On Smiles, Winks, and Handshakes: Can They Enhance Coordination?*

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Abstract:

In an experimental study we focus on a variant of the '*minimum effort game*', a coordination game with Pareto ranked equilibria, and risk considerations pointing to the least efficient equilibrium. We examine whether simple signals such as smiles, winks and handshakes could be employed and recognized by the players as a telltale sign of each other's *trustworthiness*, thus enabling them to coordinate on the more risky but more rewarding Pareto efficient equilibrium. Our experimental results show that such cues can indeed play a role as coordination devices.

J.E.L. classification codes: C72, C91, C92.

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1. Introduction

Many social interactions can be modeled as coordination games. An example is driving on the left- or right-hand side of the road. Another example is meeting with somebody at an airport. In these games, the players have a common interest, and various actions could lead to good outcomes, but the desired outcomes are only achieved if the players coordinate on the same action. In this paper we will focus on coordination games in which the equilibria can be Pareto ranked. In such games the players face a double coordination problem. First, they want to coordinate on an equilibrium, and second, they prefer to do so at the best equilibrium. Since players need to choose an action *before* knowing the action(s) of the other player(s), to go for the Pareto efficient equilibrium, what is crucial is that "*they can trust each other*" (Harsanyi & Selten [1988], p. 89) to do so. In other words, the players need some shared understanding of the situation and of the appropriate course of action this implies. There is some game-theoretic as well as the experimental literature focusing on the idea that explicit preplay communication may (or may not) help to establish such trust (see, e.g., Harsanyi & Selten [1988], Aumann [1990], Farrell & Rabin [1996], Charness [1998], or Clark et al. [2001). In this paper we will follow a *different* track. That is, we will explore experimentally the idea that there is *more* to establishing trust than explicit communication.

There is a growing body of (sometimes casual) empirical evidence that simple cues play an important role concerning the perception of trustworthiness.[1] Such cues may be unconscious, hard-wired and shaped through evolution (as seems to be the case for some body language, facial expressions, or tone of voice), but they may also be the result of deliberate *choice behavior*. Smiles, winks, handshakes, hair-styles, tattoos, dressing codes, and personalized numberplates may fall in the latter category, signaling to other people a certain '*attitude*' or trustworthiness. These cues may play a role in casual, anonymous encounters, e.g., in traffic (pedestrian or otherwise), in which no explicit preplay communication is possible, but more importantly also in many situations where there is scope for extensive communication.

For example, if there are two things concerning job interviews about which there is almost perfect consensus among the specialists, it is that the first minute is the crucial one, and that a candidate needs to make eye contact, smile, and give a firm handshake. Handshakes are essential for members of masonic lodges too. They use a '*secret handshake*' to tell the '*insiders*' from the '*outsiders*'.[2] A smile is recognized as an important asset for many businesses, as it is the first thing most people notice about others, and many people withhold custom from businesses that they perceive as being '*unfriendly*'.[3] Most important business deals are probably not based on a smile alone. But the details of important business deals are only worked out and negotiated if trust is present. And this is the main reason why important business communication tends to be conducted face-to-face, even in the age of the Internet. As London [2001] puts it, "a *good Chardonnay and a firm handshake are still worth a million bytes*". Trust in business dealings is established within a framework of explicit and tacit understandings regarding interaction routines and exchange practices, for which the relevant social norms may differ from country

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[1] See, e.g., Snijders [1996] and the references therein.

[2] A game-theoretic analysis of the evolutionary stability of '*secret handshakes*' can be found in Robson [1990].

[3] See Sherwin [2001].

to country. A recent series of articles in the Financial Times, reviewing business methods in various countries, illustrated the importance in this respect of factors such as the decorum that surrounds meeting and greeting, the use of first names or full titles, handshakes and direct eye contact, hugging, kissing and comfort distances, and clothing.[4] Establishing trust is equally important in international relationships, and the methods employed are similar too, with a distinguished role for etiquette and chivalry in diplomatic practice. Even when two countries have been in conflict for a long time, the first eye contact between new leaders is often considered to be of crucial importance for the future of the conflict. An example showing that such cues may play a role not only in establishing trust between people who meet for the first time, but even in maintaining trust in the case of repeated interactions is the one concerning long-standing doctor-patient relationships. Patients who do not trust their doctor to have done everything he could to prevent their unfortunate health states take their resort increasingly to lawsuits. Scheck [2000], therefore, suggests the following trust-building mechanism to dermatologists: "*A smile a day keeps the lawsuits away*". Finally, many people have raised the practice of using cues to establish trust to an art form: '*flirting*'.

In other words, there is some evidence that common manifestations such as handshakes, smiles, or winks can be used to establish trust. Therefore, in this paper we will test experimentally in a common interest game with Pareto ranked equilibria whether such simple cues could play a role in achieving efficient coordination.

To consider this question, our starting point is a variation of the '*minimum effort game*' (see Van Huyck et al. [1990]). We organize a laboratory experiment in which this game is played pairwise and repeatedly, but each time with a randomly chosen opponent. In each round of the game, both players simultaneously choose an '*effort level*'. The payoff of each player depends on his own choice of effort level and the minimum of the two choices. Any coordinated outcome, i.e., any outcome in which both players choose the same effort level, is an equilibrium with symmetric payoffs. The equilibria can be Pareto ranked, and the efficient equilibrium is the one in which both players choose the highest effort level. The equilibrium with the lowest effort choices and payoffs, however, is less risky, because each player can be certain not to have chosen a greater effort level than his partner. The special interest of this game lies in the fact that there is some considerable tension between payoff and risk considerations, and experimental evidence has shown that the amount of trust needed for a player to go for the more risky Pareto superior equilibrium implies a serious coordination problem. In general, players do not succeed in coordinating on the Pareto efficient equilibrium. Therefore, this seems a particularly suitable game to study the question how the necessary trust to achieve efficient coordination may be established.

In this paper we examine the following possibility. Before players choose their action in this tacit coordination game, they are casually asked to communicate their readiness for the next round to their opponent. A player can do so in two different ways. He can indicate that his current state is a plain '*ready*', or that it is '*smiling*'. The question, then, is whether these vague state messages, which are as such unrelated to the specifics of the game, acquire *endogenously* a commonly understood meaning, and will be established as a signaling device enabling the players to achieve coordination on the Pareto

[4] See Frank [2000, 2001a, 2001b, 2001c, 2001d].

efficient equilibrium. That is, could the players recognize and exploit the opportunity of reporting their current state to send a reliable signal of their trustworthiness, such that the state reports submitted by the players act as a cue foreshadowing a common understanding that allows them to feel reassured enough to go for the more risky (but potentially more rewarding) strategy of the Pareto dominant equilibrium?

Varying details of this preplay stage, while playing the same tacit '*minimum effort game*', we examine three different treatments. In the base treatment, the two players report their current state costlessly and simultaneously before they make their effort level choices. In a second treatment, we introduce small costs of reporting a '*smiling*' state. In addition to these costs, in the third treatment, the players communicate their current state sequentially. The main findings of our analysis can be briefly summarized as follows.

- *Frequency of smiles*: Smiling is practiced by a considerable minority of the players. When we introduce a small cost of smiling, the frequency of smiles is significantly lower than with free smiles. When the players are asked to communicate their readiness for the next round sequentially, the frequency of '*smile-smile*' pairs is significantly higher than in the simultaneous treatment.
- *Effort levels*: The average effort levels in '*smile-smile*' pairs is significantly greater than in mixed pairs or in non-smiling pairs. The average effort level is significantly greater with costly smiles than with non-costly smiles, both in same signal and mixed signal pairs, whereas the average effort level of pairs without smiles does not differ significantly across treatments.
- *Payoffs*: The average payoff in '*smile-smile*' pairs is significantly lower than in other pairs.

In other words, the players realize they can use their state report as a signaling device, the smiles are used and recognized as genuine telltale signs of trustworthiness, but the evolution of signaling and effort level choices in our experiment does not prevent inefficient coordination.

The rest of the paper is organized as follows. In section 2 we present the game and the treatments. The details of the experimental procedures are described in section 3, whereas the hypotheses to be tested are spelled out in section 4. The results are presented in section 5, and section 6 concludes.

2. The game and the treatments

In this section we first present the underlying tacit coordination game that we employed throughout the experiment, and then explain how our experimental design offered the players the opportunity to develop a '*secret handshake*', and the details of the different treatments in this respect.

We study a variation of the '*minimum effort game*' as presented by Van Huyck et al. [1990]. This tacit coordination game resembles a typical team situation. First, all team members simultaneously choose an individual '*effort level*'. The payoff of the team is, then, determined by the minimum of the chosen levels. Finally, each individual receives the team payoff minus the cost of his own effort exerted. In this class of games, two incentives work against one another. On the one hand, each player's additional payoff from increasing the team's minimum effort level is always greater than his marginal effort. On the other hand, each player has to bear his own effort cost, but only the minimum level is relevant for the team payoff. Hence, only combinations of strategies with all players choosing exactly the same effort level are equilibria of the game, with the payoff dominant one being the one in which all players exert the maximum possible effort. The payoffs of the game in the parameter setup we study are presented in the player interface reproduced in Figure 1. In our experiment this game was played pairwise for fifty rounds, with the players being randomly matched in each round. The instructions to the subjects can be found in Appendix A1.

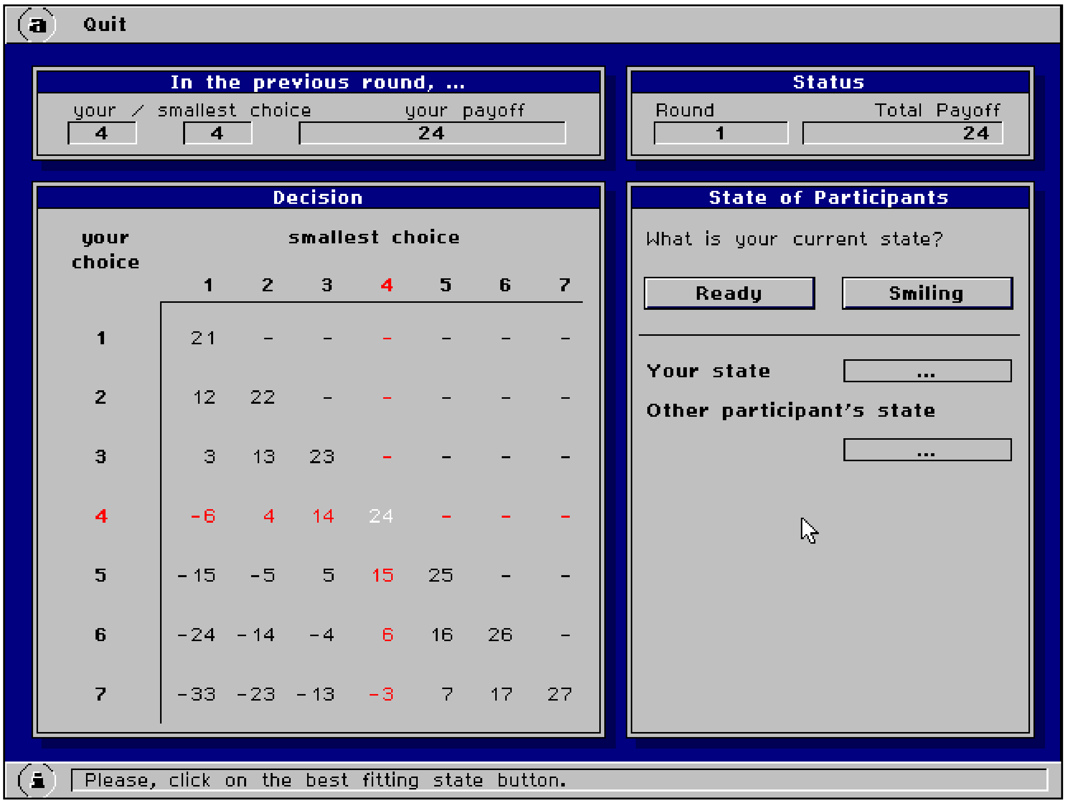

Figure 1 Player interface

As can be seen, coordinating on the efficient equilibrium is risky, because the cost of a coordination failure is high for a player choosing a high effort level. For example, a player who chooses '*7*' when his team mate chooses '*1*', suffers a loss of 54 points compared to having also chosen '*1*'. Furthermore, the advantage of being coordinated is relatively small, since players who coordinate on the efficient equilibrium (both choosing '*7*') earn only 6 points more than playing the '*safe*' strategy (choosing '*1*'), for which no coordination is necessary. Therefore, this particular parameterization of the game implies that a great deal of trust is needed to go for the Pareto efficient equilibrium, and hence it seems well-suited for the examination of the emergence of a cue telling the trustworthy from the others.[5]

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[5] In Van Huyck et al. [1990], whilst coordination on the efficient equilibrium is achieved if agents are paired repeatedly with the same opponent, no coordination is attained when subjects are randomly paired round after round. Berninghaus & Ehrart [1998], however, suggest that this result may be sensitive to the number of rounds

We now turn to the preplay phase of each coordination game. At the outset of every new round, each player was asked to report one and only one of two possible states: '*ready*' or '*smiling*'. Each round would start only after all players had pressed one of their state buttons. These buttons can be seen in the player interface in Figure 1. Hence, a choice had to be made, and no default was given.[6] In all treatments, these states were communicated to both players before they made their effort level choices.

In the base treatment (SimFree) both players would indicate a state *simultaneously*, i.e., each had to select a state before having information on the state choice of the other player. Once they had both received communication of their state decision, they could choose their effort level in the coordination game. What is more, either state could be reported with *no costs*. Our experiment involved two more treatments: a *simultaneous costly* signal treatment (SimCost), and a *sequential costly* signal treatment (SeqCost). In the costly signal treatments (SimCost and SeqCost), reporting a '*smiling*' state incurred a minor cost of one half of a point, while reporting '*ready*' was for free. In the sequential signal treatment (SeqCost), one of the players was randomly chosen (with equal probabilities for both players) to report his state first. The state chosen was transmitted to the other player, who then chose his own state, which in turn was sent to the first player.

Hence, varying our two control variables, signal cost and signal order, allows us to check and to isolate the effects of both control variables in two-way comparisons. Comparing SimFree to SimCost informs us on the effect of introducing a signal cost, while comparing SimCost to SeqCost informs us on the difference between a simultaneous and a sequential signaling mode.

Notice that there are some slight differences in the equilibria of the three treatments. In the SimFree game, the outcome of any subgame-perfect Nash equilibrium consists of any of the Nash equilibria of the minimum effort game combined with any constellation of '*ready*' or '*smile*' signals. In both the SimCost and SeqCost games, however, the set of outcomes of subgame-perfect Nash equilibria can be characterized as follows. Any constellation of '*ready*' or '*smile*' signals can occur. If both players signal '*ready*', this can be followed by any of the Nash equilibria of the minimum effort game. But if at least one player sends a '*smile*', then it is followed by a Nash equilibrium of the minimum effort game with an effort level strictly *greater* than '*1*'. The explanation for the latter result is in both cases (SimCost and SeqCost) the same. If a player anticipates that his smile will be followed by the least efficient Nash equilibrium of the minimum effort game, he will not smile because it would give him a payoff of 20.5, whereas any equilibrium of any subgame if he sends a '*ready*' signal would give him a payoff of at least 21.

Before we explain the experimental procedures in the next section, let us make some observations concerning this preplay phase. First, the players are asked to express their *mood*. In principle, the reported state is a personal, non-interactive trait. The question, then, is whether the players will turn the

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played, with the coordination problem becoming less severe if the players know that they are going to play a larger number of rounds. See also Goeree & Holt [2001] on minimum effort games with various degrees of riskiness.

[6] See the instructions in Appendix A1 for the exact wordings used in the experiment. Notice, in particular, that we do not use the word '*effort*' in the experiment.

originally internal state report into an interaction tool, reporting their state to signal trustworthiness. In other words, we focus on cues that can be used in a deliberate, strategic manner as they are open to voluntary control.[7] In this sense our study complements the literature examining cues as the result of uncontrollable, emotional trembling of muscles (see, e.g., Ekman [1985], or Frank [1988]). Three experimental studies more in line with this latter approach, abstracting from the signaling and trust-building as choice behavior, are Ockenfels & Selten [2000], Eckel & Wilson [1998], and Scharlemann et al. [2001]. The former studies whether an audience is able to detect involuntary truth-signaling by players in a bargaining game, reporting a mainly negative finding. The latter two test the *effect* of facial expressions, either of stylized icons or of actual photographs taken from a database, in one-shot extensive-form games, and find significant (although weak) effects of smiling faces.[8]

Second, explicit communication in the coordination game presented in Figure 1 would be '*self-enforcing*'. For example, if a player could signal his intention to choose '*7*', then (assuming the other player believes him) he has no incentive to choose a different effort level. Moreover, if in the original tacit coordination game a player's risk considerations led him to choose '*1*', then he would have no incentive to signal an intention of choosing any higher effort level.[9]

Third, we examine '*two-way communication*', i.e., both players are required to communicate their current state. This can lead to signal conflict problems. For example, one party may send a signal suggesting a high effort, without receiving such a signal from the other side. In such a case, it is hard to tell whether the sender will actually stick to the signaled action or not. Since he did not receive a signal, it is not clear why he should expect that the other player will coordinate on the best equilibrium. Hence, for a stable and reliable signal to emerge, the players must learn to overcome this signal coordination problem. That is, the coordination of the signaling process itself is endogenous. As is well-known, one-way communication may lead to improved coordination, as no mis-coordinated signals can arise (see, e.g., Cooper et al. [1989]). We consider two-way communication because we want to focus on signaling as *choice behavior*, and in some sense our sequential signaling treatment encompasses one-way signaling. That is, suppose that one-way communication would work, in the sense that after a smile both players would trust each other to go for the risky efficient equilibrium. If this were the case, then in our sequential treatment SeqCost it would be straightforward for the second player to confirm this common understanding by replying with a smile.

Fourth, throughout the paper we will often use the words '*communication*', '*signal*' and '*signaling*' when we refer to the preplay stage in which the players express their readiness for the next round,

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[7] As Scheck [2000] recommends in her lawsuit prevention model: "*I don't care what kind of day you are having -- fake it*" (p. 2).

[8] Our paper complements these latter two studies also in the sense, first, that in our common interest game trust does *not* conflict with equilibrium behavior, and second, that we study the *evolution* of the meaning of a smile.

[9] See, e.g., Harsanyi & Selten [1988], Farrell [1988], or Aumann [1990]. Of course this does not rule out equilibria such as '*babbling equilibria*', in which players send random messages, and the receivers just ignore them. At the theoretical level, inefficient equilibria of this sort can be ruled out by appealing to refinements that presuppose a commonly understood meaning of the signal (which may or may not be believed - see, e.g., Farrell [1993]). However, this is not possible in our experiment, where the meaning of a signal is not clear *a priori*, and a player may fail to interpret the signal in the same way as his opponent.

reporting their current state. It should be noted, however, that the preplay phase of our experiment is different from cheap talk in experiments in which players are *explicitly* asked to announce their planned action, which they could possibly do strategically (see, e.g., Cooper et al. [1992], Charness [1998], or Clark et al. [2001). The game in our experiment is also not a signaling (or sender-receiver) game, as *all* subjects play the *same* symmetric complete information game presented in Figure 1.[10] Blume et al. [1998] studies the endogenous evolution of the meaning of signals in such sender-receiver games, with the payoffs of each type of sender being common knowledge.[11] The message space is *a priori* meaningless, and the question is whether the players can learn to reach a common understanding as to the meaning of the abstract signals, distinguishing the various types of senders. Our experiment complements this study in the sense that the interest of the game in Blume et al. lies in the fact that there is incomplete information, whereas in our experiment there is only one type of player, with the coordination problem arising because of the tension between payoff and risk considerations. Moreover, in our experiment the players are not told that there is any relation between the preplay phase and the coordination game. They need to discover themselves that they could use the state reports as a signaling device to elicit trust in the game to be played. In other words, whereas Blume et al. focus on the evolution of the meaning of signals (as there is no doubt as to which signals are available and why they should be used), our paper makes a further step towards studying the emergence of signaling itself.

Fifth, and related to the previous point, we consider a *pocket-sized* signaling space, which, in particular, is smaller than the action space. The essential reason for this is that the objective of our paper is exactly to examine the relevance of simple cues in achieving efficient coordination. In this sense our experiment complements the cheap talk experiments that use a much richer language. Notice that the fact that the signaling space is smaller than the action space needs not prevent efficient coordination. Since *all* players prefer to coordinate on the *same*, Pareto efficient equilibrium, to achieve efficient coordination they need only one thing: *trust*. The signal space in our experiment allows the emergence of a cue telling the trustworthy from the other players. This is different from sender-receiver games, in which typically the number of types of senders corresponds to the number of available actions, with each type preferring to coordinate on a different action (see, e.g., Blume et al. [1998]). In those games, the size of the signal space needs to match that of the action space to allow the players to distinguish all types and to coordinate on the efficient equilibrium.[12]

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[10] Obviously, this is not strictly true to the extent that subjects may have different risk-attitudes. Notice, however, that even if we had perfect experimental control of the subjects' preferences, the whole issue of equilibrium selection, and the role of trust therein, would remain equally relevant.

[11] According to Crawford [1998], this is the only other experimental study in which the endogenous determination of the meaning of signals is studied.

[12] There is also an extensive evolutionary literature on equilibrium selection in coordination games, establishing conditions under which only efficient equilibria are consistent with various notions of evolutionary stability, and discussing in particular also the issue of the size of the signal space (see, e.g., Wärneryd [1991, 1993], Blume, Kim & Sobel [1993], Weibull [1995], Blume [1998], and Hurkens & Schlag [2000]).

3. Experimental procedures

The experiment was conducted at the University of Bonn (*Laboratorium für experimentelle Wirtschaftsforschung*) in Germany between the summer of 2000 and spring of 2001. Our subject pool consisted mainly of students of law and economics. The subjects voluntarily signed up for the experiment one or two weeks before the session. They were given no information concerning the contents or goals of the experiment beforehand. They were randomly assigned to one of the three treatments.

The experiment was computerized using *RatImage* (Abbink and Sadrieh [1995]). The subjects were seated in closed cubicles throughout the session. Upon arrival at the laboratory, each participant drew a card that determined the cubicle in which he took a seat. After all participants were seated, the written instructions (see Appendix A1) were read aloud by the experimenter. All questions were answered individually, inside the cubicle.

Sixteen participants took part in each session. The subjects were divided into two independent groups of eight participants in each session. The members of an independent group only interacted with subjects from within that group. The subjects were not informed of the size of the independent groups. They were only told that they would be randomly matched to some other participant in every round.

Eight observations, i.e., eight independent subject groups, per treatment were planned. The plan was met for the simultaneous non-costly (SimFree) and the sequential costly (SeqCost) signals treatments. But, due to a technical problem, one session had to be canceled, so that only six observations could be realized in the simultaneous costly signal (SimCost) treatment.

The experiment consisted of fifty rounds, which was known to the players. At the outset of each round, the eight members of each independent group were randomly matched to form four pairs. Then the signaling phase started. In the simultaneous signaling treatments, all signaling decisions were collected and then redistributed to the corresponding pairs. In the sequential signaling treatment, half of the subjects were randomly chosen to be the first movers in the signaling phase. Their signals were collected and sent to their partners. Then the signals of the second movers were collected and transmitted to the corresponding first movers. This procedure had been described to the subjects. It was emphasized that in any given round it is equally likely for each player to become first or second mover in the signaling phase. The signaling phase was followed by the tacit coordination game, in which all effort level choices of the subjects were collected. After all decisions were made, each subject would be shown his own choice plus the smallest value chosen in his match (but not by subjects in any other pairs), and the next round began.

The final payoffs of the subjects were equal to the sum of their payoffs over the fifty rounds, plus a DM 3.50 show-up fee. The experimental exchange rate was DM 3.50 per 100 points, and the average earnings per player was about DM 47. The duration of a session was between 70 and 100 minutes, including the time for instructions and post-experimental debriefing. The currency exchange rate at the time of the experiment was approximately $ 0.48 for DM 1.00.

4. The Hypotheses

Starting with the basic question whether a cue of trustworthiness enabling coordination on the efficient equilibrium emerges, and taking into account the two treatment variables (signal cost and signal order), we divide the hypotheses into three groups. First, if such a cue emerges, a number of predictions can be made about the average effort level choices and resulting payoffs within each treatment. We summarize these predictions in the hypotheses 1 and 2. While hypothesis 1 conveys what it means for a signal to be reliable, hypothesis 2 is based on the fact that coordinated play leading to efficient outcomes should increase the payoffs of subjects.

> **Hypothesis 1:** If a practice of smiling emerges, pairs using the signal will choose higher effort levels on average than non-smiling subject pairs.

> **Hypothesis 2:** If the smile is used as in hypothesis 1, then the average payoff of a player in a pair using that signal will be higher than that of other subjects.

Second, the essential purpose of the introduction of a signaling cost was to deter non-meaningful signaling, so that a small penalty would be enough to break indifferences, leading to a reduction of '*noisy*' signals, i.e., smiles that were not intended as coordination devices. This results in our hypotheses 3 and 4. Note that hypothesis 4 is congruent with the characterization of subgame-perfect equilibria given in section 2, where the lowest effort level of '*1*' was ruled out in pairs with at least one costly smile.[13]

> **Hypothesis 3:** Costly smiles will be less frequent than non-costly ones.

> **Hypothesis 4:** Costly smiles will be more likely to be used as coordination devices for high effort level choices than non-costly ones. That is, higher average effort levels will be observed in signaling pairs with costly smiles than in signaling pairs with non-costly smiles.

Third, the signal order treatment variable was introduced to gain some insight into the effects of the signal conflict problem of the simultaneous two-way communication treatments. In the post-experimental debriefings of the simultaneous signal sessions some subjects reported having been surprised frequently by the signal they received, and having regretted the lack of an opportunity to adjust their signal choice correspondingly. Especially when the signals were costly, thrifty non-signaling players often expressed regret for not having been able to revise their signal choice to '*smiling*', after having received a '*smiling*' signal from the other player. This inspired the following hypothesis 5.

> **Hypothesis 5:** Sequential signaling will lead to less signal conflicts than simultaneous signaling, i.e., to a smaller number of mixed signal pairs.

[13] Hypothesis 4 is also based on the same intuitive argument on which the forward induction solution is based.

5. The Results

In this section we give a detailed analysis concerning the signaling frequency, effort levels, and resulting payoffs separately. We first present in Tables 1, 2 and 3 a summary for each of the treatments SimFree, SimCost, and SeqCost, respectively.[14] In each row, the statistics for one of the possible signal constellations is presented. All statistics reported are the average of the corresponding statistics for the independent observations. Since each independent observation consists of eight subjects playing 50 rounds, the frequencies of the different signal constellations sum up to a total of 200 pairwise cases for each independent observation. Notice that in the case of simultaneous signals, i.e., in SimFree and SimCost, a differentiation between '*ready-smile*' and '*smile-ready*' pairs is meaningless, while it makes sense in the case of sequential signals, i.e., in SeqCost. For the across treatment comparisons the data of the two mixed signal configurations are pooled in SeqCost. These pooled statistics are shown in the extra columns inserted for the mixed signal constellations in Table 3.

[14] More detailed tables can be found in Appendix A2.

Table 1: Treatment SimFree – Simultaneous and Non-Costly Signals

<table>
<tr><th>signal constellation</th><th>number of cases
(% of all cases)</th><th>average effort level
(standard deviation)</th><th>average payoff
(standard deviation)</th></tr>
<tr><td>ready – ready</td><td>84.13 (42.06%)</td><td>1.46 (1.34)</td><td>17.74 (10.40)</td></tr>
<tr><td>ready – smile</td><td rowspan="2">91.25 (45.63%)</td><td rowspan="2">1.54 (1.31)</td><td rowspan="2">17.53 (10.16)</td></tr>
<tr><td>smile – ready</td></tr>
<tr><td>smile – smile</td><td>24.63 (12.31%)</td><td>2.29 (1.69)</td><td>14.15 (14.39)</td></tr>
<tr><td colspan="4">Averages of the corresponding variables over the 8 independent observations</td></tr>
</table>

Table2: Treatment SimCost – Simultaneous and Costly Signals

<table>
<tr><th>signal constellation</th><th>number of cases
(% of all cases)</th><th>average effort level
(standard deviation)</th><th>average payoff
(standard deviation)</th></tr>
<tr><td>ready – ready</td><td>158.17 (79.08%)</td><td>1.60 (0.97)</td><td>19.30 (7.30)</td></tr>
<tr><td>ready – smile</td><td rowspan="2">39.33 (19.67%)</td><td rowspan="2">2.25 (1.63)</td><td rowspan="2">14.62 (13.58)</td></tr>
<tr><td>smile – ready</td></tr>
<tr><td>smile – smile</td><td>2.50 (1.25%)</td><td>4.63 (1.80)</td><td>12.30 (16.00)</td></tr>
<tr><td colspan="4">Averages of the corresponding variables over the 6 independent observations</td></tr>
</table>

Table 3: Treatment SeqCost – Sequential and Costly Signals

<table>
<tr><th>signal constellation</th><th colspan="2">number of cases
(% of all cases)</th><th colspan="2">average effort level
(standard deviation)</th><th colspan="2">average payoff
(standard deviation)</th></tr>
<tr><td>ready – ready</td><td colspan="2">161.25 (80.63%)</td><td colspan="2">1.39 (1.04)</td><td colspan="2">18.34 (8.01)</td></tr>
<tr><td>ready – smile</td><td>10.50
(5.25%)</td><td rowspan="2">26.00
(13%)</td><td>2.29
(1.73)</td><td rowspan="2">2.01
(1.59)</td><td>13.26
(13.55)</td><td rowspan="2">14.17
(12.72)</td></tr>
<tr><td>smile – ready</td><td>15.50
(7.75%)</td><td>1.76
(1.39)</td><td>15.69
(10.96)</td></tr>
<tr><td>smile – smile</td><td colspan="2">12.75 (6.38%)</td><td colspan="2">3.96 (1.97)</td><td colspan="2">10.99 (16.11)</td></tr>
<tr><td colspan="7">Averages of the corresponding variables over the 8 independent observations</td></tr>
</table>

5.1. Frequency of Signal Constellations

In the SimFree treatment, the overall frequency of '*ready-ready*' pairs is almost equal to the frequency of mixed signal pairs and significantly greater than the frequency of the '*smiling-smiling*' pairs (Wilcoxon signed ranks test, $\alpha < 1\%$, one-tailed). In the other two treatments (SimCost and SeqCost), the general observation is that the frequency of '*ready-ready*' pairs is significantly greater than the frequency of mixed signal pairs, which in turn is significantly greater than the frequency of the '*smiling-smiling*' pairs (Wilcoxon signed ranks test, $\alpha < 2\%$, one-tailed).

Comparing the column 'number of cases' across the three tables reveals that non-costly smiles are much more frequently used than costly ones. In the non-costly signal treatment SimFree players smile on average 35 percent of the time, while this is 11 percent in the costly SimCost treatment (and 13 percent in the SeqCost treatment). The difference is significant at a level of $\alpha < 1\%$, one-tailed (Mann-Whitney U-test). Thus, signal cost clearly has the effect predicted by our hypothesis 3.

Although signal order does not seem to have an effect on the frequency with which subjects choose to report the '*smiling*' state, it does have a significant effect on the avoidance of signal conflicts as predicted by hypothesis 5. There are significantly less mixed signal pairs *and* significantly more '*smile-smile*' pairs in the sequential signal treatment SeqCost than in the simultaneous signal treatment SimCost (Mann-Whitney U-test, $\alpha < 5\%$, one-tailed). In fact, in the simultaneous SimCost treatment, 88.7 percent of the smiles occur in mixed pairs, while this is 50.5 percent in the sequential SeqCost treatment.

Figure 2, which depicts the development of signal constellation frequencies in ten-round blocks for each treatment, shows that although there are no clear trends in the development of the distribution of signal constellations over time, there are some interesting developments. For example, the relative frequency of mixed signal pairs rises over time in the SimCost treatment, while it falls in the SeqCost treatment.[15]

[15] The increase of the frequency of mixed pairs in SimCost is significant at $\alpha < 10\%$ (Wilcoxon signed ranks test; one-tailed), whereas the decrease in SeqCost is significant at $\alpha < 5\%$ for the same Wilcoxon test.

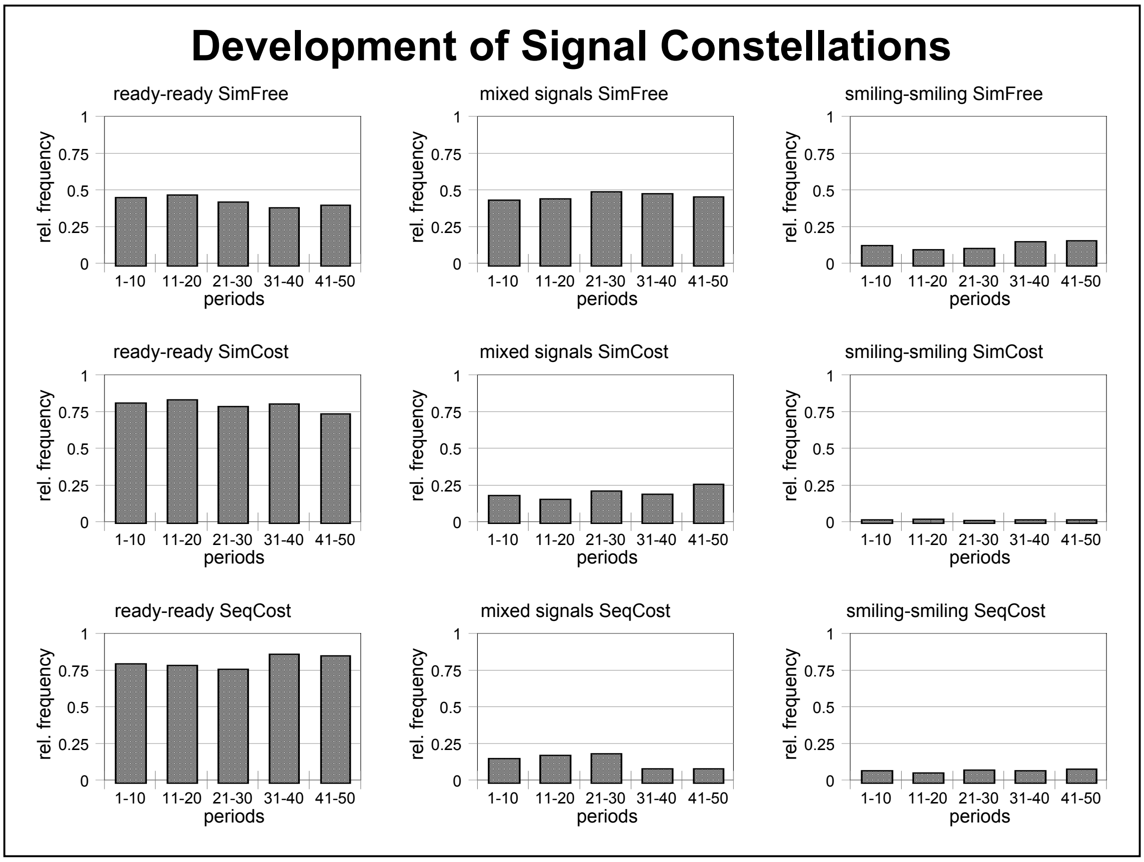

Figure 2

5.2. Choice of Effort Levels

One of the important questions of our analysis is whether effort level choices are correlated to the signal choices. Figure 3 reports for each treatment the distribution of all effort levels across all rounds for each independent observation, i.e., group of eight players, distinguishing again the various signal constellations. The thick lines identify the median effort level for each group, the boxes represent the 25th and 75th percentile, and the whiskers the 5th and 95th percentile.

We make the following observations. First, in all treatments the median effort in '*ready-ready*' pairs is always '*1*' with just one exception in the SimCost treatment. Second, in the costly treatments (SimCost and SeqCost), the median effort level in smiling pairs is always above the minimum effort of '*1*', and it is always higher than in the '*ready-ready*' pairs (with a single exception, which is the same as the one above). Third, for each of the three treatments there is a group for which the median effort level chosen by smiling pairs equaled the maximum possible effort ('*7*').

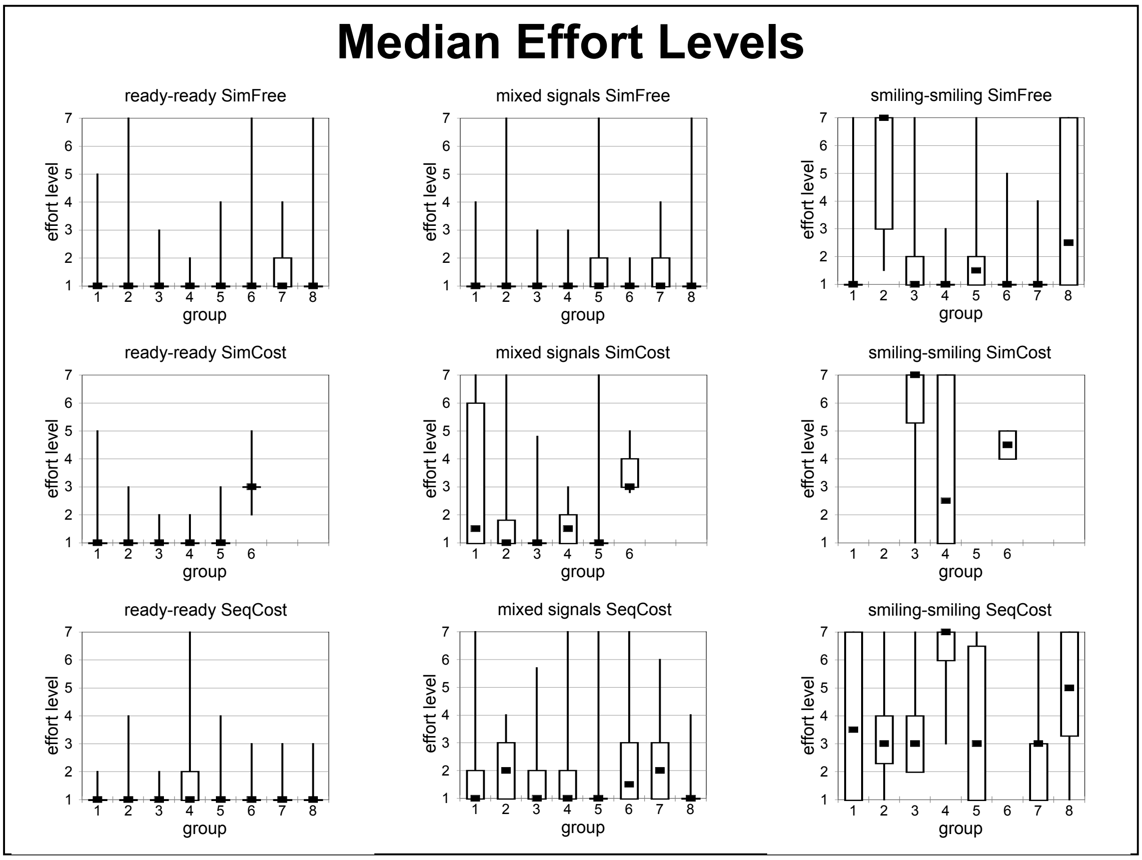

Figure 3

The average effort level chosen by subjects in each of the possible signal constellations of each treatment was shown in Tables 1, 2, and 3 above. In all three treatments, the average effort level increases with the number of smiles. It is lowest in the non-smiling pairs and highest in the smiling pairs, with the mixed signal pairs taking the middle position. This supports hypothesis 1, which predicted higher effort levels in signaling pairs. Statistical tests provide further evidence for hypothesis 1. In the simultaneous non-costly signal treatment SimFree, the subjects in '*smiling-smiling*' pairs choose significantly higher effort levels than the subjects in the mixed signal pairs and the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 5\%$, one-tailed). The difference between the mixed and the '*ready-ready*' pairs is not significant. In the simultaneous costly signal treatment SimCost, the subjects in the mixed signal pairs choose significantly higher effort levels than the subjects in the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 2\%$, one-tailed). Since '*smiling-smiling*' pairs appear only in three of the six independent groups in this treatment, the tests cannot pick up significant differences between this and the other two constellations, even though the average effort level in these pairs is more than twice as high as in the other pairs. In the sequential costly signal treatment SeqCost, both tests are significant. Subjects in the '*smiling-smiling*' pairs choose significantly higher effort levels than subjects in the mixed signal pairs, who in turn choose significantly higher effort levels than the subjects in the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 1\%$, one-tailed). Hence, smiling is used as a cue foreshadowing the choice of higher effort levels, especially if both players smile at each other.

Although all three treatments show the same type of correlation between state signal choice and effort level choices, there is a clear treatment effect. Comparing the average effort levels across treatments, we notice that there are no treatment differences concerning the effort level choices of '*ready-ready*' pairs. In both the mixed signal and the '*smiling-smiling*' pairs, however, the signal cost variable has a significant effect on effort level choices. This supports hypothesis 4, since subjects in these constellations choose significantly higher effort levels when the signal is costly than when the signal is non-costly. This result is clearly related to the significant drop in the frequency of observed smiles when a signal cost is introduced. The signal cost induces a self-selection, separating those who use the signal strategically from those who would use the signal for other reasons (or without any reason), if it were for free.

Finally, an important regularity concerning the development of the average effort levels over time should be noted. Figure 4 depicts the development of the average effort level choices for each signal constellation in ten-round blocks for each treatment. It is not surprising that in the '*ready-ready*' pairs the average effort level choices decrease over time with a tendency to converge to the lowest possible level, namely '*1*'. The same type of decline holds for the mixed signal pairs, and for the '*smiling-smiling*' pairs in the non-costly signal case.[16] This hints at stability requirements of the signaled coordination. Apparently, the one-sided smiling in the mixed pairs cannot stabilize on high effort level choices. An interesting aspect of the data is that such a decline does *not* occur in the costly signal treatments (SimCost and SeqCost).[17] That is, although even '*smiling-smiling*' pairs seem to have problems stabilizing high effort choice behavior, small signal costs may help as they sort out those subjects who would otherwise smile without choosing high effort levels.

[16] All these declines in effort levels are significant at $\alpha < 5\%$ (Wilcoxon signed ranks test; one-tailed).
[17] The clear increase in average effort in SimCost is not significant due to the small number of observations.

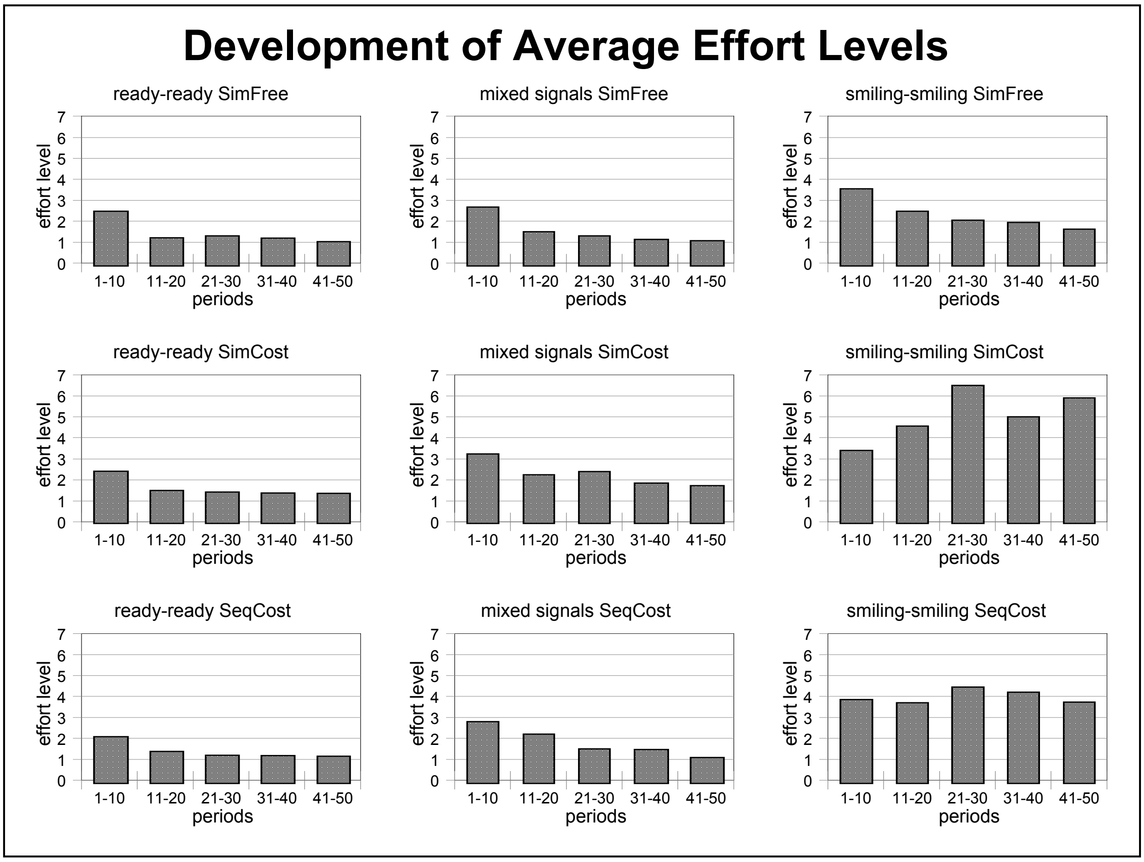

Figure 4

5.3. Payoffs

Comparing the results of the last two sub-sections, one question comes to mind. Why does the frequency of '*smiling-smiling*' pairs not rise, even when subjects are genuinely signaling high effort choices? The key to the answer to this question is the measure of 'success'. Although subjects in '*smiling-smiling*' pairs are genuinely signaling trustworthiness, they are not successful in achieving high payoffs.

Tables 1, 2, and 3 showed that while in every treatment the average effort level choice rises with the number of smiles in a pair, the average payoff drops. In the simultaneous non-costly signal treatment SimFree, the subjects in '*smiling-smiling*' pairs receive significantly lower payoffs than the subjects in the mixed signal pairs and the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 2\%$, one-tailed), while the difference between the mixed and the '*ready-ready*' pairs is not significant. In the simultaneous costly signal treatment SimCost, the subjects in the mixed signal pairs receive significantly lower payoffs than the subjects in the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 2\%$, one-tailed). Just as in the case of the effort levels, the statistical tests cannot pick up significant differences between '*smiling-smiling*' pairs and the other two constellations, because of the low frequency of '*smiling-smiling*' pairs in the data. In the sequential costly signal treatment SeqCost, the subjects in the '*smiling-smiling*' and the mixed signal pairs receive significantly lower payoffs than the subjects in the '*ready-ready*' pairs (Wilcoxon signed ranks test, $\alpha < 5\%$, one-tailed). The difference between the '*smiling-smiling*' and the mixed signal pairs, however, is not significant, even though the overall averages are relatively far apart.

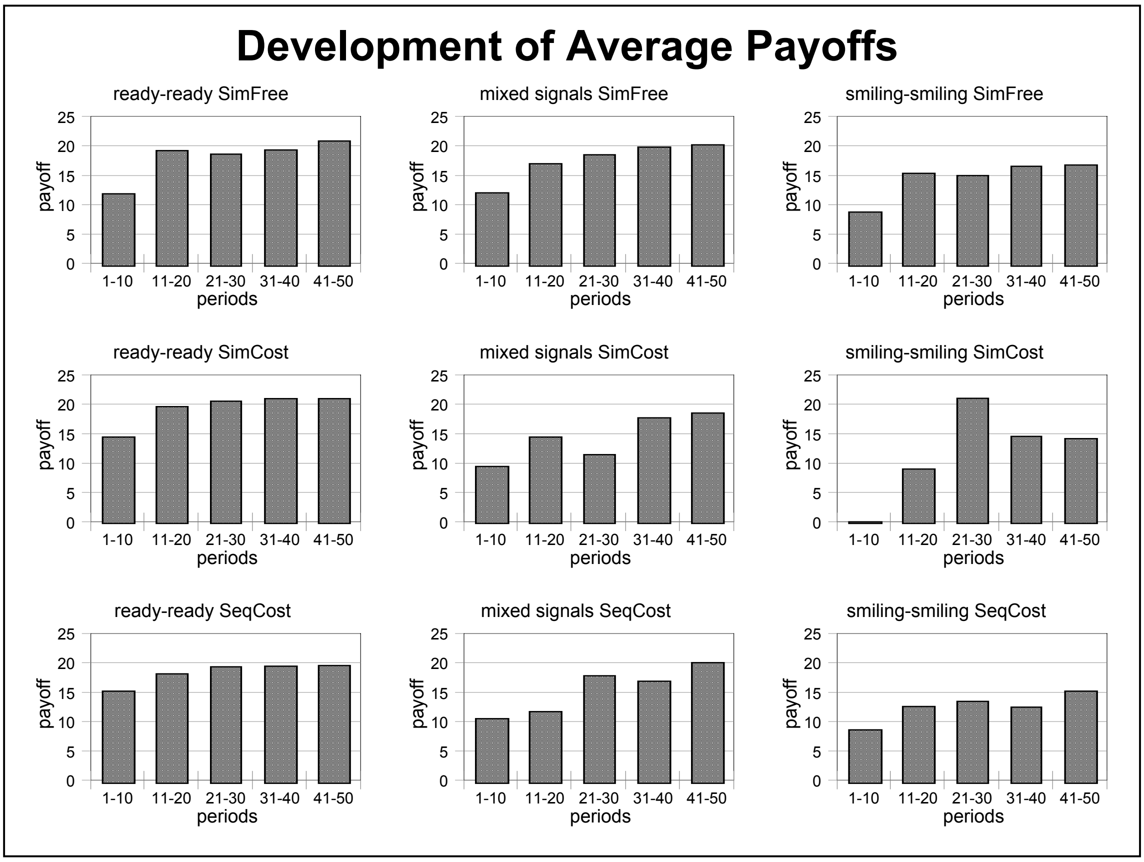

Figure 5

Figure 5 depicts the development of the average payoffs for each signal constellation in ten-round blocks for each treatment. In the '*ready-ready*' pairs of all treatments, there is a clear tendency for convergence to the '*safe*' equilibrium payoff of 21 points. The same type of development, but starting at a lower level, can be seen in the mixed signal pairs. This is due to the fact, that the average effort level choice in these pairs over time tends towards the lowest level (see Figure 4). Matters are different in the '*smiling-smiling*' pairs. The average payoff of the subjects in these pairs also increases over time. But only in the non-costly signal treatment (SimFree) is this due to a convergence towards the '*safe*' equilibrium. In the other two treatments (SimCost and SeqCost), the reason for the positive development in the payoffs of '*smiling-smiling*' pairs is the increase in coordinated effort choices, although these coordination successes are not enough to drive payoffs all the way up to the level of payoffs in the '*safe*' equilibrium.[18]

Hence, it seems that the subjects who are trying to use the smile as a coordination device are chasing a dream. They set out to improve their own and their partner's situation by signaling trustworthiness and choosing high effort levels, but end up earning substantially less than the payoff of 21 points that they could have for sure by choosing the lowest effort level. On average, the subjects who try to coordinate using the smile signal do not even manage to make up for the losses over time. Hence, hypothesis 2 must be rejected.

As explained in section 2, to achieve efficient coordination all the players need is a shared understanding of a cue signaling trustworthiness. As it turns out in our experiment, the path to reach such an unambiguous understanding seems too difficult. While the smiling emerges as a convention signaling trustworthiness, it seems the players have not reached sufficient agreement as to what degree of trust is implied by a smile, i.e., how much risk they can afford to take in the '*minimum effort game*'. In the experiment, players in smiling pairs most frequently chose the effort levels '*3*', '*4*', and '*7*'. Hence, while some subject smiles and plans to choose the effort level '*3*', it may happen that his partner smiles intending to go for '*7*'. If two smiling players who have different plans meet, then inevitably one of them will be hurt. After a few such negative experiences with 'fellow smilers', such subjects either stop smiling or they lower their effort level choice even in cases they meet another smiler. This lack of coordination leads to a destabilization and eventually to a breakdown of the signaling behavior. In other words, cautious trust leads to unraveling of the signaling convention.

6. Conclusions

The main conclusion is that we can answer the question posed in the title affirmatively. The analysis of the experimental data presents significant and substantial evidence that gestures such as smiles, winks and handshakes can play a role as cues that enhance coordination by eliciting trust. First, subjects recognize the necessity of a coordination instrument. They discover and exploit the state button as an information channel to make use of it as a meaningful communication device, genuinely signaling high effort levels through smiles. Second, small costs are enough to separate the serious from '*noisy*' signalers, as these costs implied less signaling but higher effort choices for smiling pairs. Third, subjects aim at coordinating signals when possible, as there were more smiling (and fewer mixed) pairs in the sequential state report treatment.

Notwithstanding the fact that our experimental findings support the casual empirical evidence cited in the introduction that simple cues can be used as meaningful signaling devices, indicating trustworthiness, we do not observe a tendency to widespread smiling behavior. Hence, further analysis

[18] The increases in the payoffs for mixed signaling pairs in the SeqCost treatment, and for '*smiling-smiling*' pairs in both the SimCost and SeqCost treatments are not significant (partly due to the small number of observations). All other increases in payoffs mentioned are significant at $\alpha < 5\%$ (Wilcoxon signed ranks test; one-tailed).

of the dynamics of the development of trust is needed. Understanding how trust is established exactly is clearly an issue of which the relevance goes beyond the minimum effort game, as trust is recognized increasingly as a lubricant enabling organizations and societies to home in on Pareto superior outcomes (see, e.g., Arrow [1974], Fukuyama [1995] or Kramer [1999]).

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Appendix A1: Instructions

This is an experiment in the economics of market decision making. The instructions are simple. If you follow them closely and make appropriate decisions, you may make a substantial amount of money. These earnings will be paid to you in cash at the end of the experiment. From now on until the end of the experiment you are not allowed to communicate with each other. If you have a question, please raise your hand.

In this experiment there will be 50 market rounds. In each round, you will be in a market with one of the other participants, where this person will be a randomly assigned to you in each of the 50 rounds. In each round both you and the other person in your market will pick a value of X. The value you pick and the smallest value picked for X in your market (including your own choice of X) will determine the payoff you receive.

The values of X you may choose are 1, 2, 3, 4, 5, 6, and 7. You are provided with a table on your handout and on the screen showing your payoff for every possible combination of your own X choice and the minimum X choice in your market. Please look at the table now. You will find your payoff for a round as follows: First, look for the row that is marked on the left side with the X-Value that you chose. Then look for the column that is marked with the smallest value chosen by any participant in your market at the top. For example, if you choose a 4 and the smallest value chosen is 3, you earn 14 points that round.

To be sure that everyone has understood the instructions so far, we would like to ask you to please complete the following practice table please with the help of the payoff table:

Payoff Table

Your choice of X-Value	smallest chosen X-Value						
	1	2	3	4	5	6	7
1	21						
2	12	22					
3	3	13	23				
4	-6	4	14	24			
5	-15	-5	5	15	25		
6	-24	-14	-4	6	16	26	
7	-33	-23	-13	-3	7	17	27

Practice Table

Your choice of X-Value	smallest chosen X-Value	Your Payoff Please fill in this column!
4	2	
2	2	
5	5	
6	4	

Each round starts only after all participants have pressed one of their state buttons. The states of all participants in your market are displayed to you. [Only reporting the "ready" state is free of cost. Reporting any other state costs 0.5 points.]* [In each market, one of the participants first reports his/her state. This state is shown to the other participant. Then the second participant reports his/her state and this state is shown to the first participant. Which one of the participants is first to report his/her state, is determined randomly in every round.]** In each round you make your decision by pressing your choice of X at the left hand side of the payoff table. Once all participants have made their decision, the round ends and you will be informed of the results of your market. The smallest value of X in your market and the corresponding payoff for you will be indicated in the payoff table, and also in a separate feedback window. Moreover, your total payoffs up to the current round will be indicated in a separate status window.

At the end of the experiment you will be paid according to the total payoffs you realized. For every 100 points gained you will receive DM 3.50. Additionally, you will receive a lump sum of DM 3.50 for participating in the experiment. The cash is paid to you in a separate room. No participant can see what the other participants have earned.

If you have any questions, please ask them now.

* The sentences in these brackets were included in the treatments SimCost and SeqCost, but not in SimFree.
** The sentences in these brackets were included in the treatment SeqCost, but not in SimFree and SimCost.

Appendix A2: Data at the Level of Independent Observations

Tables A1 to A3 present the data at the level of the independent observations, i.e., as frequencies for each of the groups of 8 players.

Table A1: Treatment SimFree – Simultaneous and Non-Costly Signals

round	# of pairs	ready-ready pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.	mixed signal pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.	smiling-smiling pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.
Group 1																
all	200	88	1.4	1.2	18.6	9.0	92	1.3	1.2	19.2	7.7	20	1.5	1.6	16.7	14.2
1-10	40	17	2.6	2.3	11.1	18.1	20	2.5	2.1	13.5	14.9	3	3.2	2.7	1.5	24.6
11-20	40	23	1.1	0.3	20.4	2.9	15	1.1	0.4	20.4	3.2	2	1.0	0.0	21.0	0.0
21-30	40	16	1.1	0.3	19.9	3.0	21	1.0	0.2	20.8	1.4	3	2.0	2.2	12.0	20.1
31-40	40	13	1.1	0.3	20.3	2.4	21	1.0	0.2	20.8	1.4	6	1.0	0.0	21.0	0.0
41-50	40	19	1.0	0.0	21.0	0.0	15	1.0	0.0	21.0	0.0	6	1.0	0.0	21.0	0.0
Group 2																
all	200	75	1.5	1.5	17.4	11.9	103	1.5	1.4	18.6	9.5	22	4.9	2.3	11.7	19.2
1-10	40	23	2.5	2.3	9.9	19.4	13	3.7	2.6	10.3	19.6	4	5.0	2.6	5.0	25.0
11-20	40	20	1.1	0.3	20.3	2.4	18	1.3	1.1	18.0	9.5	2	7.0	0.0	27.0	0.0
21-30	40	6	1.0	0.0	21.0	0.0	28	1.1	0.2	20.5	2.0	6	5.0	2.1	10.0	18.9
31-40	40	9	1.0	0.0	21.0	0.0	24	1.0	0.0	21.0	0.0	7	4.9	2.2	12.8	17.0
41-50	40	17	1.0	0.0	21.0	0.0	20	1.2	1.0	19.2	8.6	3	3.2	1.8	11.5	15.9
Group 3																
all	200	66	1.4	1.2	18.7	8.2	97	1.4	1.1	17.7	10.0	37	1.8	1.9	14.2	16.0
1-10	40	18	1.9	1.6	16.3	9.6	17	2.2	2.1	10.1	18.5	5	3.1	2.6	6.1	22.0
11-20	40	14	1.0	0.2	20.7	1.7	22	1.3	0.8	18.1	7.6	4	2.8	2.5	5.3	22.4
21-30	40	17	1.3	1.1	18.6	9.6	19	1.2	0.5	19.4	4.1	4	1.3	0.4	18.8	3.9
31-40	40	10	1.3	1.1	18.8	9.8	17	1.2	0.9	18.9	7.9	13	1.4	1.2	17.2	10.6
41-50	40	7	1.0	0.0	21.0	0.0	22	1.0	0.2	20.6	1.9	11	1.5	1.7	16.1	15.5
Group 4																
all	200	96	1.2	0.8	20.1	4.9	88	1.4	1.3	18.1	10.5	16	1.2	0.5	19.6	4.6
1-10	40	13	2.2	2.0	15.7	11.8	23	2.2	2.0	11.8	17.3	4	1.5	0.9	16.5	7.8
11-20	40	25	1.0	0.1	20.8	1.3	14	1.0	0.2	20.7	1.7	1	1.0	0.0	21.0	0.0
21-30	40	22	1.0	0.1	20.8	1.3	16	1.0	0.2	20.7	1.6	2	1.3	0.4	18.8	3.9
31-40	40	19	1.0	0.0	21.0	0.0	19	1.1	0.2	20.5	2.0	2	1.0	0.0	21.0	0.0
41-50	40	17	1.1	0.3	20.5	3.0	16	1.2	1.0	19.3	9.4	7	1.0	0.0	21.0	0.0
Group 5																
all	200	117	1.3	1.3	19.0	9.2	71	2.0	1.8	15.5	12.9	12	2.3	2.0	9.4	17.9
1-10	40	19	3.0	2.6	9.8	20.2	17	3.8	2.3	9.6	17.7	4	3.8	2.8	-3.8	25.4
11-20	40	22	1.1	0.3	20.4	3.0	16	1.8	1.6	13.7	14.1	2	1.8	0.8	14.2	7.5
21-30	40	24	1.0	0.0	21.0	0.0	13	1.5	1.4	16.5	12.3	3	1.5	0.5	16.5	4.5
31-40	40	28	1.0	0.1	20.8	1.2	11	1.1	0.3	20.2	2.6	1	1.5	0.5	16.5	4.5
41-50	40	24	1.0	0.0	21.0	0.0	14	1.1	0.4	20.0	3.7	2	1.5	0.5	16.5	4.5
Group 6																
all	200	38	1.3	1.3	18.0	12.1	104	1.1	0.7	19.7	6.1	58	1.5	1.4	17.4	10.9
1-10	40	8	2.1	2.3	10.9	21.1	19	1.4	1.1	17.2	10.2	13	2.8	2.4	9.3	19.9
11-20	40	7	1.1	0.3	20.4	2.3	20	1.3	1.0	18.5	8.8	13	1.2	0.6	18.9	5.8
21-30	40	10	1.3	1.3	18.3	11.8	22	1.0	0.0	21.0	0.0	8	1.0	0.0	21.0	0.0
31-40	40	7	1.0	0.0	21.0	0.0	22	1.0	0.2	20.6	1.9	11	1.1	0.3	19.8	3.1
41-50	40	6	1.0	0.0	21.0	0.0	21	1.0	0.2	20.8	1.4	13	1.2	0.4	19.6	3.2
Group 7																
all	200	103	1.6	1.3	17.1	9.4	77	1.6	1.0	17.5	7.6	20	1.4	1.1	17.2	10.0
1-10	40	23	2.7	1.7	13.8	12.0	13	2.3	1.4	14.6	9.7	4	2.1	2.0	10.9	17.7
11-20	40	23	1.5	1.1	16.7	9.9	14	1.8	0.9	17.1	7.5	3	1.3	0.5	18.0	4.2
21-30	40	22	1.5	1.3	17.2	11.0	15	1.6	1.2	16.0	10.0	3	1.5	1.1	16.5	10.1
31-40	40	17	1.2	0.4	19.4	3.4	18	1.2	0.5	19.2	4.1	5	1.3	0.6	18.3	5.8
41-50	40	18	1.1	0.4	19.8	3.8	17	1.1	0.5	19.7	4.4	5	1.0	0.0	21.0	0.0
Group 8																
all	200	90	2.0	2.1	13.0	18.5	98	2.0	2.0	13.9	17.0	12	3.7	2.7	7.0	22.3
1-10	40	22	2.8	2.6	7.1	22.2	16	3.3	2.4	8.6	19.8	2	6.8	0.4	24.2	4.2
11-20	40	15	1.8	1.8	14.1	16.4	22	2.4	2.4	9.2	20.9	3	3.7	2.7	-3.0	24.7
21-30	40	16	2.2	2.3	11.6	20.1	21	1.9	2.1	13.3	18.9	3	2.7	2.4	6.0	21.8
31-40	40	18	2.0	2.2	12.0	20.1	20	1.4	1.3	17.4	12.0	2	3.3	2.3	5.8	18.2
41-50	40	19	1.0	0.0	21.0	0.0	19	1.0	0.2	20.8	1.4	2	2.5	2.6	7.5	23.4
Average of all groups																
all	200	84.1	1.5	1.3	17.7	10.4	91.3	1.5	1.3	17.5	10.2	24.6	2.3	1.7	14.2	14.4
1-10	40	17.9	2.5	2.2	11.8	16.8	17.3	2.7	2.0	12.0	16.0	4.9	3.5	2.1	8.7	18.3
11-20	40	18.6	1.2	0.6	19.2	5.0	17.6	1.5	1.1	17.0	9.2	3.8	2.5	0.9	15.3	8.1
21-30	40	16.6	1.3	0.8	18.6	7.1	19.4	1.3	0.7	18.5	6.3	4.0	2.0	1.1	15.0	10.4
31-40	40	15.1	1.2	0.5	19.3	4.6	19.0	1.1	0.5	19.8	4.0	5.9	1.9	0.9	16.6	7.4
41-50	40	15.9	1.0	0.1	20.8	0.9	18.0	1.1	0.4	20.2	3.9	6.1	1.6	0.9	16.8	7.8

Table A2: Treatment SimCost – Simultaneous and Costly Signals

round	# of pairs	ready-ready pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.	mixed signal pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.	smiling-smiling pairs #	effort mean	effort s.d.	payoff mean	payoff s.d.
Group 1																
all	200	188	1.5	1.4	18.8	8.1	12	3.3	2.6	6.8	21.0	0				
1-10	40	37	3.0	2.3	13.6	14.6	3	5.2	2.3	6.6	22.2	0				
11-20	40	38	1.3	0.8	18.4	7.3	2	4.0	2.5	-1.3	23.4	0				
21-30	40	36	1.1	0.2	20.5	2.1	4	3.3	2.4	0.5	21.6	0				
31-40	40	39	1.1	0.5	20.3	4.5	1	1.0	0.0	20.8	0.3	0				
41-50	40	38	1.0	0.0	21.0	0.0	2	1.0	0.0	20.8	0.3	0				
Group 2																
all	200	188	1.2	1.0	19.3	8.3	12	2.1	2.2	10.6	20.0	0				
1-10	40	36	1.9	1.7	14.6	14.6	4	2.1	2.0	10.6	17.6	0				
11-20	40	38	1.2	1.0	19.3	8.7	2	1.0	0.0	20.8	0.3	0				
21-30	40	39	1.1	0.7	20.2	6.1	1	4.0	3.0	-6.3	26.7	0				
31-40	40	38	1.0	0.1	20.9	1.0	2	2.5	2.6	7.3	23.2	0				
41-50	40	37	1.0	0.0	21.0	0.0	3	2.0	2.2	11.7	20.2	0				
Group 3																
all	200	101	1.2	0.9	19.7	7.0	91	1.4	1.3	18.6	9.1	8	5.8	2.2	12.7	21.3
1-10	40	20	2.0	1.9	14.4	14.5	19	2.7	2.4	11.7	17.6	1	4.0	3.0	-6.5	27.0
11-20	40	24	1.0	0.0	21.0	0.0	14	1.1	0.3	20.1	2.3	2	4.3	2.8	-3.8	25.0
21-30	40	20	1.0	0.2	20.8	1.4	18	1.1	0.5	20.0	4.4	2	6.5	0.9	21.0	8.4
31-40	40	21	1.0	0.0	21.0	0.0	18	1.0	0.0	20.8	0.3	1	7.0	0.0	26.5	0.0
41-50	40	16	1.0	0.0	21.0	0.0	22	1.0	0.0	20.8	0.3	2	6.8	0.4	23.8	4.2
Group 4																
all	200	141	1.2	0.5	19.5	4.2	55	1.7	1.0	17.2	8.3	4	3.6	2.7	1.9	23.2
1-10	40	28	1.4	0.6	18.5	5.3	10	1.2	0.4	20.0	2.8	2	2.8	2.5	4.8	22.4
11-20	40	31	1.3	0.6	18.9	4.8	9	1.9	0.9	17.2	7.8	0				
21-30	40	32	1.2	0.5	19.5	4.1	8	1.6	0.9	16.9	7.1	0				
31-40	40	30	1.1	0.2	20.4	2.2	9	1.8	0.8	16.6	6.2	1	4.0	3.0	-6.5	27.0
41-50	40	20	1.1	0.4	20.1	3.4	19	2.0	1.2	16.2	11.1	1	5.0	2.0	4.5	18.0
Group 5																
all	200	188	1.3	1.2	18.5	9.7	12	1.5	1.7	16.3	14.9	0				
1-10	40	39	2.6	2.3	9.4	18.5	1	4.0	3.0	-6.3	26.7	0				
11-20	40	37	1.0	0.2	20.6	1.8	3	2.0	2.2	11.7	20.0	0				
21-30	40	37	1.0	0.0	21.0	0.0	3	1.0	0.0	20.8	0.3	0				
31-40	40	37	1.0	0.0	21.0	0.0	3	1.0	0.0	20.8	0.3	0				
41-50	40	38	1.0	0.0	21.0	0.0	2	1.0	0.0	20.8	0.3	0				
Group 6																
all	200	143	3.2	0.8	20.0	6.5	54	3.5	1.0	18.2	8.2	3	4.5	0.5	22.3	3.5
1-10	40	34	3.6	1.3	16.4	9.6	6	4.2	1.7	13.9	13.6	0				
11-20	40	31	3.2	1.0	19.5	6.1	7	3.5	0.6	18.3	5.7	2	4.8	0.4	21.7	4.2
21-30	40	24	3.1	0.5	21.2	4.5	16	3.3	1.0	16.5	9.1	0				
31-40	40	27	3.0	0.3	22.3	2.4	12	3.8	0.8	19.8	5.8	1	4.0	0.0	23.5	0.0
41-50	40	27	3.0	0.4	21.7	3.7	13	3.3	0.5	20.8	4.6	0				
Average of all groups																
all	200	158.2	1.6	1.0	19.3	7.3	39.3	2.3	1.6	14.6	13.6	2.5	4.6	1.8	12.3	16.0
1-10	40	32.3	2.4	1.7	14.5	12.9	7.2	3.2	2.0	9.4	16.8	0.5	3.4	2.8	-0.9	24.7
11-20	40	33.2	1.5	0.6	19.6	4.8	6.2	2.3	1.1	14.5	9.9	0.7	4.6	1.6	9.0	14.6
21-30	40	31.3	1.4	0.4	20.5	3.0	8.3	2.4	1.3	11.4	11.5	0.3	6.5	0.9	21.0	8.4
31-40	40	32.0	1.4	0.2	21.0	1.7	7.5	1.9	0.7	17.7	6.0	0.5	5.0	1.0	14.5	9.0
41-50	40	29.3	1.4	0.1	21.0	1.2	10.2	1.7	0.7	18.5	6.1	0.5	5.9	1.2	14.2	11.1

Table A3: Treatment SeqCost – Sequential and Costly Signals

round	# of pairs	ready-ready pairs					ready-smiling pairs					smiling-ready pairs					smiling-smiling pairs				
		#	effort		payoff		#	effort		payoff		#	effort		payoff		#	effort		payoff	
			mean	s.d.	mean	s.d.		mean	s.d.	mean	s.d.		mean	s.d.	mean	s.d.		mean	s.d.	mean	s.d.
Group 1																					
all	200	169	1.2	0.6	19.8	4.4	12	2.2	1.8	12.7	14.7	12	2.5	2.4	8.1	20.9	7	4.0	2.8	13.5	18.2
1-10	40	28	1.7	0.8	18.3	5.7	3	1.5	0.5	16.3	4.3	3	3.5	2.6	1.6	22.4	6	4.2	2.9	15.3	17.6
11-20	40	28	1.3	0.9	18.8	7.9	6	2.4	1.9	13.0	14.6	5	3.0	2.6	2.8	24.0	1	3.0	2.0	2.5	18.0
21-30	40	35	1.1	0.3	19.7	3.1	1	1.0	0.0	20.8	0.3	4	1.1	0.3	19.6	3.1	0				
31-40	40	38	1.0	0.2	20.8	1.4	2	3.0	2.4	2.8	21.8	0					0				
41-50	40	40	1.0	0.2	20.8	1.4	0					0					0				
Group 2																					
all	200	180	1.4	0.8	18.6	6.2	7	1.9	1.0	18.1	5.6	9	2.2	1.5	15.3	10.8	4	3.4	1.7	11.6	12.2
1-10	40	30	2.1	1.1	15.6	8.7	3	2.7	0.7	19.1	4.2	3	2.0	0.8	18.4	4.8	4	3.4	1.7	11.6	12.2
11-20	40	37	1.7	1.0	17.1	7.9	1	1.0	0.0	20.8	0.3	2	3.3	2.3	5.5	18.1	0				
21-30	40	35	1.3	0.7	18.3	6.2	3	1.5	0.8	16.3	7.0	2	2.5	1.1	17.3	4.6	0				
31-40	40	38	1.1	0.3	20.4	2.7	0					2	1.3	0.4	18.5	4.0	0				
41-50	40	40	1.0	0.1	20.9	1.0	0					0					0				
Group 3																					
all	200	125	1.2	1.0	19.6	7.5	14	2.1	1.8	14.8	13.4	19	1.3	1.1	17.9	9.4	42	3.3	1.3	14.8	11.3
1-10	40	31	1.9	1.8	15.7	14.2	4	4.0	2.4	3.8	20.6	3	1.5	0.8	16.3	6.8	2	2.8	1.5	9.8	11.6
11-20	40	28	1.0	0.2	20.7	1.7	2	1.3	0.4	18.5	4.0	6	1.8	1.7	14.0	15.1	4	2.9	1.8	11.1	15.9
21-30	40	22	1.0	0.0	21.0	0.0	6	1.6	0.6	18.8	3.9	3	1.0	0.0	20.8	0.3	9	3.7	1.2	16.5	8.5
31-40	40	26	1.0	0.1	20.8	1.2	1	1.0	0.0	20.8	0.3	2	1.0	0.0	20.8	0.3	11	3.6	1.3	14.5	12.1
41-50	40	18	1.0	0.0	21.0	0.0	1	1.0	0.0	20.8	0.3	5	1.0	0.0	20.8	0.3	16	2.9	1.2	15.6	10.3
Group 4																					
all	200	139	2.2	2.2	11.9	19.2	11	2.8	1.8	12.1	12.8	33	1.6	1.6	16.3	13.5	17	6.0	1.6	18.2	14.6
1-10	40	32	2.7	2.1	11.8	16.9	5	3.1	1.8	9.9	16.3	1	2.0	1.0	11.7	8.8	2	4.3	2.2	6.3	23.2
11-20	40	30	1.9	2.1	12.6	19.3	1	2.0	1.0	11.7	8.8	5	2.4	2.4	12.2	18.2	4	6.0	1.3	18.0	10.6
21-30	40	26	1.8	2.0	13.4	17.9	3	3.0	2.1	12.7	10.0	10	1.6	1.8	14.9	16.1	1	7.0	0.0	26.5	0.0
31-40	40	25	2.1	2.3	11.3	20.7	1	2.5	0.5	17.3	4.8	9	1.4	1.4	17.3	12.4	5	6.4	1.2	21.9	9.3
41-50	40	26	2.2	2.4	10.3	21.2	1	1.5	0.5	16.3	4.8	8	1.1	0.2	20.2	2.3	5	6.2	1.6	17.7	15.7
Group 5																					
all	200	175	1.3	1.0	19.1	7.1	15	1.8	1.8	13.3	16.6	8	1.4	0.9	16.8	7.9	2	3.5	2.6	-2.0	23.4
1-10	40	37	2.2	1.6	14.8	12.6	3	3.2	2.7	1.3	24.8	0					0				
11-20	40	34	1.4	0.9	18.6	7.0	5	2.1	1.9	10.9	17.1	1	2.5	1.5	7.3	13.8	0				
21-30	40	27	1.1	0.2	20.5	2.1	6	1.1	0.3	20.0	2.6	5	1.4	0.7	17.2	6.1	2	3.5	2.6	-2.0	23.4
31-40	40	39	1.0	0.0	21.0	0.0	1	1.0	0.0	20.8	0.3	0					0				
41-50	40	38	1.0	0.1	20.9	1.0	0					2	1.0	0.0	20.8	0.3	0				
Group 6																					
all	200	195	1.3	1.0	19.1	7.5	5	2.7	2.3	7.4	19.2	0					0				
1-10	40	37	2.3	1.8	12.9	14.7	3	2.8	2.0	7.6	15.9	0					0				
11-20	40	38	1.2	0.6	19.3	5.0	2	2.5	2.6	7.3	23.2	0					0				
21-30	40	40	1.0	0.0	21.0	0.0	0					0					0				
31-40	40	40	1.0	0.0	21.0	0.0	0					0					0				
41-50	40	40	1.0	0.1	20.9	1.0	0					0					0				
Group 7																					
all	200	155	1.3	1.0	19.1	7.0	11	2.6	1.8	11.9	14.1	16	2.0	1.4	17.1	7.3	18	2.7	1.8	9.4	16.2
1-10	40	27	2.2	1.9	14.8	12.5	4	3.3	2.2	10.5	18.8	5	2.9	1.8	15.6	8.7	4	3.1	2.5	1.4	22.2
11-20	40	27	1.2	0.8	19.2	7.0	3	2.8	1.7	10.9	13.2	5	2.0	1.0	15.8	8.5	5	2.8	1.7	10.3	17.3
21-30	40	27	1.1	0.3	20.5	2.7	3	1.7	0.7	14.8	6.9	4	1.5	0.7	18.8	3.9	6	2.6	1.6	11.3	11.2
31-40	40	38	1.2	0.6	19.3	5.4	0					0					2	2.3	0.8	14.2	7.6
41-50	40	36	1.0	0.1	20.9	1.1	1	2.0	1.0	11.7	9.3	2	1.0	0.0	20.8	0.3	1	1.5	0.5	16.0	4.5
Group 8																					
all	200	152	1.2	0.7	19.5	5.2	9	2.2	1.5	15.8	12.0	27	1.3	0.8	18.3	6.9	12	4.8	2.0	11.4	16.9
1-10	40	31	1.6	1.0	17.6	7.5	4	3.1	1.6	14.1	15.4	3	1.7	1.1	14.8	10.1	2	5.3	1.8	7.3	16.1
11-20	40	28	1.3	0.8	18.7	6.0	2	2.0	1.2	11.7	10.9	8	1.4	1.0	16.8	9.1	2	3.8	0.4	20.8	4.2
21-30	40	29	1.1	0.5	19.8	4.2	0					7	1.3	0.6	18.2	5.3	4	5.5	1.9	15.0	13.0
31-40	40	31	1.0	0.1	20.9	1.1	1	1.0	0.0	20.8	0.3	6	1.0	0.0	20.8	0.3	2	4.5	2.6	-1.0	23.6
41-50	40	33	1.1	0.5	20.5	4.4	2	1.0	0.0	20.8	0.3	3	1.0	0.0	20.8	0.3	2	4.3	1.9	11.3	15.8
Average of all groups																					
all	200	161.3	1.4	1.0	18.3	8.0	10.5	2.3	1.7	13.3	13.6	15.5	1.8	1.4	15.7	11.0	12.8	4.0	2.0	11.0	16.1
1-10	40	31.6	2.1	1.5	15.2	11.6	3.6	3.0	1.7	10.3	15.0	2.3	2.3	1.4	13.1	10.3	2.5	3.9	2.1	8.6	17.2
11-20	40	31.3	1.4	0.9	18.1	7.7	2.8	2.0	1.3	13.1	11.5	4.0	2.3	1.8	10.6	15.3	2.0	3.7	1.4	12.5	13.2
21-30	40	30.1	1.2	0.5	19.3	4.5	2.8	1.7	0.8	17.2	5.1	4.4	1.5	0.7	18.1	5.6	2.8	4.5	1.5	13.5	11.2
31-40	40	34.4	1.2	0.5	19.4	4.1	0.8	1.7	0.6	16.5	5.5	2.4	1.2	0.5	19.4	4.3	2.5	4.2	1.5	12.4	13.2
41-50	40	33.9	1.2	0.4	19.5	3.9	0.6	1.4	0.4	17.4	3.7	2.5	1.0	0.0	20.7	0.7	3.0	3.7	1.3	15.2	11.6