being truly accepted can explain the rejection of mutually beneficial trades, the choice of identity, social exclusion, marital divorce, and political correctness.

JEL Code: C73, J16, Z13.

Keywords: guilt, intentions, interdependent preference types, psychological game, second-order beliefs, social interaction.

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## 1. Introduction

In standard economics and game theory, only actions should affect payoffs. Intentions are irrelevant. It is the final outcome that matters not the process. But there are clearly situations where intentions affect payoffs. The same action might induce different payoffs depending on the intentions of the parties or players. This implies that beliefs about beliefs (i.e., intentions) affect players' payoffs. Indeed, these are games in which a player's emotions like surprise, joy, and disappointment affect her payoffs. As Geanakoplos et al. (1989, p. 61) observe "[a] player's emotional reactions cannot in general be independent of his expectations and his interpretation of what he learns in the play of the game". They refer to such games as psychological games and provide the first characterization of equilibria. As Kolpin (1992, p. 218) notes in these games "... no single utility function characterizes a player's preferences over the physical outcome set."

Geanakoplos et al. (1989, p. 69) present the following example:

"... a man is deciding whether or not to give a woman flowers. ... The woman may be unhappy for either two reasons: she might expect flowers and not receive them, or she might conclude from his behavior that he is willing to disappoint her. Thus, even if she is not expecting flowers but believes that he thinks she is expecting flowers, she will be unhappy not to receive flowers, because this indicates his willingness to disappoint her."

Gilboa and Schmeidler (1988) also analyze a related class of games. Consider the following example in Gilboa and Schmeidler (1988, p. 216):

"Mr. A hates Mr. B for 'wrongs' B did to him. Assuming Mr. A can follow a strategy which will hurt B, A will choose such a strategy for the sake of revenge. However, the revenge will be sweeter if A knows that B anticipates it. That is to say, the same play of the game may result in a higher payoff for A if B *knows* that this indeed is going to be the play of the game."

Clearly, the above examples show that beliefs and intentions can conceivably affect payoffs. Falk, Fehr, and Fischbacher (2000), Brandts and Sola (2001), Falk et al.

(2003), McCabe et al. (2003), and Offerman (2002) present experimental evidence which support the idea that intentions matter in reciprocal relationships. Indeed, intentions matter in other important ways. It is the basis for the legal distinction between murder and manslaughter and partly explains the attitudes of certain groups towards racial profiling.

In a very important contribution, extension, and application of the theoretical work of Geanakoplos et al. (1989), Rabin (1993) modeled the idea that people reward actions which have kind intentions and punish actions which have unkind intentions.<sup>1</sup> This has been recently extended in Dufwenberg and Kirchsteiger (2004) and Falk and Fischbacher (2006). Dufwenberg and Kirchsteiger (2000) have applied psychological game theory to study wage under-cutting. Also, Ruffle (1999) studies a psychological gift-giving game and Dufwenberg (2002) studies how feelings of guilt and beliefs affect the payoffs of spouses and sustain investments in marriage. In a related contribution, Charness and Dufwenberg (2005) theoretically and experimentally show how guilt aversion can cause people to fulfill their promises in partnerships. Segal and Sobel (2006) examine reciprocity in a strategic setting where players have preferences over their opponent's strategies in addition to outcomes. In addition to characterizing the equilibria of this game, they also provide an axiomatic foundation for Rabin (1993).

The purpose of this paper is to analyze a related class of social interactions. Suppose you are tolerated as opposed to being genuinely accepted by your peers and "friends". In particular, suppose you are invited to a party, movie, dinner, etc not because

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<sup>1</sup> Note that Gilboa and Schmeidler (1988) differs from these papers in one key respect. Their main goal is to point out that common knowledge and "common sense" are inconsistent in games where beliefs or information about the outcome affect payoffs (see their proposition 2). Their work may be interpreted as drawing attention to the limitations of traditional game theory in analyzing psychological-type games.

your company is desired but because the inviter would feel guilty if she did not invite you, or you got a job at an elite institution but you wouldn't have been offered the job if you were not a minority, or someone gives you a present because they felt obliged to do so not because they really wanted to give you a present? Or a friend is expected to give you a phone call because you need her emotional support. If you have a caller ID and you think she is making the call reluctantly, will you answer the phone? If your boss, supervisor, or professor tells you to feel free to come talk to her anytime you encounter problems in your work, will you take her up on that offer, if you thought she was making the offer grudgingly? Does one's enjoyment from sex depend on whether her partner's intention is a long-term relationship or casual relationship? Will the answer affect the decision to accept or reject an invitation into a sexual relationship? In all of these cases, it is conceivable that the intention behind the action will matter and hence will affect your payoffs. The average reader may be able to relate to some of these situations from personal experience. These examples are common and interesting social interactions worthy of study. They are the basis of friendships and relationships at work, school, church, and in our daily lives. They determine who we choose to go to lunch with, play with, and in general socialize with. They determine the frequency and enjoyment of our social interactions.

It is important to note that I assume that there is already some kind of superficial, implicit, or lower-level relationship between the two parties. For example, they may work at the same place. The question is "will the parties take the relationship to the next level in a world where the intentions behind actions matter?" And since it takes two to tango,

one party must have the option of inviting or not inviting the other party and the other party must have the option of accepting or rejecting the invitation.

To the best of my knowledge, this is the only paper, apart from Battigalli and Dufwenberg (2005), that examines a dynamic psychological game under incomplete information. However, my analysis is restricted to a specific albeit important context. Battigalli and Dufwenberg (2005) present a much more general and thorough analysis of dynamic psychological games. But they do not examine the kind of social interaction that I focus on or the applications herein. The bulk of Battigalli and Dufwenberg's (2005) analyses is restricted to dynamic psychological games with complete information. They briefly explain how their analyses and framework can be adapted to examine dynamic psychological games under incomplete information but caution that such games require more structure in specific situations. In their concluding remarks, they note that "... there are a variety of interesting psychological phenomena waiting to be analytically explored." This paper can be seen as taking up the challenge in Battigalli and Dufwenberg's (2005). I examine a specific and interesting dynamic psychological game under incomplete information.

In the next section, I present a dynamic psychological game model of social interactions under incomplete information. In section 2.1, I argue that this game is different from a standard game. I discuss applications in section 3. I conclude the paper in section 4.

## 2. A Dynamic Psychological Game of Social Interaction

I focus on the following specific example. Consider two people, 1 and 2. I use male pronouns for player 1 and female pronouns for player 2. Person 1 has the option of inviting person 2 to a movie, party, dinner or any social event. If person 2 believes that 1 genuinely wants her company, she gets a utility,  $v \geq 0$ , if she is invited and attends the social event. If she does not feel wanted at the social event, she incurs a psychic cost of  $\theta > 0$ . It is *important* to note that person 1 need not show that he dislikes 2's company. All that is required is that person 2 believes that person 1 probably does not like her company but is only pretending that he (i.e., player 1) likes her company. So it is player 2's inference about player 1's intentions that matters. Therefore, the *same* action (i.e., invitation) by player 1 could give player 2 *different* payoffs depending on her beliefs about player 1's intentions. Note that if  $v > 0$ , person 2 would accept an invitation from person 1 if she did not care about 1's intentions.

Let  $v$  be a random variable that is commonly known to be continuously distributed on  $[\underline{v}, \bar{v}]$  with density  $f(v)$  and corresponding distribution function,  $F(v)$ ,  $\underline{v} \geq 0$ .

Suppose that nature gives person 1 a two-dimensional type: social and guilt types. These types are independently drawn. If person 1 is of social type  $w_H > 0$ , then he derives a *benefit* of  $w_H$  from 2's company. If he is of social type  $w_L$ , then he incurs a *cost* of  $w_L > 0$ , when he is in 2's company. Let the probability distribution of these types be such that  $\Pr(w_H) = p$  and  $\Pr(w_L) = 1-p$ ,  $p \in [0,1]$ . Furthermore, person 1 feels guilty, if he does not invite person 2. This imposes a high or low cost of guilt on him. Let the cost be  $g_H > g_L > 0$ , which are distributed as follows:  $\Pr(g_H) = q$  and  $\Pr(g_L) = 1-q$ ,  $q \in [0,1]$ . Therefore  $g_H$



and  $g_L$  are his guilt types. Assume that  $g_L < w_L \leq g_H$ . The players have common priors. All this information is common knowledge. However, person 1's type on either dimension is his private information.

After observing his two-dimensional type, person 1 has two strategies: invite (I) or do not invite (D). Person 2 has two strategies: accept (A) or reject (R) an invitation from 1. The game is sequential. Player 1 is the first-mover and player 2 is the second-mover.

If person 1's social type is  $w_L$ , then he really does not want person 2 in his company. And therefore if person 2 accepted an invitation and became aware of this fact, her payoff will be  $-\theta$ . So if person 1 invites person 2, what belief should person 2 hold about person 1's type or intention? This matters to person 2, because she wants to know if person 1 is inviting her because he really likes her or because he feels very guilty otherwise. That is, person 2 needs to know whether she is being *tolerated* or being *genuinely accepted*. Person 2 wants to know the motive or intention behind 1's invitation.

Note that player 1 does *not* feel guilty so long as he invites player 2, even if he does not want player 2 to accept his invitation. For example, if his type pair is  $\{g_L, w_L\}$ , he might invite player 2 and if player 2 rejects it, then he suffers no guilt. While the motivation for this behavior may be straightforward, it may be helpful to elaborate further. One explanation is that player 1 anticipates if he does not invite player 2, then player 2 will say things or act in a manner to make player 1 feel guilty. But if player 1 invites her and she rejects it, then player 2 lacks the moral basis to make player 1 feel guilty or player 1 can justify his behavior on the basis that he invited player 2 after all. Of course, player 1's guilt need not depend on player 2's words or actions.

### 2.1 The connection to psychological games and games with interdependent types

One may be inclined to argue that this game is a standard game of incomplete information where a player's payoff is determined by the type of her opponent. This argument is flawed. Note that, in this game, player 1 will have to form beliefs about whether player 2 will accept or reject his offer and player 2 will have to form beliefs about player 1's beliefs (i.e., second-order beliefs). In particular when player 1's type pair is  $\{w_L, g_L\}$ , then his decision to invite player 2 depends on his belief of player 2's rejection probability.<sup>2</sup> If he believes that this probability is very high, then he will invite player 2. So if player 2 receives an invitation, she has to form a belief about player 1's belief of her rejection probability since she understands that player 1's belief about her rejection probability influences player 1's decision to invite her. Hence, player 2's inference of player 1's type or intention is based on player 2's beliefs of player 1's beliefs. Therefore, player 2's expected payoff will be a function of player 2's second-order beliefs. This gives a psychological game in the sense of Geanakoplos et al. (1989) and Rabin (1993). Player 2 will now have to interpret an invitation under the following possible scenarios: Is player 1 inviting her because (i) his social type is  $w_H$ , or (ii) his type pair is  $\{w_L, g_H\}$ , or (iii) his type pair is  $\{w_L, g_L\}$  but has nevertheless invited her, hoping that she will reject it and not feel guilty as a result?

Given  $\{w_L, g_L\}$ , if player 1 had no incentive to invite player 2, conditional on player 2's rejection probability, then this game would not be a psychological game. In this case, the game is a special case of games with interdependent preference types as

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<sup>2</sup> Shortly, it will be obvious that when player 1's type pair is  $\{w_H, g_L\}$ , then he invites player 2 *regardless* of player 2's rejection probability.

studied in Gul and Pesendorfer (2005). In our game, player 2 has interdependent preferences defined over player 1's types but player 1 does not have such preferences.<sup>3</sup> Hence, our game has both elements of interdependent preference types as in Gul and Pesendorfer (2005) and belief-dependent preferences as in Geneakoplos et al. (1989). There are *exogenous* beliefs stemming from incomplete information but also *endogenous* beliefs about strategies stemming from player 1's incentive to invite player 2 when his type pair is  $\{w_L, g_L\}$ .

Gul and Pesendorfer (2005) show that a model of interdependent types can capture the phenomena that psychological games seek to address. Hence, some of the applications discussed in section 3 can also be explained with a model of interdependent types. However, I argue that, compared to psychological games, games with interdependent types may give *different* explanations for the *same* phenomena. Notice also that the social interaction studied in this paper is new.

It is important to note that there exists a Perfect Bayesian equilibrium in which player 1 always invites player 2 if  $F\left(\frac{\theta(1-p)}{p}\right) < 1 - \frac{g_L}{w_L}$  and player 2 accepts this invitation if  $v \geq \theta(1-p)/p$ . In this equilibrium, player 2's rejection probability is  $F(\theta(1-p)/p)$ . A key implication of this equilibrium is that player 2 accepts every invitation if  $v$  is sufficiently high and/or  $\theta$  is sufficiently low. The result that there exists an equilibrium in which player 2 accepts an invitation, if she has a sufficiently high valuation for a sincere invitation and/or sufficiently small cost for an insincere invitation, is very obvious. I shall return to this point in section 3.

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<sup>3</sup> Gul and Pesendorfer (2005) consider more general cases where all players could have interdependent type preferences.

## 2.2 Solving the psychological game

I look for a psychological equilibrium to this game.<sup>4</sup> Note that if player 1 plays D, then player 2 does not have to respond. So the analysis is restricted to player 2's response when player 1 plays I.

Let  $\sigma \in [0,1]$  be the probability that player 2 rejects an invitation from player 1 and let  $\sigma' \in [0,1]$  be player 1's expectation of  $\sigma$ . Let  $\sigma'' \in [0,1]$  be player 2's expectation (second-order beliefs) of  $\sigma'$ .<sup>5</sup>

Note when player 1's type pair is  $\{w_L, g_L\}$ , his payoff is  $-g_L$ , if he plays D. If he plays I, his payoff is  $-(1-\sigma')w_L$ . So he is indifferent between the two strategies, if  $(1-\sigma')w_L = g_L$ . Also, since  $g_H \geq w_L$ , it follows that  $g_H \geq (1-\sigma')w_L$  necessarily holds since  $\sigma' \in [0,1]$ . So if player 1's type pair is  $\{g_H, w_L\}$ , he will invite player 2, *regardless* of player 2's rejection probability. Therefore, in this psychological game, player 1's optimal strategy is as follows: (i) if his social type is  $w_H$ , he will invite player 2; (ii) If his type pair is  $\{w_L, g_H\}$ , he will invite player 2; and (iii) if his type pair is  $\{w_L, g_L\}$  and  $-(1-\sigma')w_L = -g_L$  (i.e.,  $\sigma' = 1 - g_L/w_L$ ), then he is indifferent between inviting player 2 and not inviting her.<sup>6</sup> So if his type pair is  $\{g_L, w_L\}$ , then it is an equilibrium response to invite player 2 with probability  $\sigma'$ .

The only scenario in which player 2's rejection probability could *possibly*

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<sup>4</sup> Kolpin (1992) argues that traditional game theory can handle psychological games by allowing players to choose their beliefs. However, to the best of my knowledge, this approach has not been adopted in the literature. In non-game theoretic settings, Akerlof and Dickens (1982) and Brunnermeier and Parker (2005) allow agents to choose their beliefs.

<sup>5</sup> As in Rabin (1993), Ruffle (1999) and Dufwenberg (2002), I do not consider beliefs beyond second-order beliefs.

<sup>6</sup> I assume that this condition holds in equilibrium. I shall relax it shortly.

influence player 1's invitation decision occurs when player 1's guilt type is  $g_L$ .<sup>7</sup>

Therefore, to make the analysis interesting, I assume that  $\Pr(g_L) = 1 - q > 0$  (i.e.,  $q < 1$ ).

I first construct an equilibrium such that  $\sigma' = 1 - g_L/w_L$ . I shall relax this restriction shortly.

Given player 1's strategy, player 2 computes the posterior probabilities

$$\rho(w_L|I) = \frac{\rho(I|w_L)\Pr(w_L)}{\sum_{i=L,H} \rho(I|w_i)\Pr(w_i)} = \frac{[q + (1-q)\sigma''](1-p)}{[q + (1-q)\sigma''](1-p) + p} \text{ and}$$

$$\rho(w_H|I) = \frac{p}{[q + (1-q)\sigma''](1-p) + p}.$$

Then player 2 rejects an invitation from player 1 if

$$U(A|I) = \rho(w_H|I)v - \rho(w_L|I)\theta < 0 \tag{1}$$

Since the posterior probabilities depend on  $\sigma''$ , it follows, as argued in section 2.1, that player 2's payoff in equation (1) depends directly on her second-order beliefs,  $\sigma''$ .

This is not the case in standard game theory and it is in this sense that this game is a psychological game.<sup>8</sup> Note also that while Geanakoplos et al. (1989), Rabin (1993), Ruffle (1999) and Dufwenberg (2002) incorporate beliefs directly into the utility function, the dependence of player 2's payoff on beliefs arises naturally in my model via Bayesian updating. This is consistent with Battigalli and Dufwenberg's (2005) important extension and general analysis of incorporating *updated* beliefs in psychological games. There is a difference, though. In Battigalli and Dufwenberg (2005), a player's updated second-order beliefs about an opponent's *strategy* is endogenous. In our case, it is the

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<sup>7</sup> Of course, her social type must be  $w_L$  as well.

<sup>8</sup> See, for example, the payoffs in Geanakoplos et al. (1989), Rabin (1993) and Dufwenberg (2002).

belief about the opponent's *type* that is endogenous and more importantly depends on the player's second-order beliefs. Note also that, player 1's payoff depends on  $\sigma'$ .

Given the condition in (1), player 2 of type  $\hat{v}(\sigma'') = \frac{\rho(w_L|I)\theta}{\rho(w_H|I)}$  is indifferent

between accepting or rejecting an invitation. It follows that

$$\sigma = \int_{\underline{v}}^{\hat{v}(\sigma'')} f(v)dv = F(\hat{v}(\sigma'')), \quad (2)$$

As in Geanakoplos et al. (1989), Rabin (1993), and the other papers cited above, mutual consistency of beliefs requires that  $\sigma'' = \sigma' = \sigma$ . Given that  $F(\hat{v}(\sigma''))$  is a continuous function of  $\sigma''$  mapping the unit interval  $[0,1]$  onto itself, it follows from Brouwer's fixed point theorem that there is, at least, one solution (a fixed point) to (2). Call it  $\sigma^*$ . Unless otherwise indicated, I assume that the solution is unique. This gives the following proposition.

**Proposition 1:** *In the psychological social interaction game, there exists a semi-mixed strategy equilibrium in which player 1 always invites player 2 if his social type is  $w_H$  or if his type pair is  $\{w_L, g_H\}$ . If his type pair is  $\{w_L, g_L\}$  and  $\sigma^* = 1 - g_L/w_L$ , then he invites player 2 with probability  $\sigma^*$ . Player 2 rejects player 1's invitation with probability  $\sigma^*$ .*

Proposition 1 gives an equilibrium of the psychological game using the conditions (a)  $(1 - \sigma)w_L = g_L$  and (b)  $\sigma'' = \sigma' = \sigma$ . Note that an equilibrium with  $\sigma^* \in (0,1)$  is simply one in which player 1 mixes his strategies between D (don't invite) and I (invite), if his type pair is  $\{w_L, g_L\}$ . To construct a non-degenerate mixed strategy, it is standard to

require indifference between strategies for a player. This indifference condition for player 1 is simply given by  $(1 - \sigma')w_L = g_L$ . Hence, once we compute  $\sigma^* \in (0, 1)$  using equation (2), we can always find some  $\{w_L, g_L\}$  such that  $w_L < g_L$  and  $(1 - \sigma^*)w_L = g_L$ . Of course, I have assumed that the latter condition holds. I shall now construct an equilibrium which is not a mixed-strategy equilibrium and so does not require this indifference condition.

Now suppose  $\Pr(g_H) = q = 0$ . Then we obtain the following proposition:

**Proposition 2:** *Suppose  $\Pr(g_H) = q = 0$ . Then there exists a unique pure-strategy equilibrium in which player 1 always invites player 2, if and only if his social type is  $w_H$ . Player 2 rejects player 1's invitation with probability  $\sigma = 0$ . In this equilibrium player 1 invites player 2 with probability,  $\Pr(w_H) = p > 0$ .*

**Proof:** We first prove the existence part. Suppose player 2 plays  $\sigma = 0$ . Then given that player 1's guilt type is always  $g_L$  (i.e.,  $q = 0$ ), player 1's optimal strategy is to never invite player 2 if his social type is  $w_L$ . Therefore, player 1 invites player 2 if and only if his social type is  $w_H$ . This occurs with probability  $\Pr(w_H) = p > 0$ . And given that player 1 invites player 2 if and only if his social type is  $w_H$ , player 2's rejection probability of  $\sigma = 0$  is an equilibrium response.

To prove the uniqueness part, we note that *given*  $q = 0$  and player 2's strategy of  $\sigma = 0$ , player 1's strategy of playing I, if and only if his social type is  $w_H$ , is a *unique* best response. Hence, it suffices to show that there is no equilibrium with  $\sigma > 0$ . There are two cases to consider: (i)  $\sigma \in (0, \hat{\sigma})$ , and (ii)  $\sigma \in [\hat{\sigma}, 1]$ , where  $\hat{\sigma} = 1 - g_L/w_L$ .

In case (i), player 1's optimal response is to invite player 2, if and only if his social type is  $w_H$  because  $(1 - \sigma)w_L > g_L$ . But then player 2 will reject some sincere

invitations with positive probability, which gives a lower payoff than playing  $\sigma = 0$ . In case (ii), player 1 will invite player 2 even if his type pair is  $\{w_L, g_L\}$ , because  $(1 - \sigma)w_L \leq g_L$ . Hence player 2 will accept insincere invitations with positive probability in this case. Again, he is better off by deviating to  $\sigma = 0$  which guarantees sincere invitations. **QED**

### 3. Discussion and Applications

If  $p$  is positive but very small, the equilibrium in proposition 2 may appear to a third party as though player 2 is overly eager to socialize with player 1 but player 1 is not that eager to socialize with player 2. However, there is a more complicated social interaction at play. The only way that player 2 can deter player 1 from inviting her with the intention of assuaging his guilt is to appear to overly want to be in player 1's company. That way, if player 1 invites her, she (i.e., player 2) has a higher posterior belief that he must have indeed drawn  $w_H$ . Since player 1 has the incentive to invite her in the psychological game, even if his social type is  $w_L$ , player 2 accepts every invitation from player 1 when  $q = 0$  in order to discourage insincere invitations.

If player 1 did not have the incentive to invite player 2 when his type pair is  $\{w_L, g_L\}$ , then given  $w_L > g_L$  and  $\Pr(g_L) = 1$ , it would have been obvious that any equilibrium would involve only sincere invitations. But since player 1 might invite player 2 depending on her rejection probability, it is not obvious that the two conditions,  $w_L > g_L$  and  $\Pr(g_L) = 1$ , will give an equilibrium with only sincere invitations. In the former case, there would be only sincere invitations regardless of player 2's rejection probability. This will be the case if we only modeled the game as one with players who



have interdependent preference types as in Gul and Pesendorfer (2005). In our psychological game, player 2 guarantees that all invitations are sincere precisely because her rejection probability is zero. Of course, there are other positive rejection probabilities which guarantee only sincere invitations but they also come with additional cost of rejecting some of these sincere invitations and therefore are not optimal strategies.

The discussion in the preceding paragraph suggests that while models of interdependent preference types as studied in Gul and Pesendorfer (2005) can capture phenomena that psychological games seek to address, the intuition, motivation, or explanation for the *same* phenomenon may be *different*.<sup>9</sup> And indeed, if player 1 has the incentive to invite player 2 hoping that player 2 will reject his invitation and thereby assuage his guilt, then it is reasonable to incorporate this incentive into a model which seeks to explain player 1's behavior. Otherwise, such a model may be right but for the wrong reasons. In certain situations, the two approaches, as correctly pointed out by Battigalli and Dufwenberg (2005), are best seen as complementary.<sup>10</sup>

Following on the preceding discussion, recall that in section 2.1, we noted that there exists a PBE in which player 1 always invites player 2 and player 2 accepts this invitation if  $v \geq \theta(1-p)/p$  and  $F(\theta(1-p)/p) < 1 - g_L/w_L$ . Notice however that this equilibrium does not hold when  $q = 0$ . As shown above, the equilibrium in proposition 2 is unique. Also, the equilibrium in proposition 2 holds for any  $v > 0$ . The equilibrium in proposition 2 is *not* driven by a sufficiently high value of  $v$ . This equilibrium does not

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<sup>9</sup> My thanks are due to Joel Sobel for a comment which led me to explore this issue.

<sup>10</sup> From an applied point of view, the important point need not be whether this game can be solved by standard techniques. The important point is the socio-economic insights that can be gleaned from a given solution. Indeed, Battigalli and Dufwenberg (2005) show that a standard game like Bernheim (1994) can be given a psychological-game interpretation. Also, Kolpin (1992) argues that standard techniques can be used to solve psychological games.

require  $v \geq \theta(1-p)/p$  for player 2 to accept invitations. Notice also that proposition 1 cannot yield  $\sigma^* = 0$  or 1, since  $0 < g_L < w_L$ . By looking at the expression for  $\hat{v}(\sigma^*)$ , we see that  $\hat{v}(\sigma^*)$  is increasing in  $\theta$ . Therefore, we require  $\theta$  high enough so that  $\sigma^* \neq 0$  (i.e.,  $\hat{v} \neq \underline{v}$ ) but we also require  $\theta$  low enough so that  $\sigma^* \neq 1$  (i.e.,  $\hat{v} \neq \bar{v}$ ). So for proposition 1, we require *intermediate* values of  $\theta$ .

As noted in the introduction, Dufwenberg (2002) studies how guilt can sustain investments in marriage. Without feelings of guilt, a husband could leave a marriage (i.e., divorce) after his wife has supported him in acquiring a lucrative professional training. Mindful of this, the wife will not support her husband and the mutually beneficial professional investment will not take place. Dufwenberg (2002) then modifies the model by assuming that the stronger the husband expects that his wife trusts him to stay, the more disutility of guilt he suffers by choosing to divorce. Using psychological game theory, he shows that the husband's belief about the wife's belief could sustain mutually profitable investments in the marriage.

However, Dufwenberg (2002) admits that his explanation cannot account for why some marriages end in divorce after investments have taken place. To be sure, there are several reasons why marriages end in divorce and a single model cannot take account of all these reasons. Dufwenberg (2002) notes that incomplete information may be a reason. This is consistent with the simple model in this paper. Incomplete information coupled with the fact that a spouse may derive enormous disutility from realizing that he or she is only being tolerated may lead to a divorce even after investments have taken place. To see this, suppose a man draws  $g_H$  and  $w_L$  and invites a woman into a marital and investment relationship, after dating for some time. Then the woman will accept the

invitation, if  $\rho(w_H|I)v - \rho(w_L|I)\theta \geq 0$ . But the marriage may later end in divorce, when it becomes common knowledge that the husband's type is  $w_L$ . So a high feeling of guilt may initially sustain a marriage and subsequent investments in it but eventually it may not be enough to hold it together.

Still on proposition 2, we can glean some insight into the behavior of people who are ready to settle with a partner and make it clear that they are not into *playing games*. In other words, they are conveying the message that they are dead serious about pursuing a relationship and settling with someone. Hence, so long as they like a person (i.e.,  $v > 0$ ), they will definitely accept all invitations to go on romantic dates. This strategy increases the probability that only serious or sincere people will invite them out. Accepting an invitation may also be a *signal* that the invitee expects the inviter to be serious and sincere. Indeed, a higher probability of acceptance may be a signal of trust and also a signal of a huge cost of disappointment should the inviter turn out to be insincere (i.e., should player 1 be of type  $w_L$ ). Hence, the size of the guilt felt by the inviter for disappointing the invitee may be positively related to the invitee's acceptance probability. Therefore, by choosing a high acceptance probability, the invitee can impose a high cost of guilt on the inviter, should he disappoint her. This can sustain an equilibrium where the invitee chooses a very high acceptance rate as in proposition 2 and the inviter does not disappoint her. In this case, the invitee forces the inviter to hold a belief which makes him feel very guilty if he disappoints her and sustains an equilibrium with only sincere invitations. Dufwenberg (2002) refers to this phenomenon as *psychological forward induction*. Interestingly, we are able to obtain an equilibrium with only sincere invitations even if player 1 suffers no *ex post* guilt from inviting player 2 and disappointing her. In

our case, it is not a high guilt level that sustains sincerity but instead a very high acceptance probability by player 2.

In proposition 1, where  $\Pr(g_H) > 0$ , there are some insincere invitations in equilibrium while in proposition 2, where  $\Pr(g_H) = 0$ , there are no insincere invitations. One may then conclude that guilt breeds insincerity. But this may be inaccurate. We have assumed that guilt has no effect on social types or cannot change preferences. But it may well be that if a high level of guilt compels player 1 to invite player 2 even though his social type is  $w_L$ , then he may have done so as a way of *committing* to mentally prepare himself to enjoy player 2's company. This effect is not present in our model but in the real world, you could imagine someone saying that "if I am going to spend the next five hours with her, I have no choice but to make it a happy interaction". As Charness and Dufwenberg (2005) theoretically and experimentally demonstrate, guilt aversion and verbal promises can create commitment power which may foster trust and cooperation. Therefore, whether guilt aversion leads to insincerity or mistrust depends on the context.

Loury (1994, p. 435) defines a regime of political correctness as "... an equilibrium pattern of expression and inference within a given community where receivers impute undesirable qualities to senders who express themselves in an "incorrect" way and, as a result, senders avoid such expressions." Similarly, Morris (2001, p. 233) defines political correctness as phenomenon where "... because certain statements will lead listeners to make adverse inferences about the type of the speaker, speakers have an incentive to alter what they say to avoid that inference". To the extent that politically-correct language is employed to accommodate those that one does not like or cannot identify with, the strategy by player 1 (the sender) of inviting player 2 (the

receiver) when her type pair is  $\{w_L, g_H\}$  is consistent with political correctness. Indeed, political correctness can sensitize people and increase the probability,  $q$ , that they will be high-guilt types. However, it may have the disadvantage that people are more likely to be suspicious of each other's intentions and hence a decrease in social interactions akin to the higher likelihood of rejections as in the equilibrium in proposition 1 compared to the equilibrium in proposition 2. A politically-correct equilibrium could be viewed as one in which some  $w_L$  types mimic  $w_H$  types. Of course, in this equilibrium there will still be a few people who will deviate from the politically-correct equilibrium. This will be the group of senders with the type pair  $\{w_L, g_L\}$  who constitute a small proportion,  $(1-p)(1-q)$ , if  $q$  is very close to 1.<sup>11</sup>

So is political correctness a bad thing if it causes people to be suspicious of the intentions of others? Not necessarily. One thing missing from the model is that person 2 does not derive any disutility from not being invited (i.e., from being rejected). If she did, then we could argue that she derives utility from the mere act of being invited even if she intends to reject the offer. Therefore, political correctness need not be a bad thing if people derive utility from politically correct language *per se*. For example, people may derive utility from others restraining their use of racial slurs or derogatory language, even if they know that these people harbor such thoughts. If they do not value political correctness *per se*, then it could be welfare reducing.

In a related but different context, Morris (2001) finds that political correctness could lead to the suppression of socially valuable information. For example, a policy

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<sup>11</sup> The result that people with sufficiently extreme preferences will deviate from social norms is obtained in Bernheim (1994). Indeed, Battigalli and Dufwenberg (2005) show that Bernheim's model can be given a psychological-game interpretation.

advisor who does not want to be perceived as racist may recommend an affirmative action policy when in fact he believes that affirmative action is a bad policy.<sup>12</sup>

Notice that the condition in equation (1) holds when  $\theta$  is sufficiently high. A very high  $\theta$  may be the characteristic of a person with a very high sense of identity or self-image, which is consistent with why she may derive a high disutility from associating with people who really don't like her. Associating with people who really do not like her imposes a cost on her similar to the cost stemming from a loss of identity in Akerlof and Kranton (2000).<sup>13</sup> If so, the rejection of 1's invitation when  $\theta$  is very high may be 2's way of choosing her identity by choosing who to associate with, in the sense of Akerlof and Kranton (2000). Consistent with Akerlof and Kranton (2000), my model will predict that women may reject attempts to entice them to traditionally male professions, if they believe that they will only be tolerated but not truly accepted. A difference between my explanation and Akerlof and Kranton (2000) is that identity is an observable characteristic while intention is not. Intention can be inferred but not necessarily observed.

The analysis may also explain why a *high-ability* person may decide to reject a job offer, if she believes that affirmative action influenced the decision.<sup>14</sup> Of course, this effect is more likely to kick in, if the person has equally-attractive or better outside

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<sup>12</sup> Note that the use of racial slurs, for example, does not convey any socially valuable information. So the argument in Morris (2001) is different from the argument in the preceding paragraph.

<sup>13</sup> For recent economic models of identity, see Darity, Mason, and Stewart (2006) and Fang and Loury (2005).

<sup>14</sup> An article in the New York Times reported that a young and talented Harvard professor claimed that s/he would leave Harvard, if s/he found out that s/he was hired based on affirmative action. While this may not necessarily be credible, it is nevertheless further testimony of the fact that the intentions behind actions affect people's payoffs.

options, which she believes were not influenced by affirmative action.<sup>15</sup> If high-ability people are very proud people with a high sense of identity and self confidence then, as argued in the preceding paragraph, they will tend to have a high  $\theta$  and would not like to associate with people who do not really like them.

The analysis has been based on the assumption that player 1 incurs no cost if his invitation is rejected. It is conceivable that if and only if his social type is  $w_H$ , he might find a rejection embarrassing.<sup>16</sup> The absence of this cost explains why if player 1's social type is  $w_H$ , he always invites player 2. However, we sometimes do not invite certain people into closer relationships not because we do not like them. On the contrary, we like them but we are not sure if it is appropriate to invite them. By keeping the relationship at the original lower level, we do not rock the boat. Indeed, a rejection can even push the relationship to a much lower level. For example, imagine how telling a friend that you are romantically interested in them could damage a hitherto platonic and exciting friendship if your proposal is rejected.

Including this cost of rejection or embarrassment to player 1 will not alter the equilibrium in proposition 2. Note that including the cost of rejection to player 1 will induce player 2 to moderate her rejection rate in order to encourage player 1 to invite her if player 1's social type is  $w_H$ . Suppose  $k > 0$  is the cost of rejection or embarrassment to player 1 when his social type is  $w_H$ . Then he will not invite player 2, if  $\sigma k - (1-\sigma)w_H > g_i$ ,  $i = L, H$ . This holds if  $k$  is sufficiently high. Notice, however, that since  $\sigma = 0$  ensures that

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<sup>15</sup> Notice also that if all that the person cared about was actions *not* intentions, then it may be optimal to accept a job from a high-guilt employer in order to exploit their guilt for material gain (e.g., future higher salary).

<sup>16</sup> Of course, he does not suffer this cost if his social type is  $w_L$ , since he wants his offer to be rejected in this case anyway.

player 1 suffers no cost of rejection, the equilibrium in proposition 2 remains unchanged. Introducing the cost of rejection only strengthens the equilibrium in proposition 2.

#### **4. Conclusion**

I have presented a very simple game of intentions in social interactions in which one player (the inviter) can invite another player (the invitee) into a social relationship. The invitee, who cares about the intentions of inviter, can accept or reject the invitation. This game involves *endogenous updated beliefs* as in Battigalli and Dufwenberg (2005).

This psychological game gave rise to a complex social interaction. In particular, there is a unique equilibrium in which an invitee sticks to a strategy of accepting every invitation with the goal of discouraging insincere invitations. This may lead one to *erroneously* infer that this player is eagerly waiting for an invitation from the inviter, when indeed her behavior is driven more by strategic considerations than by an excessive desire for social acceptance.

The discussion shows that while models of interdependent preferences as studied in Gul and Pesendorfer (2005) can capture phenomena that psychological games seek to address, the intuition, motivation, or explanation for the *same* phenomenon may be *different*.

My main contribution lies in the type of social interactions examined and the applications discussed which differ from those in previous papers. To the best of my knowledge, it is the first model to combine a psychological game with interdependent preference types as studied in Gul and Pesendorfer (2005).



The literature on psychological games is small. This partly stems from the fact that psychological games are more difficult to analyze than standard games. However, the tools of psychological game theory allow us to study certain important social phenomena like the nature of reciprocity as in Rabin (1993), Falk and Fischbacher (2006) and the multiplicity of other phenomena discussed in Battigalli and Dufwenberg (2005). I have presented another important social phenomenon which appears to lend itself easily to the tools of psychological game theory.<sup>17</sup> This social interaction is interesting and common. To re-iterate, it is the basis of friendships and relationships at work, school, and in our daily lives. It determines how often we go to lunch with someone, talk to them over the phone, invite them for dinner, play with them, sleep with them, and in general socialize with them. It determines the frequency with which people invite us into their lives and the corresponding frequency with which we accept those invitations. It could also determine how genuine people think our gratitude is, when we express it. I hope that future work will extend the analysis of the effect of intentions on this type of social interaction. For example, the idea in this paper could ultimately lead to a theory of optimal paranoia or optimal mistrust.<sup>18</sup>

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<sup>17</sup> The complementary models developed in Gul and Pesendorfer (2005) and Segal and Sobel (2006) are also helpful in examining interesting social phenomena.

<sup>18</sup> I thank Zane Spindler for this observation.

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