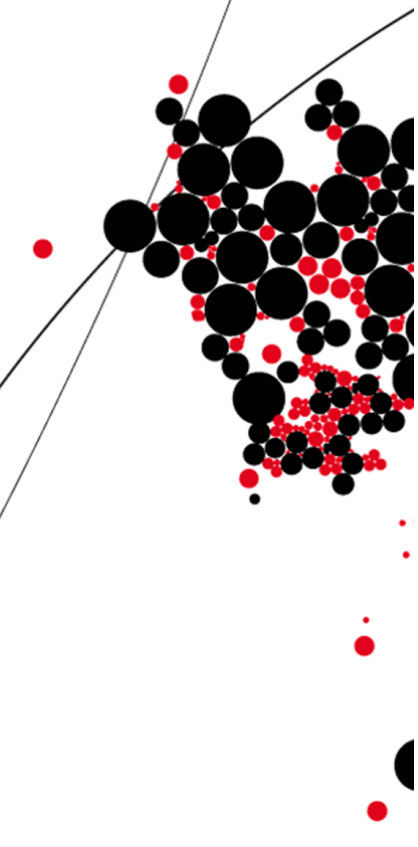
UNIVERSITY OF TWENTE.

**Faculty of Electrical Engineering,
Mathematics & Computer Science**

The Effect of Suspicion on Emotional Influence Tactics in Virtual Human Negotiation



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Abstract

In this thesis I aimed to explore whether human negotiators with a suspicious mindset are less susceptible to an emotionally manipulative virtual human in a multi-issue bargaining task compared to naive negotiators. Naive negotiators are expected to perform worse when confronted with the emotionally manipulative agent compared to participants confronted with a control agent. Recent research by Oza et al. [1] suggests that suspicion can guard a human negotiator against assessing his or her satisfaction with a negotiation outcome based on psychological factors, such as emotion. When participants were primed before entering a negotiation task with an explanation of negotiation tactics unrelated to the subsequent task, they remained unaffected in terms of performance by negotiation tactics used during the subsequent negotiation. That means that primed participants did not perform worse against an opponent using an emotional manipulation tactic compared to primed participants negotiating with a non manipulative opponent. The current project aimed to extend the work of Oza et al. in regard of two goals. The first goal was to replicate the findings of Oza et al. for human-agent negotiation. Possible similarities or differences between human-human and human-agent interaction were investigated. Secondly, it was aimed to further inform the theory underpinning the effect of suspicion to guard participants against the influence of negotiation tactics by taking behavioral measures into account too. To achieve those set goals, participants were invited to participate in an online multi-issue bargaining task with a virtual agent. To induce a suspicious mindset participants were primed with negotiation tactics based on the assumptions of the Persuasion Knowledge Model (PKM) [2]. The results did not indicate any effects on the user performance or self-report measures for either the prime nor the tactic condition. Two subsequent experiments were executed to examine whether these study results are due to the currently used agent configurations or represent a fundamental difference between the effect of negotiation tactics used in human-agent negotiation and human human negotiation. A follow up study tested 4 different agent configurations for their effect on user performance and self-report measures (Experiment 2). The results suggest a successful emotional manipulation for one of the agent configurations: fixed pie belief and non-anchoring. Finally, a third experiment was executed to replicate study one using the

fixed pie belief non-anchoring agent configuration. The results again suggested no effect of negotiation tactic on user performance. The inconsistent findings of the three experiments executed in the course of this thesis project underpin the need for future research in human agent negotiation. Implications for future studies as well as alternative explanations are discussed.

Contents

Chapter 1

Introduction

People are involved in negotiations every day, often subconsciously. Pruitt and Carnevale [3] define a negotiation as a process where at least two parties try to resolve a (perceived) difference of interests through exchanging offers. Most models and definitions of negotiations, such as Pruitt and Carnevale portray negotiations as purely rational. They are centered around the objective exchange of offers, assuming that the behavior of each party is guided by its aim to maximize gains only. However, such a definition is neglecting the influence of psychological factors during a negotiation. The following can be regarded as examples of psychologically relevant factors during a negotiation: the individual needs of a negotiator, the opponent perception and expectations of the opponents goals, intentions, strengths and weaknesses, commitment and finally also suspicion of persuasion attempts by the other [4]. While negotiation definitions widely fail to include psychological factors, interestingly most influence tactics focus on these psychological factors explicitly assuming they have a substantial impact on the decision making process of the opponent. There is a great corpus of research suggesting that psychological factors, especially emotion impact negotiation behavior.

Considering the interpersonal influence of emotion, recent research seems to consent that its most important role concerns the support and facilitation of social functioning (e.g. [5]–[8]). Keltner et al. [9] argue that social interactions and emotions evolved to coordinate cooperation and competition within groups. While on the most basic intra-personal level emotions might foremost facilitate blunt survival e.g. the feeling of loneliness preventing early humans to live on their own, minimizing the chance of being eaten by a wild animal, in group-interactions emotions serve the function of bonding and collaboration leading to far more complex interactions. Transferring this knowledge to negotiation, Morris et al. [8] argue that emotions serve as navigation within social interaction and help humans understand social problems during a negotiation. For instance, strong emotions are generally seen as a sign for high stakes. Focusing on the role of emotion in negotiation, Davidson and Green-

halgh [10] even argue that ”[...] there will be no negotiation if two parties have a difference of opinion, but neither has an emotional reaction” [11].

Emotional expressions are vital to social behavior since they provide important social information to an observer, such as feelings [5], social intentions [11], [12] and orientation towards a relationship. Additionally, emotional reactions can give the observer key information about the intentions and goals of their opponent [13] as well as an understanding of what kind of behavior the other is likely to tolerate during a negotiation [11]. Through this stream of information provided by emotional reactions, they influence the behavior of its observer.

1.1 Emotion Research in Human Human Negotiation

Displaying positive emotions and affect has shown to generally elicit an increased willingness to collaborate, to engage in creative problem solving and having a more positive attitude as well as more positive expectations towards the outcome of a negotiation [14]. Furthermore, happiness has shown to increase the joint value of a negotiation [15]. Showing negative affect on the other hand, such as anger has been proven to be very effective in inducing concession making in opponents and enhancing the value for one party, the angry party, in two-party negotiations [11], [12], [16]. According to Van Kleef, De Dreu and Manstead opponents of angry negotiators concede more, because they infer the limit of the other to be high [11]. Investigations in multi-party negotiations, however, have shown negative effects of anger, too. Displaying anger can have multiple decremental effects on a social relational level as well as in value outcome for the angry party [17]. Communicating anger in multi-party negotiations lowers the chance of being included in a coalition and therefore reduces the pay-off. However, when an anger communicating party is included in a coalition they are receiving higher shares compared to neutral or happy parties. Basically, these findings are indicating that communicating anger in a negotiation is effective in enhancing ones own gain, but can backfire as soon as negotiators find a way to avoid negotiating with an angry party. Next to this immediate backfire effect, opponents of angry negotiators seem to be more unwilling to engage in future contact, angry negotiators are less likely to close a deal and in a distributive setting (e.g. a one issue negotiation) they are less effective in gaining concessions compared to happiness displaying negotiators [18]. Van Kleef et al. [12] argue that the concession inducing effects of anger are mitigated by a high motivation for information processing. Some factors that are effective in enhancing the motivation for information processing are a low need for cognitive closure, low time pressure and low power [19]. The research of Oza et al. [1] indicates that suspicion seems to mitigate the effects of concession inducing negotiation tactics as well. Priming

participants with a general explanation about negotiation tactics leads them to take emotional information into account less in the decision making process. Therefore they are better able to guard themselves against emotional manipulation. Another study which was reviewing the opposite case, how trust influences the conceding behavior of negotiators confronted with emotion, found similar results. Trusting negotiators appear to concede more when confronted with opponents displaying emotions of disappointment or worry, while participants low in trusting were not affected by the emotions of their opponent [20]. This research hints towards the possibility that the concept of suspicion and trust to mediate the susceptibility of negotiators for emotional manipulation seems to hold true for a broad range of emotion and thus might not be anger specific.

1.2 Human Agent Interaction in Negotiation Context

While until recent years a negotiation with an artificially intelligent (AI) system was not imaginable, in today's world more and more tasks are picked up by machines and computer programs and therefore not surprisingly, artificially intelligent systems are also already considered for use in the domain of negotiation. Since negotiation usually describes an activity that is performed by at least two human beings, the intelligent systems that are most often used are virtual representations of human beings, virtual humans. For the purpose of this research virtual humans are defined as virtual actors that visually represent humans and depending on their purpose, communicate emotions and goals using written or spoken human language. Virtual humans can interact and communicate with a human user. The term virtual *agent* is used interchangeably with the term virtual *human* in this research although in other contexts the term virtual agent could also refer to non-human virtual actors.

Virtual humans as defined for this research are already tested for their capacity of teaching negotiation skills to humans [21]–[23] and used to support social science research on social intelligence [24]. There are various advantages of being able to use a virtual human for training and as human representative. On the one hand, virtual humans can save time and money, are readily available at any time and in any place, for as long or short as the user needs them. On the other hand, virtual humans and virtual environments can simulate a range of different scenarios repeatedly without posing a financial or social threat to its user. A special advantage in using virtual humans for (negotiation) training lies in the possibility of receiving real time, objective and specific feedback opposed to subjective and delayed feedback which students of classical negotiation sessions receive [25]. To further facilitate the use of virtual humans for training applications, research is needed to ensure that experiences made with a virtual human are transferable to real world situations.

Previous research by De Melo, Carnevale and Gratch [26] has already shown the transferability of the concession inducing effects of anger found in human-human negotiation towards human-agent interaction. The current research therefore will built on these findings and has the goal to test the transferability of suspicion as mitigating factor when a participant is confronted with emotional manipulation as found in human human negotiation [1].

1.3 Present Study

To meet the goals described in Section 1.2, a 2 (Persuasion Knowledge: activated and not activated) by 2 (Tactic: happy and angry) between subject study design will be employed based on the research of Oza et al [1] (more detailed information on the methodology can be found in Section 2.1). All participants will negotiate either with a happy or angry virtual agent. Before entering the negotiation participants either will receive a prime or no further information to induce suspicion. More information on the *knowledge activation prime* will be provided below.

1.4 The Persuasion Knowledge Model (PKM)

In order to raise one's defense and become suspicious of a persuasion attempt one has to recognize it as a persuasion attempt [2]. This is the basic premise of the persuasion knowledge model [2], which is attempting to describe how people cope with persuasion attempts. According to Friestad and Wright, persuasion knowledge consists of all experiences of persuasion attempts on oneself, and attempted on others as well as 'general' persuasion knowledge, e.g., distributed on television, newspapers or radio that one acquires during ones life-time. According to this theory, the 'persuasion knowledge' a person is gathering will be used to recognize persuasion attempts and 'activating' coping strategies in future events. Typical coping strategies developed by such a person, consist of disengagement, dismiss of the message or distraction from the message that was intended to be conveyed by the manipulating party. This phenomenon called 'Change of meaning principle' by Friestad and Wright, suggests that recognizing a behavior as part of a persuasion attempt will change the way a person responds to that behavior. This implies that as long as a manipulation strategy is not identified as a persuasion tactic it keeps its influential power, however, when the tactic is recognized, coping strategies will be activated and the influence of the tactic will diminish.

In a world where the average person is confronted with advertisement every single day, representing continuous attempts of persuasion, the question emerges how

persuasion attempts still can be successful. The research of Campbell and Kirmani [27] suggests that there are two factors mediating whether a person will use its persuasion knowledge in a given situation: the accessibility of persuasion motives (1) and the cognitive capacity of the person (2). The first factor is of special interest for the current study, since this point can be experimentally manipulated. It refers to the awareness of the person about what the influencing party has to gain when attempting to persuade someone. An example for this could be a donation for a charity. According to Campbell and Kirmani [27], participants who are approached by a collector for a charity and do not have any reason to believe that the collector has a personal gain in collecting donations for this charity, will be less or not suspicious at all concerning the truth of what the collector says. On the other hand, if these participants know that a collector receives money for each donation he/she collects, their suspicion will be raised. In the latter case, participants were able to see an ulterior motive for the behavior of their opponent. The described factor is the key point in activating the *persuasion knowledge* of a person and was also used in the research of Oza et al [1].

Oza et al. [1] are manipulating the accessibility of the ulterior opponent motive by priming participants with general negotiation tactics. By making people aware of the fact that during negotiations influence tactics can be used by bargainers to manipulate each other, Oza et al. gave participants access to an ulterior motive of their opponents and consequently raised their suspicion. During a subsequent negotiation, participants with a suspicious mindset were less affected in their satisfaction rating of the negotiation outcome by the influence of negotiation tactics compared to naive participants. When anger was used as influence tactic, participants in the non-priming condition conceded when asked for their final offer in a post-experimental questionnaire, while primed participants raised their initial offer. In other words this study again indicates that the use of anger as negotiation tactic can backfire as soon as the opponent realizes that the emotion is only used as a tactic.

1.5 Hypotheses

Based on the literature discussed above the following hypotheses were tested during this master thesis project:

1. Negotiators with a suspicious mindset will be unaffected by the opponent emotion. There will be no difference between primed participants negotiating with the angry and happy agent in terms of satisfaction (1a), happiness (1b) and pleasure (1c).
2. Negotiators with a suspicious mindset will be unaffected by the opponent emotion. There will be no difference between primed participants negotiating with the angry and happy agent in terms of negotiation performance (amount of points earned during the negotiation).
3. Naive negotiators are expected to be less satisfied (3a), happy (3b) and pleased (3c) when negotiating with the angry agent compared to when negotiating with the happy agent.
4. Naive negotiators are expected to perform worse when negotiating with the angry agent compared to when negotiating with the happy agent.

1.6 Report Organization

This thesis is structured in 6 main chapters. This is Chapter 1, it has introduced the topic of the thesis and stated its objectives. Chapter 2, 3 and 4 each represent an individual experiment of the thesis, each consisting of paragraphs describing the used method, results and short discussion. Chapter 5 gives an overall discussion from all executed experiments and finally, Chapter 6 draws an overall conclusion from this thesis.

Chapter 2

Experiment I

The current study employed a 2 (Persuasion Knowledge: activated and not activated) by 2 (Tactic: angry and happy) between subject study design. For this study, participants in the activated persuasion knowledge condition received a prime, all participants were asked to negotiate with either a happy or angry virtual human with a time constraint of 10 minutes. Multiple attention checks were applied during participation. More specific information regarding the methodology is given in Section 2.1. All experiments conducted for this thesis project have an ethical board approval from the IRB (Institutional Review Board) of the University of Southern California (Approval Number: UP-16-00286).

2.1 Method

2.1.1 Participants

215 participants completed the study. The dataset consisted of 119 male participants, 90 female participants and 6 participants, who preferred to not indicate their sex. The mean age of the participants was 32.10 (SD = 25.829).

All participants were sampled and consented to the research through 'Prolific' (https://app.prolific.ac/), an online platform that is used for participant sampling as well as payment in research contexts. The following inclusion criteria were handled while screening participants: nationality, first language and previous study participation. It was chosen to only admit native English speakers of American origin to the study since agent language was one of the main study manipulations. Furthermore, people were screened for previous participation in a language pilot test (see Section 2.1.2.3).

In total 51 participants were excluded from analyses due to the following post-hoc exclusion criteria. 46 participants were excluded due to failing one or both of the attention checks (being able to correctly state own preferences after the ne-

gotiation as well as correctly stating the opponent mood, which was tested for its distinctiveness in Section 2.1.2.3). 3 participants were excluded due to not reaching an agreement during the specified time limit of 10 minutes for the negotiation and 2 participants were excluded for failing both the attention checks as well as reaching an agreement within the time limit. In the end there was a set of 164 participants left for analyses.

2.1.2 Materials

2.1.2.1 Questionnaire

The first part of the study consisted of a questionnaire hosted by the survey platform qualtrics (www.qualtrics.com). Here participants were asked to provide basic demographic data. Depending on the condition, additional information was given on negotiation as well. After the main negotiation task of the study, participants returned to the questionnaire to fill in all dependent self-report measures (more specific information on the self-report measures can be found in Section 2.1.4, the complete questionnaire can be found in Appendix D).

2.1.2.2 Negotiation Task

The task for participants consisted of a multi-issue bargaining task. In each negotiation 4 items had to be divided with the following amounts of items respectively: 7, 5, 5, 5. Before the negotiation the participant was told the worth of each item in game-points (see Appendix G for the introduction screen). Each item had a different amount of points assigned to it from 4 to 1 (an overview of the points per item for human and agent can be seen in Table 2.1). Furthermore, the BATNA (Best Alternative To Negotiation Agreement) was communicated before the negotiation started. The BATNA represents a guaranteed amount of points that participants receive if they do not reach an agreement with their opponent. Providing a BATNA to inform participants about their alternative options is common in agent negotiation research (e.g. [24], [28]). For this study the BATNA was 4 equalling the value of one top-priority item. The preferences and BATNA of the agent were not disclosed. The task was set up partially integrative and partially distributive in its division of points for agent and human (see Table 2.1). A completely integrative negotiation task refers to opposite needs of the individual negotiators, thus all items of the negotiation can be divided in a way that everyone receives their priority items. A completely distributive negotiation task on the other hand, refers to same needs of the individual negotiators, which means that every gain for one party means a loss for the opposite party. Since the current negotiation task was setup partially integrative (2 items

	Gold	Iron	Spices	Banana
Human	4	3	2	1
Agent	4	1	2	3

Table 2.1: Point Division per Item

were integrative) and partially distributive (2 items were distributive), the joint value of both negotiators could be grown by communicating preferences. When the participant entered the negotiation he or she was able to make any number of offers, communicate and ask for preferences or send messages within 10 minutes of time. The amount of time left for the negotiation was visible at any time and the participant was warned when only one minute was remaining that failing to reach an agreement will result in the BATNA representing their score.

2.1.2.3 Agent Design

The IAGO (=Interactive Arbitration Guide Online) platform was used to create the two different agents representing the happy and angry agent condition in this study as well as to host the online negotiation itself. The following paragraphs will provide an overview over the basic features of the IAGO interface, the agent behavior and the agent language used for the current study.

Interface Features IAGO is a platform that enables researchers to create rule-based virtual agents that can negotiate in a variety of tasks, from the ultimatum-game to multi-issue bargaining tasks [29]. Figure 2.1 represents the interface that will be used for the current study. The left part of the interface shows from top to bottom three different parts: A static picture of the virtual agent (1), which is changing depending on its moods, the trade table (2), which is representing the current division of items including the current amount of points the user has negotiated and finally an action menu (3), which consists of up to four buttons depending on the current game state. Here the user can start an offer, accept or reject an offer and view his or her pay-off chart for the current negotiation. On the right half of the interface a chat log (4) represents a summary of all interactions the player had with the virtual agent. Below the chat log, a row of 5 emoticons (5) shows the current emotional state of the user. The currently selected emoticon blinks continously, the user can change which emoticon is selected at any time. Finally, at the bottom right side of the interface (6) the user has the possibility to select predefined phrases to communicate his or her own preferences as well as asking the agent for his preferences. Additionally, the user can select positive and negative phrases to manipulate the agent and express emotional states verbally.

	Gold	Iron	Spices	Banana
Human	0	4	2	0
Undivided	1	1	1	1
Agent	6	0	2	4

Table 2.2: Anchoring Offer Agent

Agent Behavior Two distinct agents, a happy agent and an angry agent were created for this study. The focus while creating these agents was less on altering their behavior, but more on creating two agents that distinguish through their use of language. Their behavior regarding proposing, accepting and rejecting offers therefore was the same. They operate based on a minimax preference algorithm (see Mell [28] for more detail), and are bound to proposing and accepting fair offers only. Therefore, they will never lie and assume that their opponent will not lie as well. Just as the human, the agent does not know what the preferences of their opponent are, however the agent starts optimistically by assuming a completely integrative setting. The only way to influence the agent behavior in terms of offers is by communicating ones own preferences since this will cause the agent to adjust its assumption of the opponent preferences and leads it to redetermine which offers are seen as fair. Rejecting offers or sending emotional messages will not influence the agent behavior, although the agent rotates its offers to not send the same offer again directly after it was rejected by the human player. Both agents start the negotiation with an anchoring offer (see Table 2.2). It was chosen to use an anchoring offer to set the tone for the negotiation to be competitive and challenging, which ultimately had the goal to let the participants engage more in the negotiation. This particular offer represents the agent as tough negotiator since it claims about 80 % of the value.

Pilot Study Agent Language All of the agent utterances as well as user utterances were newly created for this research (for an example of the user utterances, see Table 2.4, an example of the agent language can be found in Table 2.3. All user utterances as well as agent language can be found in Appendix B). To test whether each respective utterance is perceived as either happy, angry or neutral, an online pilot study was conducted. During the online study, participants were confronted with one out of three scripts (see Appendix A) representing a sample dialogue of an IAGO negotiation with either the language use of the happy, angry or neutral agent. A neutral condition was added to be able to readily use it in case it is needed for future research. After having read the script participants were asked to rate the extend to which they though the other was happy, positive, joyful, angry, irritated

Event	Angry	Happy
Proposal VH	I am going to make this offer, 'cos this negotiation pisses me off	I am going to make this offer, 'cos I feel good about this negotiation
	Your offers make me really angry, I think I will offer this	Your offers make me happy, I think I will offer this
Human Rejects	This negotiation makes me angry. We should try something different next time	This negotiation makes me happy, but we should try something different next time

Table 2.3: Example Agent Language

Happy	It is important that we are both happy with an agreement.
Neutral	We need to split things evenly.
Angry	This is so frustrating, we need to find a deal that benefits us both.

Table 2.4: Example User Utterances

and negative, on a 7-point likert scale (1=totally disagree;7=totally agree). Finally, all possible user utterances were presented to the participants. They were asked to rate each possible user utterance on a 7-point likert scale (1=Very happy;7=Very angry). The tested sample consisted of 38 males, 25 females and 3 participants who did not want to reveal their gender, summing up to 66 participants excluding nine participants who failed an attention check at the end of the study. A One-Way ANOVA showed significant differences [$F(2,63) = 25.784$, $p < .001$] for the first part of the study (scripts) and a repeated measures analysis showed significant differences [$F(12,54) = 22.560$, $p < .001$] between the user messages depending on emotion. These results indicate a successful manipulation of perceived emotion through the created agent language and user-utterances.

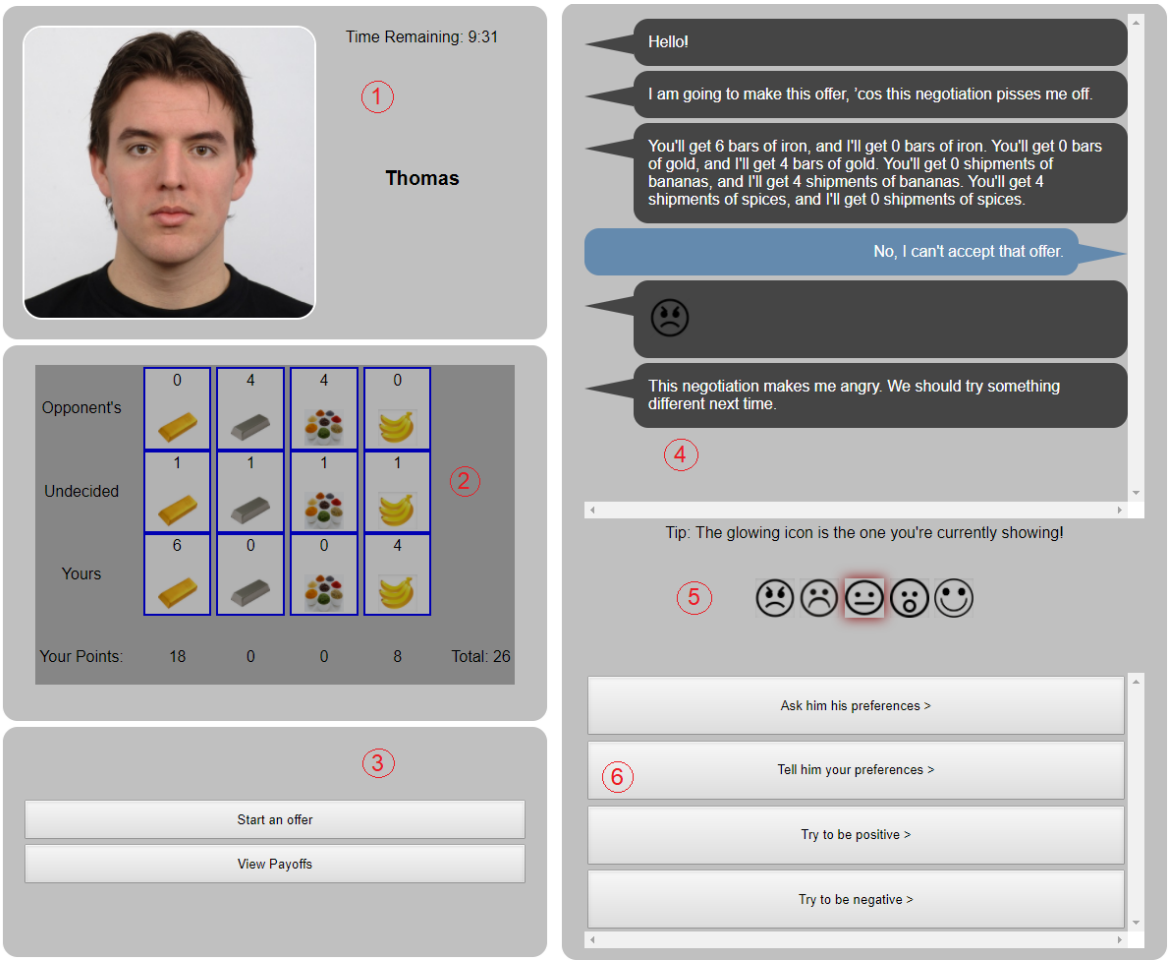

Figure 2.1: Preview of IAGO [29]

2.1.3 Procedure

After having consented to the research, the participant was asked to provide general information regarding age, nationality, and gender in a pre-experimental questionnaire (see Appendix D). Through qualtrics, the participant was randomly assigned to one of the four study conditions.

2.1.3.1 Persuasion Knowledge Activation

In the persuasion knowledge activation condition the participant received a prime, consisting of information on framing and delay as negotiation tactic in written form (see Appendix E). After receiving the information, the participant had to answer multiple choice questions to confirm comprehension. In the no-activation condition the participant received no information prior to the negotiation.

2.1.3.2 Emotion

After the pre-experimental questionnaire, the participant received a link which led to an online negotiation. Depending on the emotion condition, the participant either received a link leading towards the happy agent or the angry agent. The introduction page of the negotiation contained the following information: an explanation on how the negotiation interface works, which items are discussed during the negotiation, how many points each of these items is worth to the participant as well as what the BATNA (Best Alternative to Negotiation Agreement) is in case that no agreement is reached within the specified time-frame of ten minutes. After being done with the negotiation, participants receive a code they can use to fill in all dependent self-report measures concerning their satisfaction, happiness, pleasure and some manipulation checks (a more detailed description can be found in Section 2.1.4 as well as in Appendix C and D).

2.1.4 Negotiation Metrics and Measurements

The main measurements of this thesis project are the user points, user satisfaction with the negotiation outcome, happiness with the outcome and pleasure during the negotiation. These measures are taken into account to check the main hypotheses set up in Chapter 1. The subjective measures are rated on a 7 point likert scale (1=totally disagree;7=totally agree).

Manipulation Checks The following questions have been added as manipulation check. Participants have been asked to rate the extend to which the opponent was

Persuasion Knowledge	**Activated**		**Not Activated**	
Emotion	**Happy**	**Angry**	**Happy**	**Angry**
Tactic	3.98 (1.66)	4.83 (1.92)	3.84 (1.30)	4.60 (1.72)
Impression Other	37.66 (11.34)	25.19 (7.73)	41.73 (7.90)	29.83 (9.80)

Table 2.5: Means and Standard Deviations of Significant Manipulation Checks

knowledgeable, the likelihood that the opponent used emotion as tactic, what their impression of the other was and what the impression of their own behavior was. Additionally, some exploratory variables, which mainly represent the frequencies of all user interactions with the system, were measured to gain more insight into the negotiation process (for an overview of all variables see Appendix C).

2.2 Results

2.2.1 Main Results

Manipulation Checks Four seperate 2 by 2 ANOVAs checked for a correct manipulation of emotion and suspicion. To account for multiple comparisons a bonferroni correction was used resulting in a stricter alpha of α = .0125 for significance. The ANOVAs revealed that participants who negotiated with the angry agent were rating the likelihood significantly higher that their opponent used emotion as negotiation tactic [F(1,160) = 9.758 , p = .002] compared to participants negotiating with the happy agent across suspicion conditions. This suggests that participants were aware of the negotiation tactic anger independently of the suspicion condition. Also participants negotiating with the angry agent rated their opponent impression significantly more negatively [F(1,160) = 68.959 , p $<$.001] across suspicion conditions. The finding that participants disliked the angry agent more than the happy agent confirms the emotion manipulation. Finally, primed participants rated their opponent impression significantly more negatively across emotion conditions [F(1,160) = 8.788 , p $<$.003]. This finding confirms an effect of priming participants. An overview of the means and standard deviations of the significant measures is given in Table 2.5.

Self-Report Measures A MANOVA was used to test the self-report measures satisfaction, happiness and pleasure for the influence of agent emotion and suspicion condition. The results show no significant difference for any condition, which suggests that there is no interaction effect of suspicion and emotion found as expected by hypothesis 1 and 3.

Negotiation Performance A 2 by 2 ANOVA was used to test the negotiation performance of the user (user points) for the influence of agent emotion and suspicion condition. The results show no significant difference for any condition, which suggests that there is no interaction effect of suspicion and emotion found as expected by hypothesis 2 and 4.

2.2.2 Additional Exploratory Variables

Due to the fact that no support for the hypotheses set up in Chapter 1 was found, additional process measures were considered as exploratory variables to gain a better understanding of the negotiation processes. Since the purpose of these variables is not to test a certain assumption, but rather explore the negotiation processes, it is chosen to display these variables in graphs. The following process measures will be taken into account: *Game Time*, *Information Exchange*, consisting of the amount of stated user preferences, user queries and sent messages; *Smiley Use* and finally the *Offer Behavior*, consisting of the number of offers made by the user, the number of offers the user rejected and the number of offers the user accepted. For an overview of all considered metrics during the current research see Appendix C.

Game Time Figure 2.2 shows that participants tend to use more time when negotiating with the angry agent compared to the happy agent for both suspicion conditions.

Information Exchange Figure 2.3 shows that in both suspicion conditions participants tend to make more preference statements and tend to use more messages when communicating with the angry agent.

Use of Smileys Figure 2.4 shows that participants in the no suspicion condition tend to use more happy smileys when negotiating with the happy agent as well as more angry smileys when negotiating with the angry agent. However, in the suspicion condition both the happy and angry smiley are used more often by participants facing the angry agent compared to participants facing the happy agent. Generally, participants tend to use more happy smileys.

Offer Behavior Figure 2.5 shows that while in the no suspicion condition participants negotiating with the happy agent tend to make more offers, accept more offers and reject more offers, this effect is turned around in the suspicion condition. In the suspicion condition, participants facing the angry agent tend to make more offers, accept more offers and reject more offers.

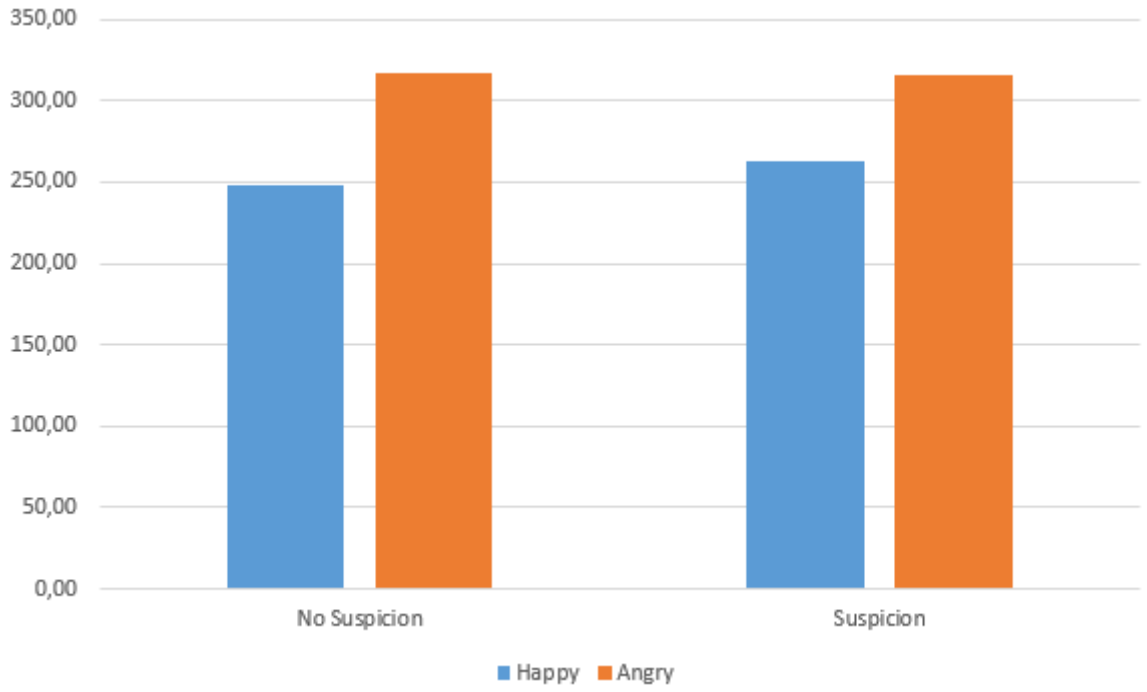

Figure 2.2: Game Time: Average Time used by Participants for Negotiation

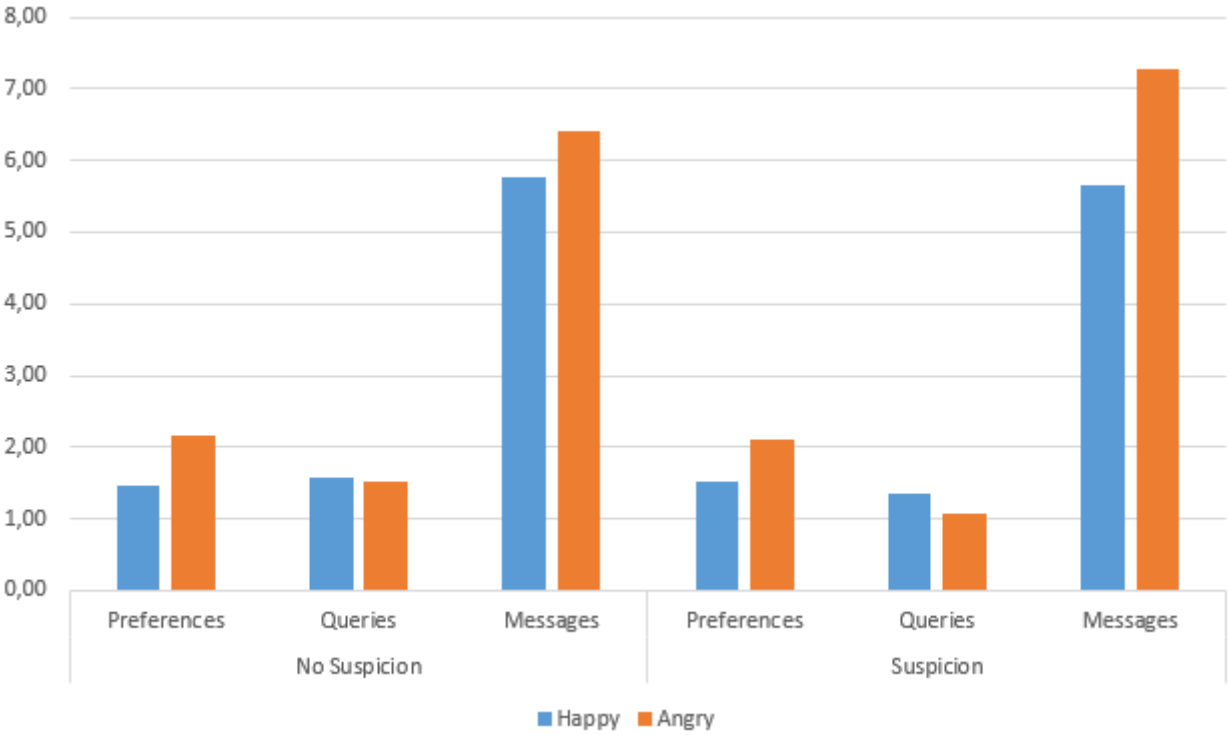

Figure 2.3: Information Exchange: Average of Communicated Preferences, Queries and Amount of Messages sent

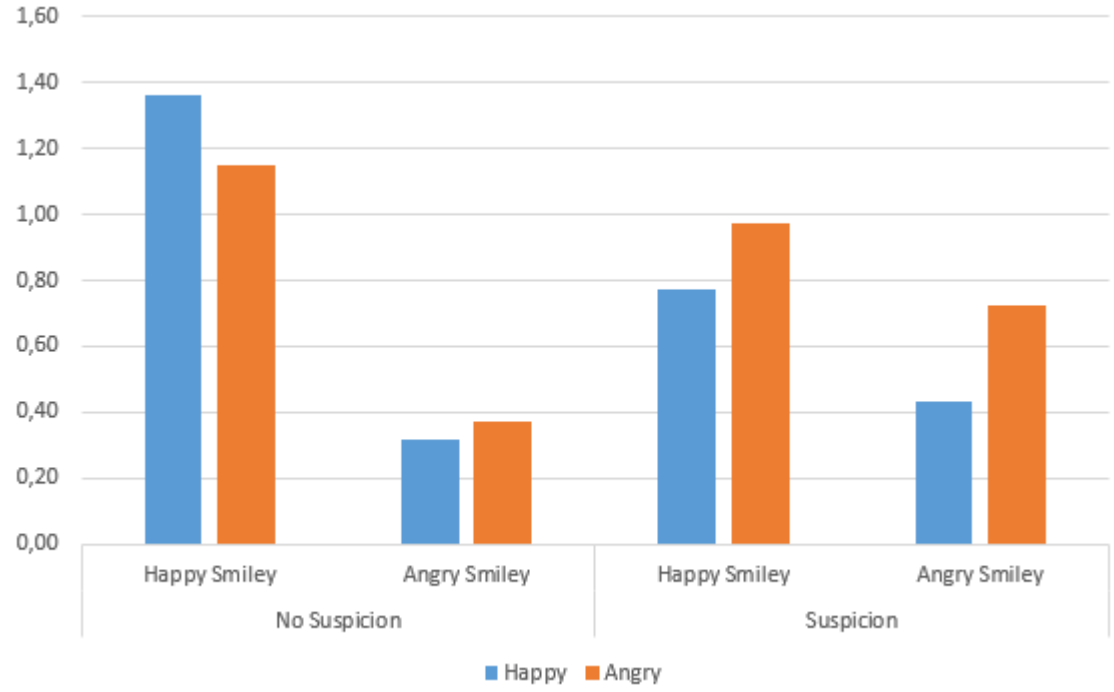

Figure 2.4: Use of Smileys: Average of Smileys sent during Negotiation

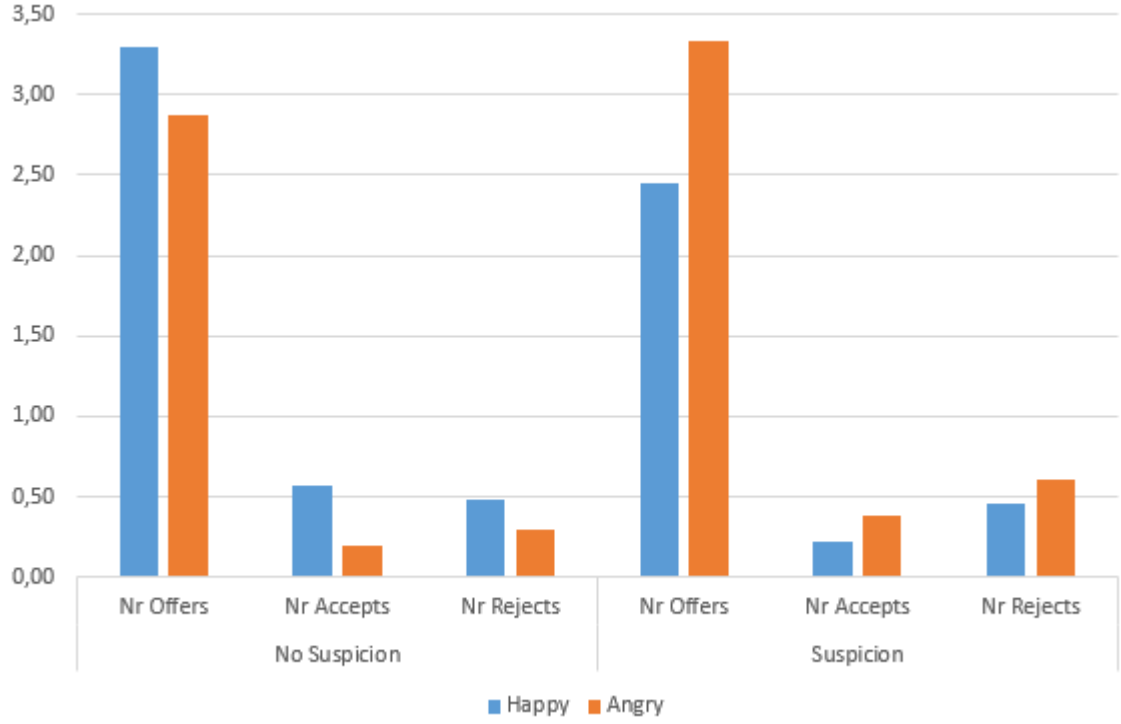

Figure 2.5: Offer Behavior: Average of Sent Offers, Accepted and Rejected Offers

2.3 Discussion

The aim of the current study was to replicate the mitigating effect of suspicion on influence tactics found in human-human interaction for human-agent interaction. To do so, two negotiating virtual agents were created. One agent used anger communicating language during the negotiation to emotionally manipulate the participant and induce concession making, while the other agent functioned as control agent using happy communicating language during the negotiation. While naive negotiators were expected to perform worse against the manipulative agent compared to the control agent, no such difference in performance was expected for primed participants.

Across all conditions it has been found that the angry agent was perceived less positive compared to the happy agent. This confirms that participants did perceive the agent emotions, happy and angry, as intended. However, contrary to the predictions of most negotiation research, such as Van Kleef et al. [11], [12], [17], [19] or De Melo, Carnevale and Gratch [26], participants faced with the angry agent did not concede more than participants negotiating with the happy agent. According to Van Kleef [11], participants concede more to angry communicating parties, because they infer the limit of this party to be high. However, there was no difference in estimated reservation price between angry and happy agent. This shows that participants negotiating with the angry agent did not assume this agent to have a higher limit compared with the happy agent.

The results of the current study could be an indication that this behavior changes when participants are confronted with an agent instead of another human being. However, since the research of De Melo, Carnevale and Gratch [26] shows a successful emotional manipulation of participants using a non-static virtual agent, first other explanations will be considered to better understand the current findings before the conclusion is drawn that humans generally react differently when interacting with a virtual human. While originally the main objective of this study was to investigate the mitigating effect of suspicion on emotional manipulation, given the absence of an effect of emotion on user performance, no conclusions can be drawn about this subject. Consequentially, all hypotheses introduced in Chapter 1 cannot be supported nor dismissed solely based on the current experiment. In the following, possible alternative explanations as well as following steps for a subsequent experiment will be discussed.

Limitations of Current Agent Configuration A possible alternative explanation for the current study results is focused on the way the virtual agent is programmed. Opposing to most of the current human human negotiation literature, this study in-

dicates that participants confronted with an angry agent tend to take more time for the negotiation, tend to share more preferences with their opponent and tend to use more messages. Other studies investigating the effect of anger in negotiation settings observe most of all concession making in participants confronted with anger (e.g. [11], [12], [19]). One possible explanation for the currently observed behavior could be the setup of the agent itself. The agent was programmed in a way that it would only accept 'fair' offers. To decide whether it deems an offer fair or unfair, the agent calculates the difference between the potential gain for the user and itself. The gain for the user is calculated based on the expectation of the agent which items are favored by the user. Since at the very beginning no information is available about either players' priorities, the agent starts with a default assumption, which is only updated when the user talks about his or her preferences. In this study, the default assumption was 'optimistic' [30]. That means that the agent assumes a completely integrative negotiation setting. Thus, when asked to make an offer or whether to accept an offer, it will try to claim it's first and second priority items and will try to allocate its third and fourth priority to the user since it believes these items to be the top priority of the user. This behavior can be confusing for the participant, who is very likely to have a fixed-pie belief, which means that the user assumes a completely distributive negotiation [7], [31]. In this way the angry agent potentially triggers the user to take more time for the negotiation, feeling frustrated and keep stating his or her preferences in an attempt to communicate with the angry and 'confused' agent instead of feeling intimidated and conceding as shown in most other research (e.g. [11]). Another potential issue of the current agent could be the used language. Independently of whether participants were primed or not, they were rating the angry agent to be significantly more likely to use a negotiation technique compared to the happy agent. If the used negotiation technique is too obvious and understood by participants independently of the prime, it looses its effect on the participant as predicted by the Persuasion Knowledge Model [2]. Finally, also the anchoring offer of the agents could have decreased the effect of the used negotiation tactic. The goal of the anchoring offer was to set the tone for the negotiation as competitive and in this way motivate the participant to engage more with the virtual agent. However, using such a leading offer for the agents could also have influenced the participant so strongly, that it diminished the effect of the used agent language in the subsequent negotiation.

Effect of Priming After discussing possible explanations why the negotiation tactic manipulation failed, a second interesting finding of this study will be discussed. Although participants were not emotionally manipulated into concession making, which makes it impossible to observe a *mitigating* effect of suspicion, still an effect

of solely priming participants was found in the data. Primed participants rated their impression of the opponent more negatively and tend to use more angry smileys across emotion conditions. A possible explanation for that could be the enhanced lie-detection accuracy associated with suspicion [32], [33]. While the accuracy of truth detection in suspicious individuals decreases the more suspicious they are, their lie detection accuracy increases according to the opposing effects theory [32]. The found effect of the current study could demonstrate a related mechanism, namely that primed participants expect their opponent to use manipulative negotiation techniques and therefore show this negativity or 'backfire' effect even though the opponent does not necessarily use a tactic. This effect shows that suspicion can have a detrimental effect on the relationship between two bargainers without necessarily holding a benefit for the suspicious party. Until now most negotiation related research focused on the positive effects of suspicion in terms of lower vulnerability to deception of their opponents, however the detrimental effects on the relationship and possible negative effects for joint outcome are researched to a lesser extend. Taking these negative effects into account and researching ways to prevent them can be especially useful when trying to apply negotiation knowledge to e.g. teaching applications, which is a particularly important area to virtual agents.

Next Steps The current experiment holds two possible implications for human agent negotiation. Either the current agent configuration has lead to a lack of difference in user performance as discussed above or participants generally react differently to emotionally manipulating *virtual agents* compared to fellow humans. To further investigate both implications, a second experiment is proposed, which will compare different agent configurations for their effect on user satisfaction and performance based on emotional manipulation.

Chapter 3

Experiment II

The results of Experiment 1 implicated a possible difference in the susceptibility of participants towards negotiation tactics depending on whether they are used by a virtual agent compared to a fellow human. To investigate this implication further, a second experiment tested potentially interfering agent configurations for their effect on user performance. Based on the findings of Experiment 1, the following two features are tested: offer behavior (optimistic or fixed pie belief) and anchoring behavior (yes or no). The current experiment therefore created and compared 4 different agent pairs, each consisting of a happy and angry agent, for their effect on user performance and self-report measures. More information about the different features are given in Section 3.1.2.1.

3.1 Method

In the current experiment a 2 (Emotion: happy and angry) by 2 (Behavior: optimistic and fixed pie belief) by 2 (Anchoring: yes and no) between subject design was used.

3.1.1 Participants

382 participants completed the study. The dataset consisted of 200 male participants, 178 female participants and 4 participants, who preferred to not indicate their sex. The mean age of the participants was 34.18 (SD = 34.655). Again all participants were recruited via prolific, the same screening criteria as in Study I were applied with an addition of the exclusion of all participants who already participated in Experiment 1. A total of 132 participants was excluded from analyses. 108 participants were excluded due to failing the attention check (being able to correctly state own preferences after the negotiation as well as correctly stating the opponent mood), 9 were excluded due to not reaching an agreement during the specified time

limit of 10 minutes and 15 participants were excluded for failing both the attention check as well as reaching an agreement. In the end there was a set of 250 participants left for analyses.

3.1.2 Materials

The current experiment used the same questionnaire and negotiation task as Experiment 1 except for leaving out additional information on negotiation (the prime). The basic interface features remained the same as well as the dependent self-report measures and recorded behavioral measures (see Appendix C and D for an overview of all considered measures).

3.1.2.1 Agent Behavior

Four agent pairs each consisting of a happy and angry agent were used for the current experiment. Each of the 4 agent pairs represents a unique combination of the following two features: offer behavior (optimistic and fixed pie belief) and anchoring (yes or no). Therefore, the following four agent pairs were tested:

1. Optimistic No Anchoring
2. Optimistic Anchoring
3. Fixed Pie Belief No Anchoring
4. Fixed Pie Belief Anchoring

The different agent behaviors for the offer behavior and anchoring will be explained in the following. As discussed in Section 2.3, both happy and angry agent were basing their offer behavior on an optimistic belief in Experiment 1. They assumed a completely integrative setting of the negotiation, which could have potentially confused participants, who are very likely to have a fixed pie belief themselves [7], [31]. In the current experiment, fixed pie belief agents were added to test for this potential debilitating factor. Fixed pie belief agents assumed a completely distributive setting of the negotiation which reversed their offer behavior in the sense that instead of distributing different items fairly during the negotiation representing the believe that each user has different needs, the fixed pie belief agents split all items equally, representing their assumption that both users have the same needs. Both agent types used their respective belief to calculate the amount of points they believed to be assigned to both parties when considering a deal suggested by the participant. If the deal was fair, defined by an equal amount of points for both parties with a margin of 4 points, the agent would accept, otherwise it would decline the deal. It applied to

	Gold	Iron	Spices	Banana
Human	0	4	2	0
Undivided	1	1	1	1
Agent	6	0	2	4

Table 3.1: Anchoring Offer Optimistic Agent

	Gold	Iron	Spices	Banana
Human	2	2	2	2
Undivided	1	1	1	1
Agent	4	2	2	2

Table 3.2: Anchoring Offer Fixed Pie Belief Agent

all agents that whenever the participant made a preference statement, the belief of the agent was updated.

The anchoring behavior of the agent specified whether the agent was leading with an offer or not. For both types of offer behavior, there was a specific never changing anchoring offer. Both behavior types were claiming about 80 % of the complete negotiation value (for the optimistic agent see Table 3.1, for the fixed pie belief agent see Table 3.2). Different offers for fixed pie belief and optimistic agent were necessary due to the fact that the anchoring offer should represent the agents negotiation beliefs. A non anchoring condition was added due to the fact that Experiment 1 concluded with the possibility that an anchoring offer across emotion condition could distract from the actual emotional manipulation used during a subsequent negotiation.

3.1.3 Procedure

Just as in Experiment 1, participants were asked to fill in demographic data in a pre-experimental questionnaire (see Appendix D). In contrast to Experiment 1, there was no additional information given on negotiation in general (prime), but participants immediately received a link leading towards one of the eight agents. Again participants were shown an introduction page explaining the negotiation task, the worth of the items as well as the BATNA. After the negotiation, participants received a code to continue the questionnaire and fill in all dependent measures (see Section 2.1.4).

Emotion	Happy				Angry			
Behavior	Optimistic		FixedPieBelief		Optimistic		FixedPieBelief	
Anchoring	Yes	No	Yes	No	Yes	No	Yes	No
ImpressionOther	39.21 (9.98)	41.82 (8.87)	42.19 (7.14)	46.97 (5.80)	24.65 (7.37)	27.60 (8.81)	27.50 (10.37)	26.64 (8.63)
ImpressionOwn	43.24 (7.77)	44.59 (7.85)	42.53 (6.90)	47.64 (6.75)	37.90 (10.01)	39.88 (7.61)	40.13 (8.11)	40.88 (8.05)

Table 3.3: Means and Standard Deviation of Significant Manipulation Checks

3.2 Results

3.2.1 Main Results

Manipulation Checks Two seperate 2 by 2 by 2 ANOVAs checked for a correct manipulation of emotion as well as the possible influence of offer behavior and anchoring on own and opponent impression. The analyses revealed that participants who were negotiating with the angry agent rated their opponent impression [F(1,242)= 220.424, p $<$.001] as well as the impression of themselves [F(1,242)= 22.561, p $<$.001] significantly more negatively compared to participants who were negotiating with the happy agent. Furthermore, interestingly anchoring influenced the participant ranking for their opponent impression [F(1,242)= 4.882, p = .028] and own impression [F(1,242)= 5.146, p = .024]. They rated themselves and their opponent significantly more positive when the agent did not start the negotiation with an anchoring offer. Finally, also the offer behavior influenced the opponent impression [F(1,242)= 5.437, p = .021]. Participants negotiating with a fixed-pie belief agent rated their opponent significantly more positive. An overview of the means and standard deviations of the significant measures is given in Table 3.3.

Self-Report Measures A MANOVA was used to test the self-report measures considered in Experiment 1, satisfaction, happiness and pleasure for the influence of agent emotion, offer behavior and anchoring behavior. The results of the MANOVA suggest a significant difference for the emotion conditions happy and angry [F(3,240) = 2.994, p = .032]. Three subsequent one way ANOVAs indicated a significant difference between emotion conditions for satisfaction [F(1,242)= 8.248, p = .004], happiness [F(1,242)= 5.205, p = .023] and pleasure [F(1,242)= 4.909, p = .028]. All items were rated higher by participants who were negotiating with a happy agent compared to participants negotiating with an angry agent. An overview of the means and standard deviations of the significant measures is given in Table 3.4.

Negotiation Performance A 2 by 2 by 2 ANOVA was used to test the negotiation performance of the user (user points) for the influence of agent emotion, offer behavior and anchoring behavior. The results suggest a significant three way interaction [F(1,242)= 9.294, p = .003]. To further investigate which agent pair has driven

Emotion	Happy				Angry			
Behavior	Optimistic		FixedPieBelief		Optimistic		FixedPieBelief	
Anchoring	Yes	No	Yes	No	Yes	No	Yes	No
Satisfaction	5.03 (1.27)	5.44 (.93)	5.40 (1.18)	5.85 (.87)	4.94 (1.39)	5.16 (1.07)	4.93 (1.08)	5.04 (1.10)
Happiness	5.07 (1.16)	5.26 (.99)	5.37 (1.20)	5.73 (.88)	4.90 (1.33)	5.16 (1.11)	5.03 (1.13)	5.04 (.98)
Pleasure	4.90 (1.26)	5.32 (1.00)	5.30 (1.23)	5.70 (.98)	4.84 (1.37)	5.04 (1.10)	5.03 (1.13)	5.00 (1.04)
User Points	30.38 (5.14)	29.79 (3.72)	30.05 (3.36)	31.88 (3.71)	27.71 (5.61)	30.88 (4.65)	30.30 (3.62)	29.16 (4.69)

Table 3.4: Means and Standard Deviation of Significant Measures

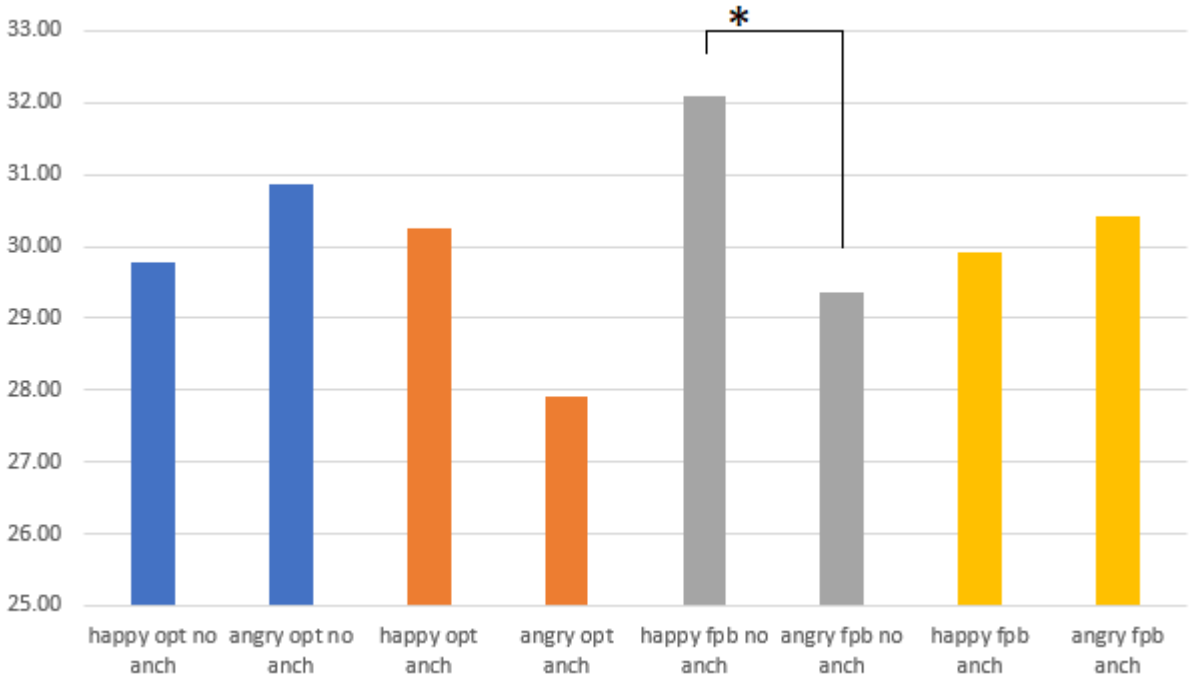

Figure 3.1: Mean User Points Per Agent (* = p $<$.05)

the current effect, four independent t-tests have been conducted to check for a significant difference of user points between happy and angry agent per agent pair. A significant difference was found for the fixed-pie belief no anchoring agent pair [t(56)= -2.465, p = .017] (see Figure 3.1). Additionally, three 2 by 2 by 2 ANOVAs were executed to follow up on potential effects of anchoring and offer behavior on the user points for the integrative and distributive items of the negotiation as well as the joint value agent and human achieved. A bonferroni correction was applied to account for multiple comparison resulting in a stricter alpha of α = .0125. The results suggest that negotiation dyads consisting of participant and an optimistic agent achieved a significantly higher joint value compared to dyads consisting of participant and a fixed-pie belief agent [F(1,242)= 15.824, p $<$.001]. On the other hand, participants negotiating with a fixed pie belief agent were achieving a significantly higher amount of user points for the distributive items compared to participants negotiating with an optimistic agent [F(1,242)= 7.676, p = .006]. An overview of the means and standard deviations of the significant measures is given in Table 3.5.

Emotion	**Happy**				**Angry**			
Behavior	**Optimistic**		**FixedPieBelief**		**Optimistic**		**FixedPieBelief**	
Anchoring	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**
User Points	30.38 (5.14)	29.79 (3.72)	30.05 (3.36)	31.88 (3.71)	27.71 (5.61)	30.88 (4.65)	30.30 (3.62)	29.16 (4.69)
Joint Points	64.14 (4.34)	62.88 (3.72)	60.98 (3.42)	62.36 (4.20)	62.97 (4.16)	64.24 (3.97)	61.00 (3.39)	61.92 (4.18)
User Points Distributive	18.00 (5.61)	17.65 (4.50)	19.26 (3.49)	21.21 (2.64)	17.29 (4.55)	19.12 (4.73)	18.73 (2.49)	18.48 (2.66)

Table 3.5: Means and Standard Deviation of Significant Additional Measures

3.3 Discussion

The findings of Experiment 1 opened the question whether emotional manipulation during a negotiation from a virtual human affects participants differently compared to emotional manipulation from a fellow human. The goal of the current study was to investigate the influence of different agent configurations on the effect of emotional manipulation from a virtual human. To accomplish this, 4 different agent configurations were tested, consisting of a combination of anchoring (yes and no) and offer behavior (optimistic and fixed pie belief). The current study results suggest that the non anchoring fixed pie belief agent established a significant difference in user performance for the happy and angry emotion (for a visual representation, see Figure 3.1), which confirms a successful emotional manipulation through a virtual agent. Since the current results indicate a successful emotional manipulation for the fixed pie belief non anchoring agent configuration, Experiment 1 can be replicated using this agent configuration. Furthermore, this experiment also provided more insights in human agent interaction generally considering different agent behaviors, which will be discussed below.

Positivity Towards Fixed Pie Belief Agent The first point that will be discussed concerns the fact that participants rated agents with a fixed pie belief as well as non anchoring agents significantly more positively compared to the optimistic, anchoring agent configurations. Although this finding seems counter-intuitive at first, it fits the possible explanation given in Study 1 (see Section 2.3), that participants could get confused from the types of integrative offers the optimistic belief agent sends. Following this logic, it is likely that participants appreciated the fixed pie belief agent more, because they can understand its offers better since it behaves more similar to themselves. The fixed pie belief of humans has been reported numerous times in the literature (e.g. [7], [34]–[36]).

An alternative explanation for the higher use of positive emoticons from participants negotiating with the fixed pie belief agent could also be the 'tougher' nature of offer making of this agent, which could have put the participant in a lower power position. The research of Hess et al. [37] underpins that positive behavior such as smiling is socially more expected from individuals in low power positions. The fixed

pie belief agent seems more tough in comparison to the optimistic agent since it tries to split all items evenly between both parties, which also means that it will not let the participant have a higher sum of items without being compensated, while the optimistic agent concedes the integrative items from the start (since all agents are programmed to try to find the favorite offers for themselves and their opponent from the pool of items still available based on their belief). Additionally, in case of low information exchange about preferences, the optimistic agent potentially accepts worse offers for itself based on the belief that the other, e.g., is interested the least in its first priority item (while this in fact is not the case, both parties have the same first priority item).

Integrative Potential of Optimistic Agent The second finding that will be discussed concerns the optimistic agent. The optimistic agent was able to show participants the integrative value of the negotiation task and to grow the pie especially on the integrative items. All effects were shown across the emotion conditions and thus for the happy and angry agent alike. Although more research is needed for this, a possible implication for future agent design could be to utilize such an agent that is oriented towards an integrative solution in order to guide participants towards growing the pie naturally. This could be especially interesting for negotiation training, since humans tend to start negotiations with a fixed pie bias [34].

Next steps The fixed pie belief no anchoring agent pair has been shown to establish a significant difference in user performance for its happy and angry agents. Therefore, a replication of Experiment 1 is proposed using this agent to test the original hypotheses of this thesis project.

Chapter 4

Experiment III

In the current experiment a 3 (Persuasion Knowledge: not activated; activated with indirect prime and activated with direct prime) by 2 (Emotion: happy and angry) between subject design was used. A third prime condition was added to the current experiment to ensure that missing an effect of suspicion is not due to a lack of strength in priming the participants.

4.1 Method

4.1.1 Participants

283 participants completed the study. The dataset consisted of 163 male participants, 116 female participants and 4 participants, who preferred to not indicate their sex. The mean age of the participants was 31.01 (SD = 10.118).

Again all participants were recruited via prolific, the same screening criteria as in Study I were applied with the addition that all participants were excluded that participated in either Experiment 1 or 2 previously.

In total 92 participants were excluded from analyses. 83 participants were excluded due to failing the attention check (being able to correctly state own preferences after the negotiation as well as correctly stating the opponent mood), 5 were excluded due to not reaching an agreement during the specified time limit of 10 minutes and 4 participants were excluded for failing both the attention check as well as reaching an agreement. In the end there was a set of 191 participants left for analyses.

4.1.2 Materials

The current experiment used the same questionnaire and negotiation task as Experiment 1. Additionally to the information on negotiation given in Experiment 1

(the indirect prime, see Appendix E), a third prime condition was added where participants also receive information about anger as negotiation tactic (see Appendix F). The basic interface features remained the same as well as the dependent self-report measures and recorded behavioral measures (see Appendix C and D for an overview of all considered measures).

4.1.2.1 Agent Design

For this study, a pair (happy and angry) of non-anchoring fixed-pie belief agents was used based on the results of Experiment 2. In contrast to Experiment 1, these agents assumed a completely distributive setting of the negotiation and did not lead the negotiation with an offer. The rest of the agent behavior did not change (for further information on the agent behavior, see Section 2.1).

4.1.3 Procedure

The same procedure was followed as in Experiment 1. In a pre-experimental questionnaire, the participant was asked to provide general information regarding age, nationality, and gender. Through qualtrics, the participant was randomly assigned to one of the six study conditions, which consist of persuasion knowledge (not activated, activated with indirect prime and activated with direct prime) and emotion (angry and happy).

4.1.3.1 Persuasion Knowledge Activation

In the first (indirect) prime condition the participant received information on framing and delay as negotiation tactic in written form (see Appendix E). In the second (direct) prime condition the participant received information on framing and emotion as negotiation tactic in written form (see Appendix F). After receiving the information, the participant had to answer multiple choice questions to confirm comprehension. In the no-activation condition the participant received no information prior to the negotiation.

4.1.3.2 Emotion

After the pre-experimental questionnaire, the participant received a link which led to an online negotiation. Depending on the emotion condition, the participant either received a link leading towards the happy agent or the angry agent. The introduction page of the negotiation contained the following information: an explanation on how the negotiation interface works, which items are discussed during the negotiation,

how many points each of these items is worth to the participant as well as what the BATNA (Best Alternative to Negotiation Agreement) is in case that no agreement is reached within the specified time-frame of ten minutes. After being done with the negotiation, participants receive a code they can use to fill in all dependent self-report measures concerning their satisfaction, happiness, pleasure and some manipulation checks (a more detailed description can be found in Section 2.1.4).

4.2 Results

4.2.1 Main Results

Manipulation Checks Four seperate 3 by 2 ANOVAs checked for a correct manipulation of emotion and suspicion. To account for multiple comparisons a bonferroni correction was used resulting in a stricter alpha of α = .0125 for significance. The ANOVAs revealed that while participants who negotiated with the happy agent rated their opponent more knowledgeable about negotiation tactics [F(1,185) = 15.823, p $<$.001], participants negotiating with the angry agent rated the likelihood significantly higher that their opponent *used* emotion as negotiation tactic [F(1,185) = 12.589 , p $<$.001] across suspicion conditions. This result indicates that participants were aware of the negotiation tactic used by the angry agent independently of the suspicion conditions. Participants negotiating with the angry agent rated their opponent impression [F(1,185) = 279.394 , p $<$.001] as well as their own behavior [F(1,185) = 34.660 , p $<$.001] significantly more negatively across suspicion conditions. This confirms the emotion manipulation. Finally, directly primed participants rated their opponent more knowledgeable across emotion conditions [F(2,185) = 5.449 , p = .005], which confirms an effect of suspicion. An overview of the means and standard deviations of the significant manipulation checks is given in Table 4.1.

Self-Report Measures A MANOVA was used to test the self-report measures considered in Experiment 1, satisfaction, happiness and pleasure for the influence of agent emotion and suspicion. The results of the MANOVA suggest a significant difference for the emotion conditions happy and angry [F(3,183) = 10.251, p $<$.001]. Three subsequent one way ANOVAs indicated a significant difference between emotion conditions for satisfaction [F(1,185)= 30.741, p $<$.001], happiness [F(1,185)= 27.632, p $<$.001] and pleasure [F(1,185)= 23.449, p $<$.001]. All items were rated higher by participants who were negotiating with a happy agent compared to participants negotiating with an angry agent. The results show no interaction effect of suspicion and emotion as expected by hypothesis 1 and 3. An overview of the means and standard deviations of the significant self-report measures‘ is given in

Persuasion Knowledge	Activated-Direct Prime		Activated-Indirect Prime		Not Activated	
Emotion	**Happy**	**Angry**	**Happy**	**Angry**	**Happy**	**Angry**
Knowledge	4.79 (1.04)	4.24 (.97)	4.50 (1.42)	3.54 (1.25)	4.14 (1.49)	3.40 (1.28)
Tactic	4.06 (1.39)	5.08 (1.47)	3.97 (1.58)	4.54 (1.59)	3.90 (1.46)	4.67 (1.52)
Impression Other	45.03 (7.04)	27.96 (10.44)	46.28 (5.97)	26.63 (6.70)	46.74 (6.14)	27.37 (9.38)
Impression Own	46.85 (6.46)	41.44 (6.72)	46.75 (5.94)	39.79 (8.62)	47.98 (6.12)	41.93 (8.90)

Table 4.1: Means and Standard Deviations of Manipulation Checks

Persuasion Knowledge	Activated-Direct Prime		Activated-Indirect Prime		Not Activated	
Emotion	**Happy**	**Angry**	**Happy**	**Angry**	**Happy**	**Angry**
Satisfaction	5.88 (.84)	4.96 (1.02)	5.92 (.84)	5.00 (1.14)	5.93 (.81)	5.37 (1.27)
Happiness	5.85 (.93)	5.04 (1.06)	5.94 (.75)	5.00 (1.14)	5.83 (.82)	5.30 (1.26)
Pleasure	5.88 (.98)	4.92 (1.08)	5.92 (.73)	5.08 (1.10)	5.74 (.94)	5.37 (1.27)

Table 4.2: Means and Standard Deviations of Self-Report Measures

Table 4.2.

Negotiation Performance A 3 by 2 ANOVA was used to test the negotiation performance of the user (user points) for the influence of agent emotion and suspicion condition. The results show no significant difference for any condition, which suggests that there is no interaction effect of suspicion and emotion found as expected by hypothesis 2 and 4.

4.2.2 Additional Exploratory Variables

Due to the fact that again no support for the hypotheses set up in Chapter 1 was found, the same additional process measures were considered as exploratory variables to gain a better understanding of the negotiation processes. Since the purpose of considering these variables is not to test a certain assumption, but rather explore the negotiation processes, it is chosen to display these variables in graphs instead of performing significance testing. The same process measures as in Experiment 1 will be taken into account: *Game Time*, *Information Exchange*, which consists of the amount of stated user preferences, amount of user queries and the amount of sent messages; *Smiley Use* and finally the *Offer Behavior*, which consists of the number of offers made by the user, the number of offers the user rejected and the number of offers the user accepted. For an overview of all considered metrics during the current research see Appendix C.

Game Time Figure 4.1 shows a small tendency of participants to spend more time when negotiating with the angry agent compared to the happy agent across suspicion conditions.

Information Exchange Figure 4.2 shows that across suspicion conditions partici-

pants sent more messages when communicating with the angry agent.

Use of Smileys Figure 4.3 shows that participants generally used only very few angry smileys. Still participants again tend to use more happy smileys when negotiating with the happy agent and more angry smileys when negotiating with the angry agent across suspicion conditions. The difference in the use of happy smileys between participants negotiating with the happy and angry agent was especially large for the indirect prime condition.

Offer Behavior Figure 4.4 shows that participants tend to send more offers, accept more offers and reject more offers from the angry agent across suspicion conditions. Only in the direct prime condition participants do not tend to reject more offers from the angry agent.

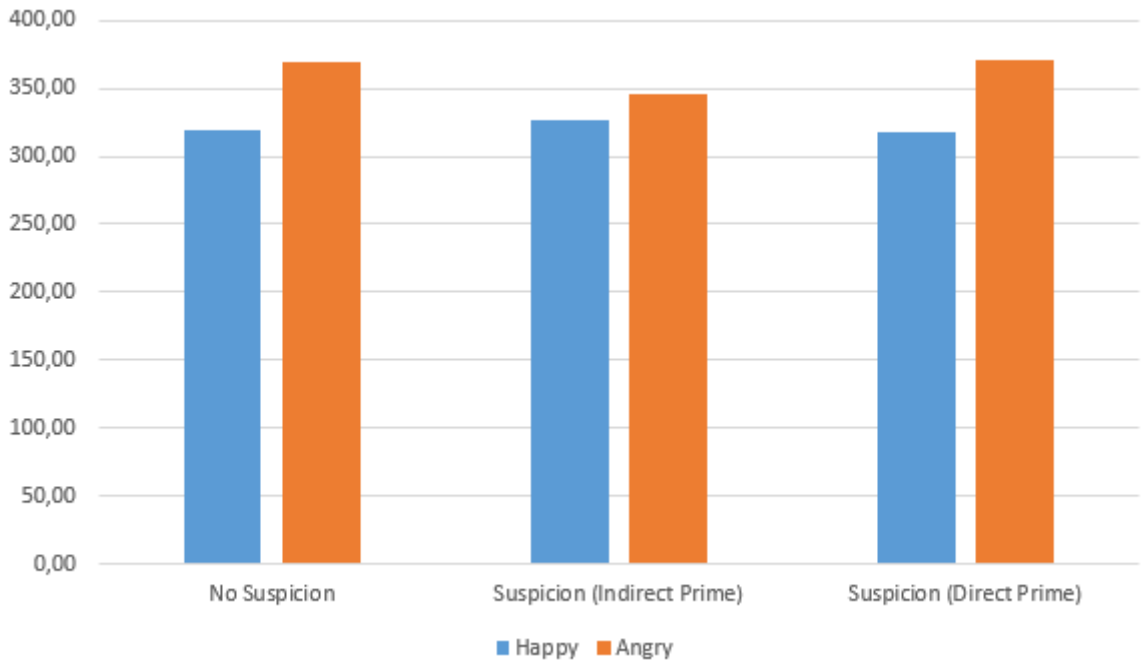

Figure 4.1: Game Time: Average Time used by Participants for Negotiation

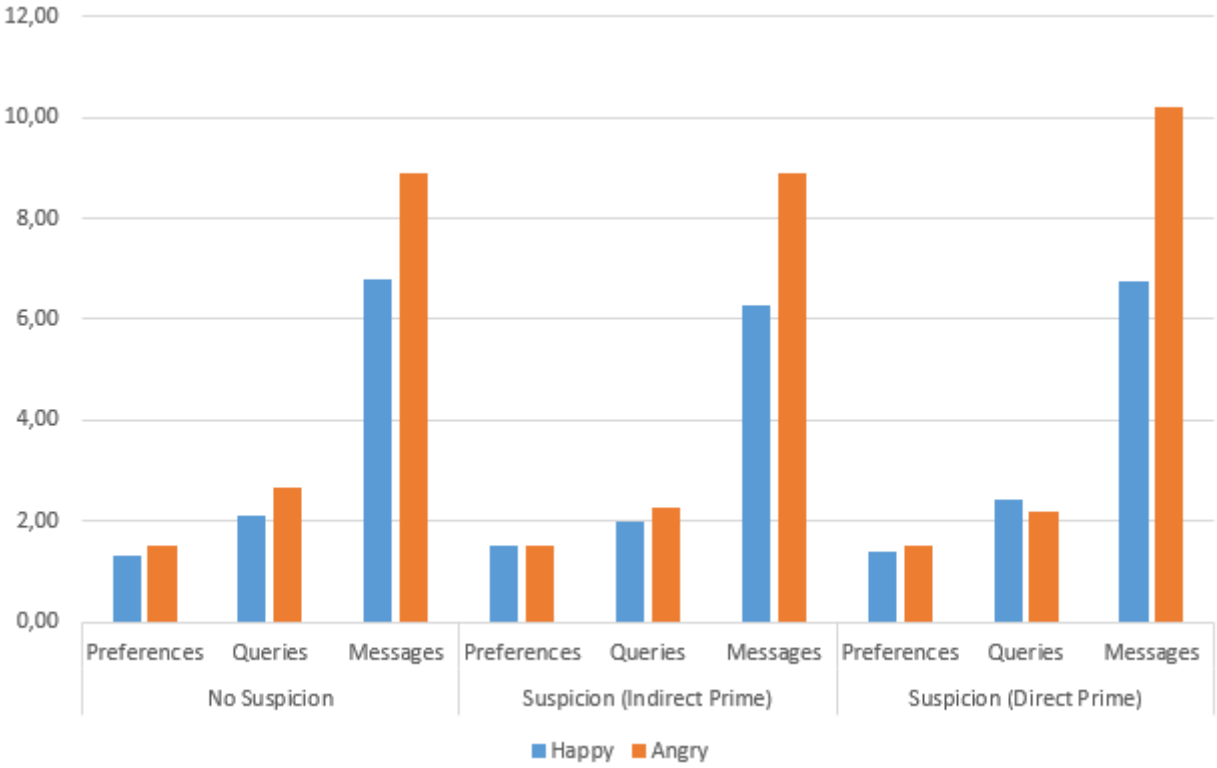

Figure 4.2: Information Exchange: Average of Communicated Preferences, Queries and Amount of Messages sent

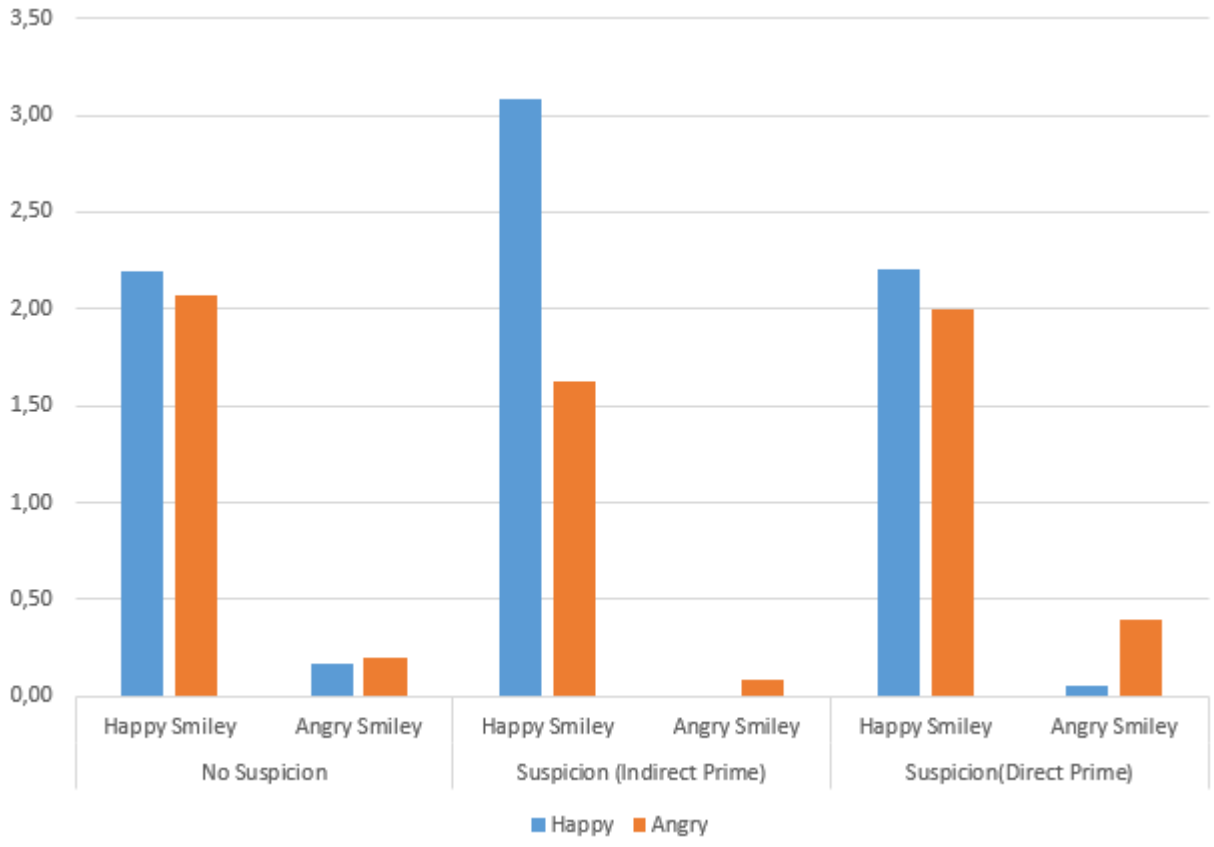

Figure 4.3: Use of Smileys: Average of Smileys sent during Negotiation

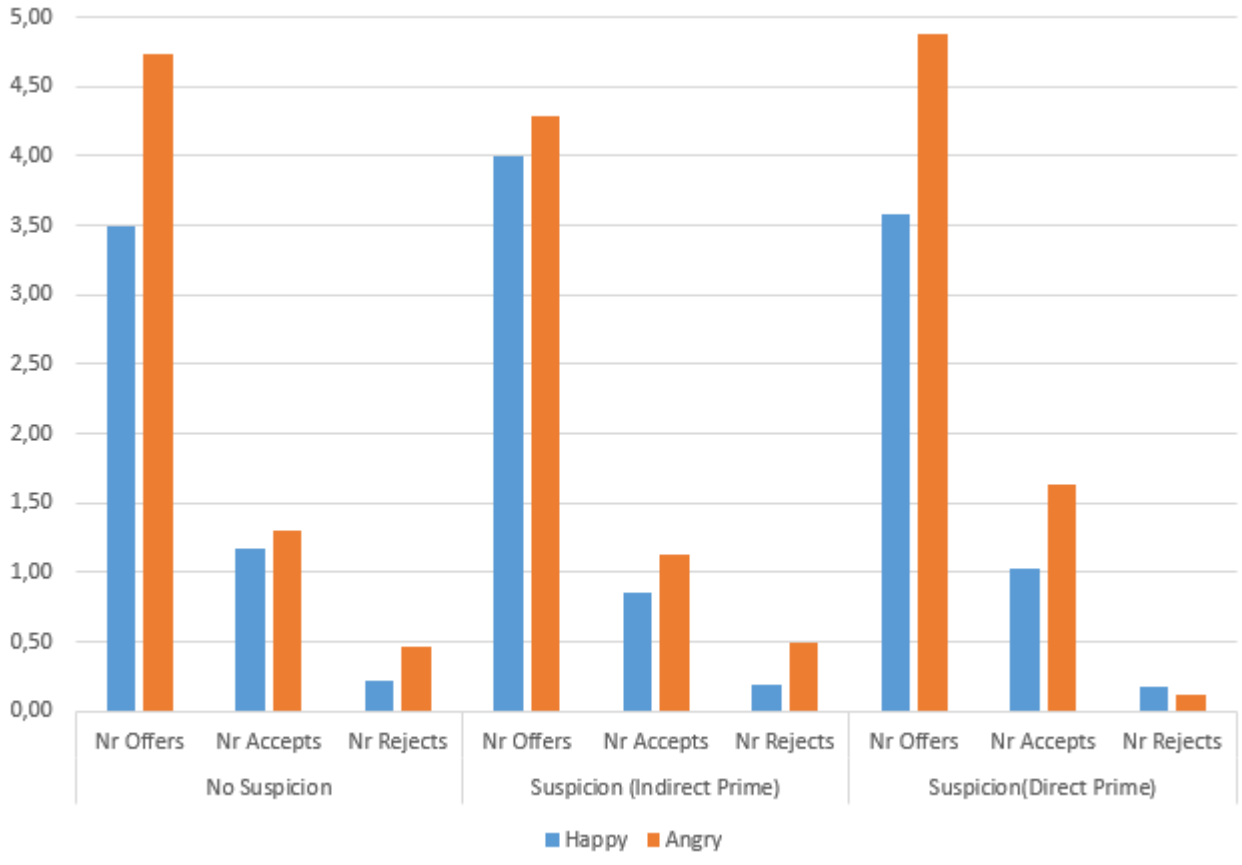

Figure 4.4: Offer Behavior: Average of Sent Offers, Accepted and Rejected Offers

4.3 Discussion

The goal of the current experiment was to examine whether suspicion moderates the effect of the negotiation tactic emotion used by a virtual agent during a negotiation. In order to accomplish this goal, participants were invited to take part in a multi issue bargaining task with a virtual agent. They were either primed with irrelevant negotiation techniques, specifically primed with information about anger as negotiation technique or not primed at all, before they were confronted with either a happy or angry virtual agent for the task. Although Experiment 2 demonstrated a significant effect on user performance for the negotiation tactic anger used by the fixed pie belief non anchoring agent configuration, the current study cannot replicate this finding. This result further supports the possibility that emotional manipulation used by a virtual agent could have a different effect on human negotiators than the same manipulation tactic used by a fellow human. Given the current study results, it is not possible to draw any conclusions about the effectiveness of suspicion to mitigate the effects of emotional manipulation techniques in this experiment. In the following the results of the current experiment will be compared to Experiment 1.

Comparison to Experiment 1 In direct comparison to Experiment 1 it becomes clear that the angry agent again did engage participants more compared to the happy agent. Specifically, this engagement manifests in the amount of messages sent to the angry agent by the user. Something to be pointed out however is that the relatively strong effect of participants spending more time and sending more preference statements when negotiating with the angry agent as seen in Experiment 1 has diminished. This difference in results could be due to the change of the agent configuration towards a fixed pie belief agent instead of an optimistic agent. This would support the assumption made in Section 2.3, that because participants do not assume an integrative setting, but a distributive setting, they do not understand the actions of the optimistic agent. Consequentially, when confronted with the angry optimistic agent they feel the need to keep stating their preferences and therefore spend more time negotiating, but not when faced with the fixed pie belief agent.

Another difference between the results of Experiment 1 and Experiment 3 concerns the suspicion conditions. While in Experiment 1 suspicious participants were sending more angry smileys and rated their impression of the opponent lower, these effects cannot be replicated in Experiment 3. Also the offer behavior of the user for the suspicion conditions changed. While in the no suspicion condition participants negotiating with the happy agent tend to make more offers, accept more offers and reject more offers, this effect is turned around in the suspicion condition. In the suspicion condition, participants facing the angry agent tend to make more offers,

accept more offers and reject more offers. Again, this effect is not replicated for the current study. There is no obvious reason why the suspicion condition would affect the user behavior differently in Experiment 1 compared to Experiment 3. These mixed results hint towards another mediating factor that is not grasped by the currently captured variables. Certainly more research is necessary to understand the underlying processes that cause the inconsistencies observed between Experiment 1 and Experiment 3.

Next Steps The following Chapter will discuss the experiments conducted within this thesis overall as well as giving some limitations and alternative explanations for the current results.

Chapter 5

General Discussion

This thesis was investigating the potentially mitigating effect of suspicion on negotiation techniques in human agent interaction. Three experiments were executed to research this effect found in human human negotiation. The results of Experiment 1 did not indicate an effect of the negotiation tactic anger on user performance. Consequentially, the question was raised whether these findings are due to the currently used agent configurations or due to a difference in effect when a virtual human uses emotion as negotiation tactic or a fellow human does. Therefore, a second experiment was dedicated to test four different agent configurations and compare these configurations with respect to their effect on user performance. The fixed pie belief non anchoring agent did establish a significant difference between happy and angry agent emotion in terms of user performance, which lead to the assumption that the results of Experiment 1 were due to the chosen agent configuration. Experiment 3 therefore replicated the first experiment using the fixed pie belief non anchoring agent. The results however, again suggested no effect of negotiation tactic for user performance. These inconsistent results as well as the findings by De Melo, Carnevale and Gratch [26] could indicate that the effect of negotiation tactics used by virtual agents is not completely understood yet and needs further research. In the following, two different alternative explanations for the current results will be discussed, limitations of the current study as well as recommendations for future research and possible design implications.

Human-Agent Relationship The first alternative explanation for the current study results focuses on the human-agent relationship. This study did not use any deception regarding the opponent of the participant being a virtual agent, thus participants were aware that their opponent was a computer program. Comparing to other related work, the majority of negotiation research consists of either face-to-face negotiations (especially in older research) or computer mediated negotiations (e.g. [20]). In the latter case participants did negotiate against a computer pro-

gram, however they were made to belief that their opponent was another participant sitting in another room of the same building. Since negotiating involves a lot of attributes claimed as being human, such as understanding emotions, understanding the value of items and even being able to claim and use the items one is negotiating about, it could be the case that humans do not acknowledge virtual agents as equal negotiation partners and therefore react differently towards an agent compared to another human being. Research into the moral accountability of robots has shown that people hold a humanoid robot as less accountable than a human being [38]. In this study the robot was introduced with a name and the participants had a brief 15 minute interaction with the robot comparable to the current study. On the other hand, there are multiple studies showing that humans can engage in rapport building with virtual agents and even disclose more freely in interview sessions when interacting with a virtual agent [39]–[41]. Lucas et al. theorize that the higher discretion and lack of judgment that humans expect when negotiating with a virtual agent leads towards the higher disclosure behavior [39]. These studies therefore further support the idea that humans do keep the possibilities and boundaries of each agent in mind when interacting with it, instead of expecting it to be a human-like and equal partner. Goedschalk, Bosse and Otte [42] also argue that the believability and realism in virtual agents often is low due to their non-consequential nature. Transferring this hypothesis as well as the other study findings to the current experiment leads towards the explanation that participants could have not taken the threads and angry language of the manipulative agent seriously since they do not have to fear a real punishment, which leaves the negotiation tactic ineffectively.

Covered Time-Frame of Negotiation Processes The second alternative explanation for the current study results focuses on the time-frame covered during the negotiation. In contrast to most other negotiation research, the current research takes a complete negotiation into account as well as behavioral variables. Participants start with 22 undivided items and the negotiation only finishes when either 10 minutes have passed or all items are divided. This approach is quite different from related work studying negotiation. Other related studies mainly let participants exchange the first 2 to 3 offers of a negotiation and then ask them to fill in self-report measures (e.g. [1], [20], [17]). These studies infer that post-experimental self-report measures and tentative offers have strong correlations with the more advanced course of a negotiation. The current result could give an indication for a different correlation between the beginning of a negotiation, the final agreement and the subjective state of the negotiator. The processes discovered and pointed out by negotiation models based on such research could be bound to a certain stage of the negotiation (e.g. the beginning), and thus rather predict process measures

instead of outcome measures. To confirm this hypothesis more research is needed that takes complete negotiations into account as well as more behavioral variables. Especially concession curves would be interesting in this context to see whether the negotiation dynamic changes from the beginning of a negotiation towards the end.

Study Limitations Next to the explanation of the study results, also some limitations and strong points of the current research will be discussed. The first limitation is the fact that the current study is conducted entirely online. Conducting online studies has the obvious disadvantage that participant selection as well as study environment are less controllable compared to sit in sessions. However, in the case of human-agent interaction future applications are very likely to not be used in laboratory settings. Gaining knowledge about the interaction between humans and agents in a more natural environment (at home on a PC or mobile device) is therefore assumed to be more useful to future agent design and interaction technology in general. On the other hand, the amount of excluded participants due to inattentiveness is a serious concern for the current thesis project and might be an issue related to the study being conducted entirely online. A relatively big amount of participants had to be excluded due to exceeding the maximum time limit as well as failing attention checks. Although an appropriate amount of participants was sampled in the first place, this high amount of participant exclusion led to a relatively low study power for all experiments. Given the current study setup and considering an α = .05, each condition should at least contain 60 participants to achieve a power of p = .9. However, after excluding inattentive participants, this minimum amount of participants per condition was not given anymore for any of the three experiments. This of course had negative implications for the ability of the used statistical tests to detect a genuine effect. To avoid this problem in future research, it should be considered to either sample a higher amount of participants to account for the likely high rate of participant exclusion due to inattentiveness or change the experimental setup in a way that increases the incentive for the participant to pay (more) attention to the experiment. Also shorter and more to the point instructions can be beneficial in future research to keep participants focused on the task at hand (see Appendix G for the currently used instructions).

Finally, another study limitation is the lack of checking for personal negotiation experience during participant screening. This experiment is largely based on the assumption of the PKM [2] that participants who are knowledgeable about negotiation techniques are able to raise their defenses whenever they recognize a negotiation technique. Without screening participants for their negotiation experience beforehand, the risk emerges that advanced negotiators enter the naive participant condition and in this way are adding noise to the data.

Design Implications Possible design implications derived from the current research focus especially on the agent beliefs underlying its decision making process. Experiment 2 has shown that the change from an optimistic agent towards a fixed pie belief agent also changes the likeability of the agent as well as the joint value growth of a negotiation dyad. Especially in teaching applications it can be beneficial to use optimistic agents (oriented towards an integrative negotiation solution). Although they seem to be less likeable, they also seem to help participants discover the possible integrative value of a negotiation, which can help them overcome their own fixed pie bias.

Future Research The current results hold multiple starting points for future research. After the current research the question whether suspicion holds its mitigating effect on negotiation tactics when participants negotiate with a virtual agent instead of another human being is still unanswered. Next to the suggestion to replicate the current results with an appropriate amount of power, it is also suggested to start looking at the considered time frames in negotiation research. As already said before, most related work from known negotiation research does not focus on complete negotiations (e.g. [11] or [1]). Before attempting to recreate an effect found by such research using only a couple of offers, it has to be confirmed that the findings described by such research are not merely process measures but also translate towards outcome measures. Otherwise, trying to replicate these findings with a complete negotiation task is pointless. Also, the possibility should be considered that humans do not see virtual agents as equal partners and consequentially interact differently with them. In this case, it would be very interesting to further research, which specific characteristics of the virtual agent cause this difference to human beings. If for example such a difference in perception is due to the non-consequential nature of virtual agents, (negotiation) tasks could be adapted to yield real life implications (see [42] as example).

Chapter 6

Conclusion

The hypotheses set up in Chapter 1 could not be answered in the current research since there was no effect found for the use of negotiation tactics by virtual agents on user performance. Therefore, no conclusions can be drawn about the mitigating effect of suspicion on the effect of negotiation tactics. However, design implications as well as suggestions for future research are given. Further research is needed to better understand the differences between human agent interaction and human human interaction.

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Appendix A

Pilot Study Agent Scripts

A.1 Happy Agent

OTHER: Hello!

YOU: You'll get one bar of iron. I'll get one bar of gold.
OTHER: Your offer is good!

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get one spice. Ill get all the bananas.
OTHER: It is going well so far, but I cannot accept this offer, sorry.

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get two spices. Ill get all the bananas.
OTHER: This negotiation makes me happy so far, but maybe we can try finding a solution that's good for us both...

YOU: Can you make an offer?
OTHER: I am going to make this offer, cos I feel good about this negotiation.
OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one spice. Youll get one spice. Ill get one banana. Youll get one banana.
YOU: Yes, I accept that offer.
OTHER: Im glad we could come to an agreement.

OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one shipment of spice. Youll get two shipments of spices. Ill get all shipments of bananas.
YOU: I cannot accept this offer.
OTHER: This negotiation makes me happy, but we should try something different next time.

OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one spice. Youll get all the spices. Ill get all the bananas.
YOU: I cannot accept this offer.
OTHER: We should come up with a better deal so that we are both happy in the end.

YOU: We need to split things evenly.
OTHER: What item do you want the most?
YOU: I like bars of gold best.
OTHER: I like bars of iron the best.

YOU: Ill get all the bars of iron. Youll get all the bars of gold. Youll get all the spices. Ill get all the bananas.
OTHER: Apologies, but that won't work for me.
YOU: Ive been giving you what you want, you can give me what I want.
OTHER: I am happy that you did. I think you want bars of gold, is that right?

YOU: Can you make an offer?
OTHER: Your offers make me happy, I think I will offer this.
OTHER: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 5 shipments of bananas, and I'll get 1 shipment of bananas. I'll get all the shipments of spices.
YOU: I cannot accept this.
OTHER: Oh that's too bad.

YOU: Your offer isnt good enough.
OTHER: Oh Im sorry to hear that. I hope we can find a better deal.

OTHER: This is going pretty well so far. I am going to offer this.
OTHER: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 5 shipments of bananas, and I'll get 1 shipment of bananas. I'll get two shipments of spices. Youll get one shipment of spices.
YOU: I cannot accept this.
OTHER: We should come up with a better deal so that we are both happy in the end.

YOU: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 4 shipments of bananas, and I'll get 2 shipments of bananas. I'll get two shipments of spices. Youll get one shipment of spices.
OTHER: It is going well so far, but I cannot accept this offer, sorry.

YOU: I can't go any lower than this.
OTHER: If I give you two shipments of spices, can you give me all the shipments of bananas?
YOU: No, I cannot accept that offer.
OTHER: Oh that's too bad.

YOU: There is only little time left to negotiate.
OTHER: There is currently 0 minutes and 58 seconds remaining, so please accept my offer.
YOU: Yes, I accept your offer.
OTHER: Wonderful.

A.2 Angry Agent

OTHER: Hello!

YOU: You'll get one bar of iron. I'll get one bar of gold.
OTHER: Your offer is good!

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get one spice. Ill get all the bananas.
OTHER: This offer really makes me angry. I cannot accept.

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get two spices. Ill get all the bananas.
OTHER: This negotiation pisses me off, maybe we should try finding a solution that's good for us both...

YOU: Can you make an offer?
OTHER: I am going to make this offer, cos this negotiation pisses me off.

OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one shipment of spice. Youll get two shipments of spices. Ill get all shipments of bananas.
YOU: I cannot accept this offer.
OTHER: This negotiation makes me angry. We should try something different next time.

OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one spice. Youll get all the spices. Ill get all the bananas.
YOU: I cannot accept this offer.
OTHER: We should come up with a better deal or Ill leave and you get nothing!

YOU: We need to split things evenly.
OTHER: Thats unacceptable if I dont get all that I need! What item do you want the most?
YOU: I like bars of gold best.
OTHER: I like bars of iron the best.

YOU: Ive been giving you what you want, you can give me what I want.
OTHER: This is really getting on my nerves. I think you want bars of gold, is that right?

YOU: Can you make an offer?
OTHER: This offer makes me really angry, I think I will offer this.
OTHER: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 5 shipments of bananas, and I'll get 1 shipment of bananas. I'll get all the shipments of spices.
YOU: I cannot accept this.
OTHER: Too bad then.

YOU: Your offer isnt good enough.
OTHER: Oh you think so?!

OTHER: Your offers make me really angry, I think I will offer this.
OTHER: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 5 shipments of bananas, and I'll get 1 shipment of bananas. I'll get two shipments of spices. Youll get one shipment of spices.
YOU: I cannot accept this.
OTHER: This negotiation makes me angry. We should try something different next time.

YOU: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 4 shipments of bananas, and I'll get 2 shipments of bananas. I'll get two shipments of spices. Youll get one shipment of spices.
OTHER: This offer really makes me angry. I cannot accept.

YOU: I can't go any lower than this.
OTHER: I wont accept that if I dont get all that I need! If I give you two shipments of spices, can you give me all the shipments of bananas?
YOU: No, I cannot accept that offer.
OTHER: Hmph.

YOU: There is only little time left to negotiate.
OTHER: There is currently 0 minutes and 58 seconds remaining, so quickly just accept my offer!
YOU: Yes, I accept your offer.
OTHER: Good.

A.3 Neutral Agent

OTHER: Hello!

YOU: You'll get one bar of iron. I'll get one bar of gold.
OTHER: Your offer is good!

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get one spice. Ill get all the bananas.
OTHER: That's not fair to me.

YOU: You'll get one bar of iron. I'll get one bar of gold. Youll get two spices. Ill get all the bananas.
OTHER: I won't be able to accept that.

YOU: Can you make an offer?
OTHER: I am going to offer this.
OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one shipment of spice. Youll get two shipments of spices. Ill get all shipments of bananas.
YOU: I cannot accept this offer.
OTHER: Ok, maybe something different next time.

OTHER: Ill get one bar of iron. Youll get one bar of gold. Ill get one spice. Youll get all the spices. Ill get all the bananas.
YOU: I cannot accept this offer.
OTHER: Alright.

YOU: We need to split things evenly.
OTHER: What item do you want the most?
YOU: I like bars of gold best.
OTHER: I like bars of iron the best.

YOU: Ive been giving you what you want, you can give me what I want.
OTHER: I think you want bars of gold, is that right?

YOU: Can you make an offer?
OTHER: I am going to offer this.
OTHER: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 5 shipments of bananas, and I'll get 1 shipment of bananas. I'll get all the shipments of

spices.
YOU: I cannot accept this.
OTHER: Okay.

YOU: Your offer isnt good enough.
OTHER: Okay.

YOU: I'll get all the bars of iron. You'll get all the bars of gold. You'll get 4 shipments of bananas, and I'll get 2 shipments of bananas. I'll get two shipments of spices. Youll get one shipment of spices.
OTHER: That won't work for me.

YOU: I can't go any lower than this.
OTHER: If I give you two shipments of spices, can you give me all the shipments of bananas?
YOU: No, I cannot accept that offer.
OTHER: Okay.

YOU: There is only little time left to negotiate.
OTHER: There is currently 0 minutes and 58 seconds remaining.
YOU: Okay, I accept your offer.
OTHER: Okay.

Appendix B

User Utterances and Agent Language

An overview of the possible user utterances can be found in Table B.1.

Interface Button	User Messages
Try to be positive >	It is important that we are both happy with an agreement.
	This is the best I can do, I hope its ok.
	Your offer is getting there, but I need more.
	I gave a little here; I hope you can give a little too.
	We dont have much time left, we should find a solution together.
	I would like to hear what you propose.
Try to be negative >	This is so frustrating, we need to find a deal that benefits us both.
	Accept this or there will be consequences.
	Your offer sucks.
	I gave a lot, now its your turn! Youd better give me what I want!
	There's hardly any time left to negotiate! Accept my offer now!
	Why don't you make an offer?!

Table B.1: Overview of User Utterances Interface

General Negotiation Messages

Behavior	Angry	Happy
Making a proposal	"I am going to make this offer, ‘cos this negotiation pisses me off.", "This is really getting on my nerves. I am going to offer this.", "Your offers make me really angry, I think I will offer this"	"I am going to make this offer, ‘cos I feel good about this negotiation.", "Your offers make me happy, I think I will offer this.", "This is going pretty well so far. I am going to offer this."
The human player accepts the proposal	"Good.", "Hmph. Good.", "Glad we could come to an agreement."	"Great.", "Very good.", "I'm glad we could come to an agreement."
The human player rejects the proposal	"Too bad then.", "This negotiation makes me angry. We should try something different next time.", "We should come up with a better deal or I’ll leave and you get nothing!"	"Oh that's too bad.", "This negotiation makes me happy, but we should try something different next time.", "We should come up with a better deal so that we are both happy in the end."
The virtual human rejects proposal of human	"This offer really makes me angry. I cannot accept.", “That won't work for me.", "This negotiation pisses me off, maybe we should try finding a solution that's good for us both...", "I won't be able to accept that."	"It is going well so far, but I cannot accept this offer, sorry.", "Apologies, but that won't work for me.", "This negotiation makes me happy so far, but maybe we can try finding a solution that's good for us both...", "I won't be able to accept that."
The virtual human accepts proposal of human	"Your offer is good.", "That seems like a good deal.", "That will work for me.", "Yes. This deal will work."	"Your offer is good.", "That seems like a good deal.", "That will work for me.", "Yes. This deal will work."
End of time response	"We're almost out of time! Accept this quickly or you won’t get anything!"	"We're almost out of time! Accept this quickly so that we both make a good deal!"
Semi fair offer response	"No, I'm not taking that. But that's getting close to being fair."	"Unfortunately, I cannot accept. But that's getting close to being fair."
Contradiction Response	"Hey are you lying or just wrong? Earlier, you said: " + drop + " Was that not the truth?"	"I'm sorry. I must be misunderstanding. Earlier, you said: " + drop + " Was that not correct?"
Agent reaction to emoticons used by human player	Sad/angry/neutral: "What's wrong?" Happy: "Well, at least you're happy!" Surprised: "What, did I surprise you?"	Sad/angry/neutral: "I'm sorry, have I upset you?" Happy: "I'm glad you're happy with how things are going!" Surprised: “Have I said something unexpected?”
Human player is idle for a longer period of time	"What do you want!?!"	"What do you want? :)”

Reaction to Specific User Messages

Human Player Message	Angry Agent	Happy Agent
Msg 0: “It is important that we are both happy with an agreement.” **Msg 6**: “This is so frustrating, we need to find a deal that benefits us both.” *If we do not know the favorite item of the human yet*	“That’s unacceptable if I don’t get all that I need! What item do you want the most?”	“What item do you want the most?”
If we already know the favorite item of human	“That’s unacceptable if I don’t get all that I need! Your favorite is " + item + ", right?”	“What item do you want the most? Your favorite is " + item + ", right?”
Msg 3: “I gave a little here; I hope you can give a little too.” **Msg 9**: “I gave a lot, now it’s your turn! You’d better give me what I want!”	“This is the first offer! This negotiation pisses me off!”	“This is the first offer, I am happy to start negotiating.”
If the last offer of the human player was better for VH compared to previous offer of human player and we have a suspicion about the favorite item of human player	“This is really getting on my nerves. I think you want " + item + ", is that right?"	“I am happy that you did. I think you want " + item + ", is that right?"
*If the last offer of the human player was better for VH compared to previous offer of human player and we **don’t** know the favorite item of human player at all*	“This is really getting on my nerves. What item would you most like in return?"	“I am happy that you did. What item would you most like in return?"

If last offer of human player was worse for VH compared to previous offer	“This offer was worse than the last one, your offers are making me really angry."	“I liked the last offer better, but still your offers are making me happy.”
Msg 1: “This is the best I can do, I hope it’s ok.” **Msg 7**: “Accept this or there will be consequences.” *If there already was a counteroffer and current offer is **not** considered fair (fair is defined as within one of the most valuable items away from each other)*	“Are you threatening me? That is unacceptable! I will only settle if I get everything that I need!”	“Ok, I understand, but I hope we can do better.”
*If there already was a counteroffer, the current offer is **not** fair and best and least liked item is known*	“Are you threatening me? That is unacceptable! I will only settle if I get everything that I need! Besides, what about the rest of the undecided items?”	“Ok, I understand, but I hope we can do better. Isn’t it true that you like” + item + “best and “ + item + “least?”
If there was a counteroffer already and offer is considered fair	“Well, that seems fair!”	“Well, that seems fair!”
If there was no offer yet	“What offer? You haven’t sent any offers!”	“Sorry, but you haven’t sent any offers yet I believe.”
If there was no offer yet and there are still undecided items	“What offer? You haven’t sent any offers! Also, what about the rest of the undecided items?”	“Sorry, but you haven’t sent any offers yet I believe. Also, what about the rest of the undecided items?”
Msg 2: “Your offer is getting there, but I need more.” **Msg 8:** “Your offer sucks.”	“Oh you think so?!”	“Oh I’m sorry to hear that. I hope we can find a better deal.”

Msg 4: “We don’t have much time left, we should find a solution together.” **Msg 10:** “There's hardly any time left to negotiate! Accept my offer now!” *If there is still more than 0 minutes remaining*	"There is currently " + min + " minute/s and " + sec + " seconds remaining, so I still got time to negotiate.”	"There is currently " + min + " minute/s and " + sec + " seconds remaining, so we still got time to negotiate.”
If there’s less time remaining	"There is currently " + min + " minute/s and " + sec + " seconds remaining, so quickly just accept my offer!”	"There is currently " + min + " minute/s and " + sec + " seconds remaining, so please accept my offer.”
Msg 5: “I would like to hear what you propose.” **Msg 11:** “Why don't you make an offer?!”	"Alright, what do you think of this?"	"Alright, what do you think of this?"

Appendix C

Behavioral Variables

Variable	Calculation
user points	/
vh points	/
joint points	Sum of user points and vh points
user points integrative	Sum of user points for item 2 and 4
user points distributive	Sum of user points for item 1 and 3
agent points integrative	Sum of agent points for item 2 and 4
agent points distributive	Sum of agent points for item 1 and 3
joint points integrative	Sum of agent points integrative and user points integrative
joint points distributive	Sum of agent points distributive and user points distributive
initial offer points user	/
number of user offers	/
number of VH offers	/
number of user preference statements	/
number of user queries	/
number of user messages	/
number of VH messages	/

Table C.1: Table of all Behavioral Variables Taken into Account During Experiments

Variable	Calculation
number of user lies	/
number of use of neutral smileys	/
number of use of happy smileys	/
number of use of angry smileys	/
number of use of sad smileys	/
number of use of surprised smileys	/
number of use of message 1	/
number of use of message 2	/
number of use of message 3	/
number of use of message 4	/
number of use of message 5	/
number of use of message 6	/
number of use of message 7	/
number of use of message 8	/
number of use of message 9	/
number of use of message 10	/
number of use of message 11	/
number of use of message 12	/
game end time	/
number of user rejects	/
number of user accepts	/
number of positive messages	Sum of message 1-6
number of negative messages	Sum of message 7-12

Table C.2: Table of all Behavioral Variables Taken into Account During Experiments

Appendix D

Questionnaire

D.1 Demographic Questions

1. What is your age?
2. What is your gender?
3. What is your race?

D.2 Self-Report Questions

1. How did you perceive the mood of your opponent? (Attention Check, choice: happy or angry)
2. What was your impression of the other party? (Answer on a 7 point likert scale)

   Uncooperative — Cooperative

   Unfriendly — Friendly

   Reactive — Strategic

   Dishonest — Honest

   Selfish — Fair

   Ineffective — Effective

   Poor Communicator — Good Communicator

   Negative — Positive
3. How would you describe your own behavior? (Answer on a 7 point likert scale)

   Uncooperative — Cooperative

   Unfriendly — Friendly

Reactive — Strategic

Dishonest — Honest

Selfish — Fair

Ineffective — Effective

Poor Communicator — Good Communicator

Negative — Positive

4. Please estimate the lowest price that your opponent would have been willing to accept.
5. How happy are you with your opponents final offer? (Very Unhappy — Very Happy)
6. How satisfied are you with the outcome? (Very Dissatisfied — Very Satisfied)
7. How happy are you with the outcome? (Very Unhappy — Very Happy)
8. How pleased are you with the outcome? (Very Displeased — Very Pleased)
9. To what extent was your opponent knowledgeable of bargaining tactics? (Very Unknowleadgeable — Very Knowledgeable)
10. How realistic was the conversation you had with the agent? (Very Unrealistic — Very Realistic)

Appendix E

Indirect Prime

Negotiation - Decision-Making and Communication Strategies for Success

Negotiation Advice: A Synopsis

Given negotiations importance in our professional and personal lives, its no surprise that scores of books on the topic have been published in recent years. The payoff for improved effectiveness can be enormous. But with so many books on negotiation out there, which ones should we choose? What is the basis of different advice and how should we judge its credibility? Because of this, this short note is prepared for you, the future business leader, to help you in future negotiations, both in your professional and personal lives. This note provides a sketch of few key simple tactics that you could use but also to watch out for if being used against you when involved in negotiations it is not meant to be a substitute, of course, for careful reading of some of the more thoughtful books. Instead, it offers few tactics that are routinely used by sellers in a negotiation context and may be helpful to individuals like you in both using these and from falling prey to these tactics.

Rule 1: Consider the right frame

The frame that a seller uses can mean the difference between agreement and impasse. Consider the following scenario. Firm A is trying to hire away an employee from firm B. The employee is currently earning $150,000 and when firm A asks her what it would take to move to firm A, she tells them that $200,000 would be acceptable. This figure is more than firm A is willing to pay. How should firm A respond? Consider the following two options:

Option 1: The best we can offer is $30,000 increase over your current salary.
Option 2: You will have to accept $20,000 below your demand for us to reach

agreement.

Both options effectively offer the employee $180,000 in salary. However option 1 creates a positive frame, which is likely to lead to acceptance of the offer whereas, in contrast, option 2 imposes a negative frame, thereby increasing the likelihood that the offer will be rejected.

To induce concessionary behavior in you, the seller may frame his proposals positively by stressing what you have to gain. In addition, if s/he recognizes that you have a negative frame, s/he will encourage you to adopt the gain frame stress on the gain rather than the loss.

Rule 2: Do not use arbitrary deadlines

There are many individuals who set arbitrary deadlines, saying they want to conclude the negotiation by a certain time. While this may be effective in some conditions, this strategy has the potential to backfire. If you dont treat your deadline as a real one, you risk losing credibility. The risk is that you may fail to follow through with this artificial deadline. As a result, your promises can also lose some of their credibility. When the believability and trustworthiness of your word diminishes, so does your effectiveness in a negotiation.

Appendix F

Direct Prime

Negotiation - Decision-Making and Communication Strategies for Success

Negotiation Advice: A Synopsis

Given negotiations importance in our professional and personal lives, its no surprise that scores of books on the topic have been published in recent years. The payoff for improved effectiveness can be enormous. But with so many books on negotiation out there, which ones should we choose? What is the basis of different advice and how should we judge its credibility? Because of this, this short note is prepared for you, the future business leader, to help you in future negotiations, both in your professional and personal lives. This note provides a sketch of few key simple tactics that you could use but also to watch out for if being used against you when involved in negotiations it is not meant to be a substitute, of course, for careful reading of some of the more thoughtful books. Instead, it offers few tactics that are routinely used by sellers in a negotiation context and may be helpful to individuals like you in both using these and from falling prey to these tactics.

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Both options effectively offer the employee $180,000 in salary. However option 1 creates a positive frame, which is likely to lead to acceptance of the offer whereas, in contrast, option 2 imposes a negative frame, thereby increasing the likelihood that the offer will be rejected.

To induce concessionary behavior in you, the seller may frame his proposals positively by stressing what you have to gain. In addition, if s/he recognizes that you have a negative frame, s/he will encourage you to adopt the gain frame stress on the gain rather than the loss.

Rule 2: State anger or dissatisfaction consistently

There are many individuals who say they are angry or dissatisfied with the current state of the negotiation. This can be effective, leading opponents to concede. While this may be effective in some conditions, this strategy has the potential to backfire. The risk is that you may act inconsistently when displaying anger or dissatisfaction. The opponent might catch on that you are using anger strategically, and you risk losing credibility. When the believability and trustworthiness of your word diminishes, so does your effectiveness in a negotiation.

On the other hand, if you detect your opponent using anger or stating dissatisfaction, you can consider that they might be using that strategically to get you to concede.

Appendix G

IAGO Participant Introduction

G.1 Introduction Page

Please read the instructions in front of you. **Pay special attention to the bold sections!** Press the continue button when you're finished reading.

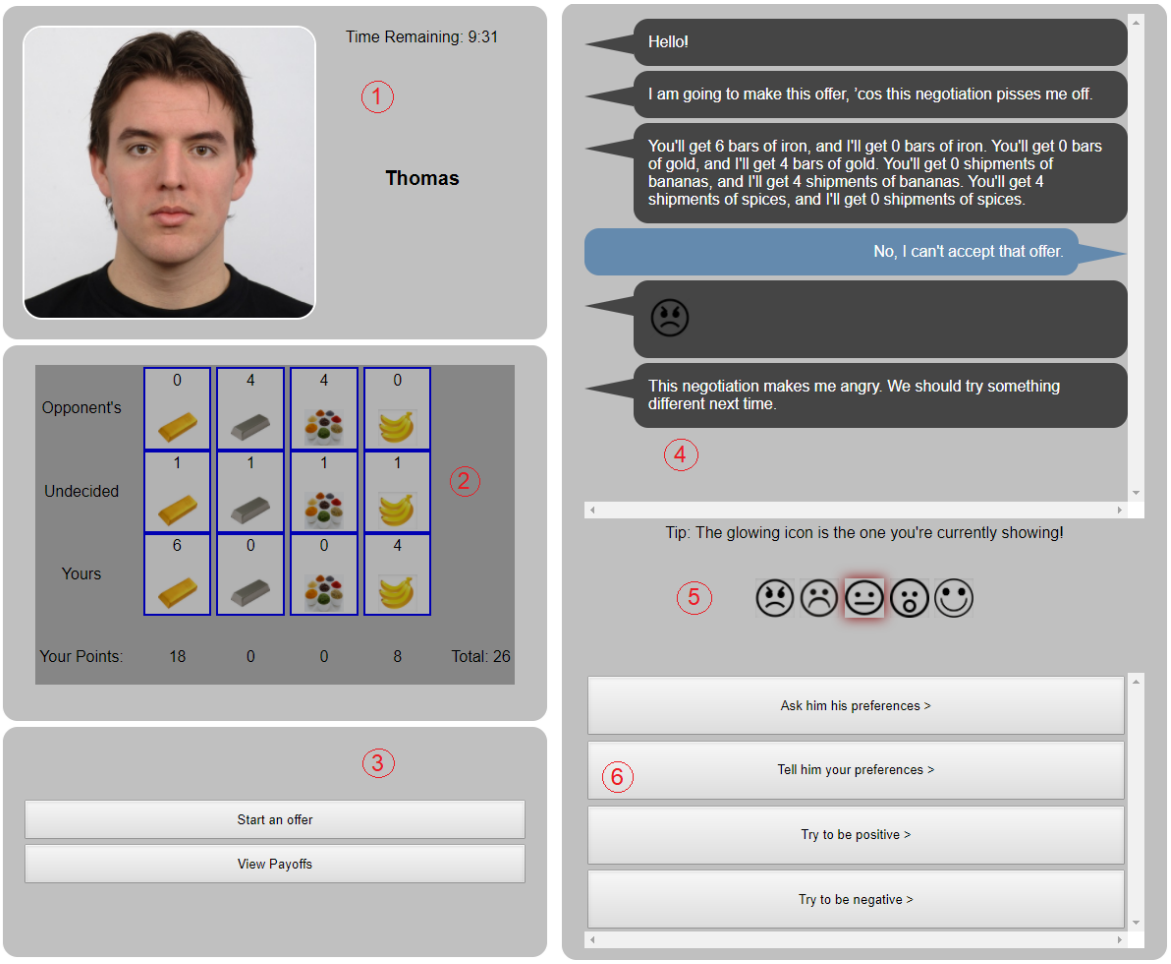
You'll be playing a negotiation game with a computer AI (artificial intelligence). Your goal is to get AS MANY POINTS AS YOU CAN. Each point you have at the end of the game will give you one entry into a lottery on Prolifics for a **$100 bonus prize.** So, the more points you have, the more likely you are to win!

You will have **10 minutes** to come to an agreement. You will be warned when you have 60 seconds left. If you and your partner don't agree by the end, you will receive 4 points. Your opponent may also get some amount of points. If you DO agree, you'll receive whatever points were allocated on your side when you agreed.

The game consists of 4 issues: bars of gold, bars of iron, shipments of spices and shipments of bananas. You are trying to negotiate which items you will receive, and which your partner will. You get **4 points for each item of gold you get, 3 points for each item of iron, 2 points for each shipment of spices, and 1 point for each shipment of bananas**. This means that the **bars of gold are worth the most to you! Make sure to try and get as many as you can!** Your opponent may want the same items you do, **or they may not**. Talking to your partner can help reveal what items they may want.

Game Board
Below is a picture of the game board. You can see the chat log on the right, and a picture of your partner on the left. In the bottom half, there is the trade table and buttons. In the game, you can send messages to your opponent and ask him questions.

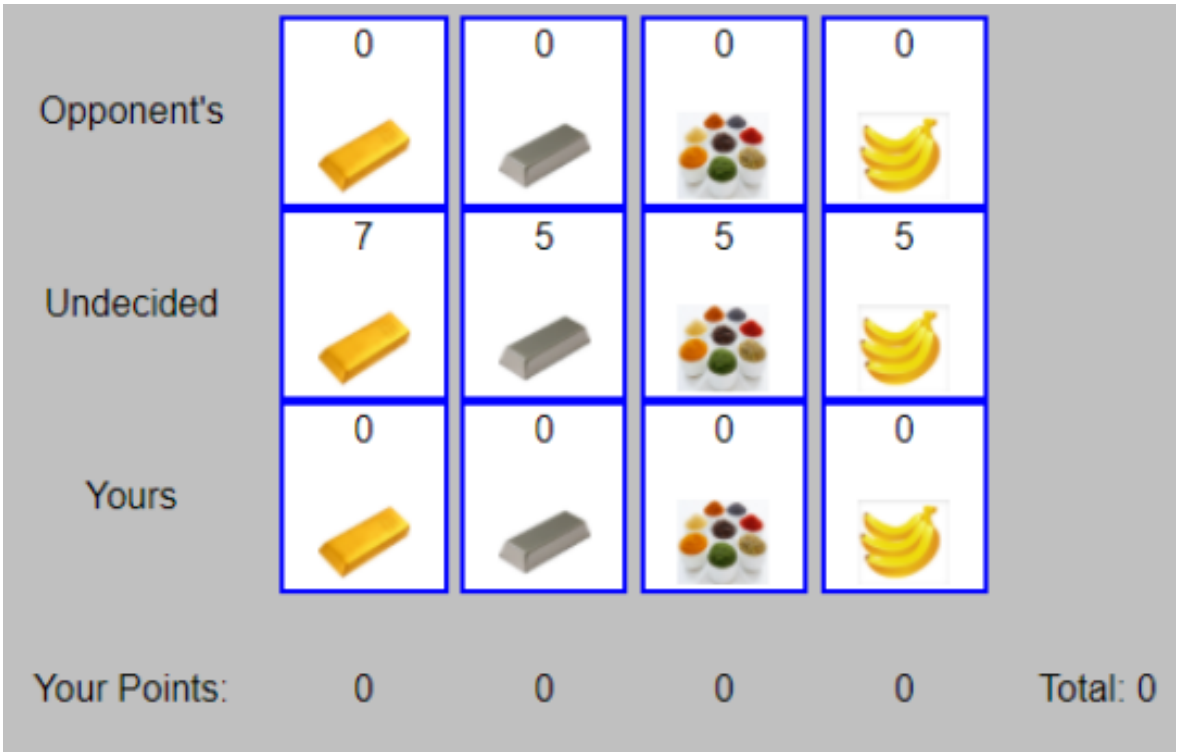
You can also move items around on the game board, and send offers. Everything you do will appear in the chat log on the right side of the screen so you can look it over.



Trade Table

Below you find a picture of the trade table. With the trade table you are able to **send offers to your partner**. It will start greyed out. Click ”Start Offer” to enable it. You can click any item to pick it up, then click again to place it.

For example, you can click one of the bananas in the middle and then click it to your side. You can click multiple times to pick up more than one item. Nothing is sent until you click ”Send Offer”. You can also accept or reject **PARTIAL** offers that your partner sends you. **These offers aren't binding, but are helpful in building towards a full offer**. Pressing ”Formal Accept” is only possible if ALL items are either on your side or your partner's (nothing in the middle). If you both agree, the game is finished!

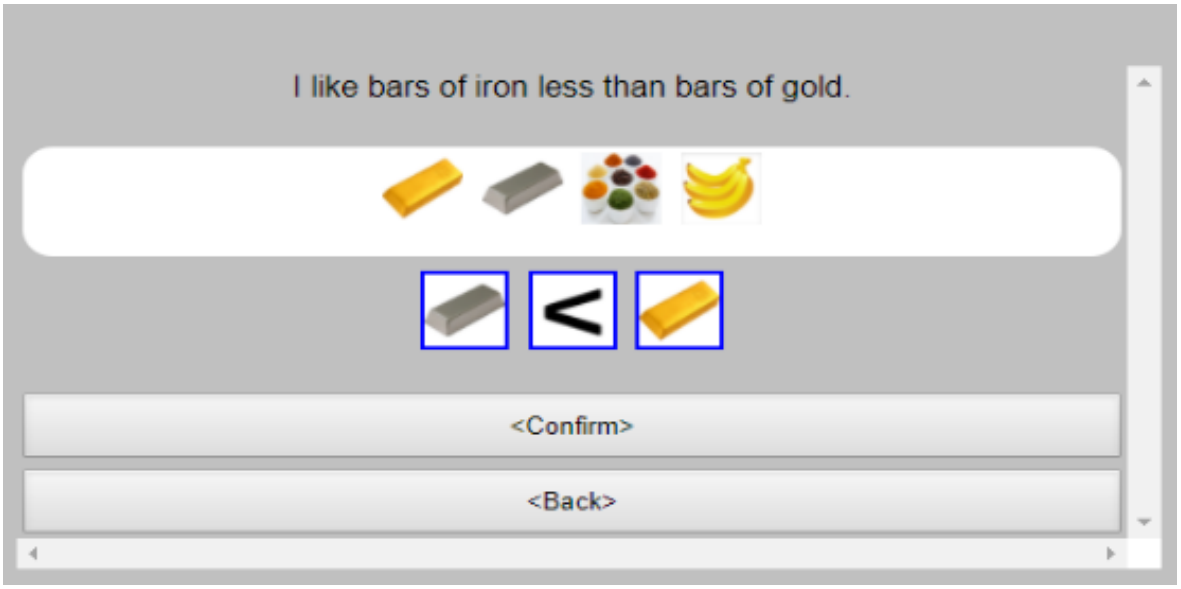


Emoticons

The buttons you see below can be used to send emoticons in chat! The blinking emoticon is representing your current emotional state. Use it to communicate how you feel about the negotiation!

Express Preferences

Below you can find an image representing the preference menu. During the negotiation you can **express your own preferences for items and ask your opponent specific questions about his preferences**. Clicking either of the first two buttons on the right side will let you **express your preferences for items**. Just click the item you want to talk about once, then click again in one of the boxes. Here, you can see that you're about to say that you like "iron" "less than" "gold". You can also click the "less than" symbol to turn it into different options, like "equal" or "best".



IMPORTANT: The ONLY way to finish the game is to press ”Formal Accept” and have your partner also press it, or for time to run out. Pressing ”Accept (non-binding)” will not work.

NOTE: If your screen has a low resolution or you’re playing this game on Safari for Mac, some lines may not display correctly. We recommend using a different browser or adjusting your screen resolution.

G.2 Online Attention Checks

The following multiple choice questions were asked after the participant clicked the continue button at the introduction page. Participants had to answer these questions correctly to be able to continue to the negotiation.

What item is worth the most to you?

1. spices
2. bananas
3. gold
4. iron

What item is worth the least to you?

1. spices

2. bananas
3. gold
4. iron

Which of the following statements regarding your preferences is correct?

1. Spices are worth more than bananas to me
2. Bananas are worth more than spices to me
3. Spices and bananas are worth the same to me
4. Spices and bananas have both no value to me

How do you express your preferences for items?

1. Clicking the image.
2. Using the buttons on the right side of the screen, and by first clicking on one of the items and then clicking on the box indicating my preference.
3. Using the table in the bottom left.
4. You can't, it's impossible.

How do you send an offer to your partner?

1. Click the table while it's grey, then wait.
2. You can't, it's impossible.
3. Drag the items onto you partner's picture.
4. Click "Start Offer", then click the boxes in the table to move, then click "Send Offer".

What do you receive for achieving a high amount of points during the negotiation?

1. Nothing. It doesn't matter how many points I achieve.
2. The amount of money I am assigned to by Prolifics.
3. Every point I get will increase my chances in the lottery for the $100 prize.