

The communicative function of facial expressions in cooperation and competition

The communicative function of facial expressions in cooperation and competition

Master Thesis Social Psychology

Department of social sciences – Utrecht University

By Vic Willems

Student number 3807355

Mentor Ron Dotsch

Date 12 July 2015

Wordcount 12924

Words abstract 219

The communicative function of facial expressions in cooperation and competition

Abstract

What is the effect of a cooperative or competitive mindset on the facial displays of amusement and sadness when amusement and sadness were induced? Three studies were conducted to answer this question. Study 1 tested a newly developed method, based on a button press effort task, for inducing a cooperative or competitive mindset in participants. It was found that for the used population this manipulation was effective. Study 2 aimed to validate and update a method of emotion elicitation using videos, based on previous research by Gross and Levenson (1995). Results indicated that the recommended videos by Gross and Levenson for inducing amusement or sadness were still valid in the current population. Study 3 used the manipulations validated in Study 1 and 2 to test whether there is an effect of a cooperative or competitive mindset on the displays of amusement and sadness, and visibility of the face, when amusement and sadness were induced. No effect was found of mindset on sadness and amusement displays. However, there was an unpredicted interaction effect between mindset and induced emotion on visibility of the face, with visibility of the face being less when sadness was induced, but only in the competitive condition. For all three studies limitations and implications of the results are discussed. Recommendations for future research are made.

The communicative function of facial expressions in cooperation and competition

General Introduction

Cooperation and competition are key characteristics of human interaction. It is the difference between striving for a common goal and trying to beat the other to achieve the same goal. Cooperation and competition have played an important role in human evolution. Cooperation can foster the evolution of groups in many ways, like resource sharing and risk-reduction reciprocity (see Smith, 2003 for an elaborate discussion of human cooperation and evolution; Barclay & Willer, 2007; Henrich & Henrich, 2007; Kaplan et al., 1985).

Communication plays an integral part in the mechanism of cooperation and competition. By communicating, people determine whether they will be competing or cooperating and how successful the cooperation can be (Smith, 2003).

Facial expressions are a crucial part of human non-verbal communication (Blair, 2003; Frith, 2009). These expressions are often a quick and salient source of information. This information can contain many types of content, e.g. what the other is doing, feeling, planning on doing, or where their attention is directed (see Frijda, 1953 for a complete summary of the types of content interpreted from facial expressions; Etcoff & Magee, 1992; Parkinson, 2005). It is likely that facial expressions comprise an important communication channel in cooperation, as they can help to coordinate behaviors quickly. However, it is much less clear whether this communication channel operates similarly when two people are in competition with each other. Is it possible that the function of facial expressions, or the strategic display of facial expressions, changes depending on whether people cooperate or compete? Three studies were conducted to answer exactly this question.

Communicative functions of facial expressions

There are two theories that represent a divide in the different explanations of why we produce facial expressions. Ekman (1972) proposes that a hard-wired connection exists between basic emotions and distinctive facial expressions. An intrinsic emotion corresponds to a facial display

The communicative function of facial expressions in cooperation and competition

of this emotion, unless inhibited or moderated by societal norms. Where Ekman assumes that facial expressions are primarily an expression of an inner emotion, Fridlund's (1994) Behavioral Ecology View considers facial expressions to consist of primarily communicative messages. For example: a sad facial expression could communicate that the displayer is in need of comforting or support, a smile could communicate that one is friendly and it is fit to approach the displayer. One of the main implications of the latter perspective is the effect of social situations on facial expressions. Fridlund's theory makes a strong prediction: because an emotional display needs a receiver, emotional displays would be absent, or at least significantly less frequent and intense, in non-social situations.

The evidence regarding both these theories so far has been mixed. Kraut and Johnson (1979) performed a study examining the facial expressions of bowlers. They found that the bowlers, when they threw a strike or spare, only smiled after they turned around in the direction of their teammates. They started smiling when they became socially engaged, a finding Fridlund predicted, but cannot be explained by Ekman's theory. Fernández-Dols and Ruiz Belda (1995) demonstrated similar findings: they found that Olympic medal winners displayed smiles more frequently during interactive sections of the award ceremonies. Smiles were absent during phases in which no social interaction was required, thus demonstrating that internal happiness is not a sufficient condition for smiling. Devereux and Ginsberg (2001) examined the effects of sociality (whether the displayer is alone or in the presence of other people) on the production of laughter, a strong, less voluntary outing of amusement. They found that laughter is also facilitated by the presence of another person, regardless of whether this person was a friend or a stranger.

Jacobs, Manstead and Fischer (2001) examined the social aspect of sadness displays. They analyzed facial displays after the viewing of a sad film clip and found more sadness displays in a non-social condition than in a social condition, the opposite of what Fridlund predicted. Soussignan and Schaal (1996) examined facial expressions of children while smelling a pleasant or an unpleasant odor. They found that observers could correctly identify facial responses to unpleasant odors (disgust) in only the non-social condition while responses to pleasant odors were only correctly

The communicative function of facial expressions in cooperation and competition

identified in the social condition, suggesting mixed sociality-effects. Jäncke (1996) examined the sociality of anger displays by using facial EMG. He found that the imagined presence of an adversary increased frowning in participants (See Parkinson, 2005; Reisenzein, Studtmann & Horstmann, 2013, for a more extensive review of the literature on the sociality of facial expressions so far).

Sociality alone does not determine the display of facial expressions. There are a number of factors that moderate the effect of sociality on facial expressions. Studies by Devereux and Ginsberg (2001), Jacobs et al. (2001) and Hess (1995) incorporated moderators of sociality into their designs, like whether the other people present were strangers or friends of the participants. They found an interaction of internal experience, sociality and the nature of relation, with these three factors interacting with each other in multiple ways to bring about facial expressions.

Hess (1995) proposed to view facial displays as messages with both an intrinsic emotional basis and a communicative goal, with the nature of the relation between displayer and receiver as a condition influencing the relative balance between these components¹.

Concluding, evidence has been mixed and has shown that not all emotions are affected in the same way under the same circumstances. Based on previous research it is not possible for any theory explaining the function of facial expressions (Ekman's or Fridlund's) to correctly explain all research findings.

Cooperation and competition

None of these previous findings consider the cooperative or competitive relationship between displayer and receiver as a moderator of sociality. Although cooperation and competition could have a certain overlap with the friend-stranger moderator, there are some fundamental differences. The friend-stranger distinction does not activate the common goal-competing for the same goal distinction the way the cooperation-competition does. Furthermore, a friend is not by

¹ We are paraphrasing Hess here. Hess uses specific terminology not found elsewhere. See Hess (1995) for her exact wording of the proposed theory.

The communicative function of facial expressions in cooperation and competition

definition a cooperator. The influence of (facial) communication on cooperation has been widely tested (Wichman, 1970; Cooper, DeJong, Forsythe & Ross, 1992; Bornstein, Gneezy & Nagel, 1999).

We propose that analyzing the opposite direction is an important next step in the research of facial expressions: by investigating the effect of cooperation/competition on facial displays we can gain further understanding of the nature of facial expressions.

Ekman's (1972) and Fridlund's (1994) theories lead to different predictions of how facial displays of emotion would be affected by cooperation and competition. Since the underlying emotion (and its strength) would not differ, facial displays of emotion should not differ between a cooperative and a competitive situation. On the other hand, the Behavioral Ecology View explains expressions as a means of communication that can be altered to influence the communicated message, meaning that displays could differ between a cooperative and competitive situation. Since it would not be adaptive to show facial expressions, and thus communicate your internal state to a competitor, the Behavioral Ecology View would predict less facial expressions in a competitive situation.

We will be focusing on the emotions of amusement and sadness. These two emotions cover different sides of the emotional spectrum: positive and negative emotion. Both these emotions have already been researched multiple times under the effect of sociality (Fridlund, 1994; Fernández-Dols & Ruiz Belda, 1995; Jacobs et al., 2001; see Parkinson, 2005 for an overview of the literature of the effect of sociality on different emotions) and a variety of moderators of sociality, like whether the receiver is a friend or a stranger, or what role social motives play (Devereux & Ginsberg, 2001; Hess, 1995). We will be introducing a (to our knowledge) yet untested moderator of sociality - cooperation and competition - into the equation. Based on the previous research we expect these two emotions to be influenced differently by factors like sociality or the relation between displayer and receiver, giving us a broad impression of the emotional spectrum (Reisenzein, 2013).

We have different predictions for these emotions. Based on previous research showing that smiling is largely facilitated by sociality (Fridlund, 1994; Hess, 1995; Jacobs et al., 2001; Fernández-

The communicative function of facial expressions in cooperation and competition

Dols & Ruiz Belda, 1995) we expect smiles to be more common in the presence of others while we expect sadness displays to be less common in the presence of others. However, if facial expressions are mainly communicative, as Fridlund suggests, we expect less smiling in the competitive condition; since facial displays signal useful information about the environment or the situation, it would be beneficial to show this to a cooperator, but to hide it from a competitor.

For sadness displays, according to Ekman we would not expect a difference between the cooperative and the competitive condition, because the experienced emotion and display rules would not differ; people should not display sadness when another person is present, regardless of competitive or cooperative circumstances. According to Fridlund's theory, however, we might expect a difference between these conditions: on the one hand, we may hypothesize that, since the proposed goal of displaying sadness is to receive help or comfort (Fridlund, 1993), we are more likely to see sadness displays in the cooperative condition, because cooperators would be more likely to help. An alternative explanation could be that sadness signals weakness, and people want to hide their weakness from competitors, also leading to less sadness displays in the cooperative condition. On the other hand, one might also display sadness as a means to manipulate a competitor into showing empathy or mercy and in doing so it could be beneficial to show sadness to a competitor. We have no strong prediction. Any difference in emotional display between the cooperative and competitive condition, regardless its direction, can be interpreted as evidence for the behavioral ecology view.

Study 1. Manipulating cooperation and competition

1.1 Introduction

A mindset is a commonly known concept used to describe a particular way of thinking in a specific situation. It is the result of a total of activated cognitive procedures (Gollwitzer, 2012). A mindset can be induced in people by means of priming (Meyer & Schvaneveldt, 1971; Sassenberg &

The communicative function of facial expressions in cooperation and competition

Moskowitz, 2005). Two specific mindsets people can have are a cooperative (striving for a common goal) or a competitive (trying to beat the other to achieve the same goal) mindset. To test whether people signal differently in a cooperative compared to a competitive mindset, a manipulation to induce these mindsets was needed.

We developed a manipulation based on a button-press effort task to induce either a cooperative or a competitive mindset in participants. Participants played a game with a supposed co-player in which they were instructed to press the spacebar repeatedly as quickly as possible. The goal was to either gather as many points as possible together (cooperative condition) or to gather more points than the co-player (competitive condition), thus inducing the competitive/cooperative condition. The goal of Study 1 was to test whether this newly developed manipulation is a reliable and valid way of inducing either a cooperative or a competitive mindset.

To test the effectiveness of this manipulation we used three different outcome variables. The first was a Prisoner's Dilemma Task (PDT; Luce & Raiffa 1957). This task is commonly used to measure cooperation among humans (Anshel & Kipper, 1988; Mokros et al., 2008). In this task participants completed 30 trials in which they had to choose between a more cooperative and a more selfish option. We expect participants in the cooperative condition to choose the competitive option more often than participants in the competitive condition.

The second was a Dictator Game (DG), as described in Brocklebank, Lewis & Bates (2011) and Luce & Raiffa (1957). This task is frequently used to measure pro-sociality (Cornelissen, Dewitte & Warlop, 2011; Bohnet & Frey, 1996). In this task participants completed six trials in which they were asked to divide a certain amount of points. In each of these trials there was a social and a non-social option. We expect participants in the cooperative condition to choose the pro-social option more often than participants in the competitive condition

In the third and final outcome measure participants were shown two faces and were asked which one they would expect to look most like their co-player. One of these faces looked

The communicative function of facial expressions in cooperation and competition cooperative, the other looked competitive. This way we could measure not only the mindset of the participant, but also how competitive or cooperative his/her mental image of the co-player and their relation was. These faces were generated by reverse correlation (we conducted a pilot to generate these faces, see Appendix A for a complete report of this pilot). We expect participants in the cooperative condition to choose the cooperative face more often than participants in the competitive condition.

1.2 Method

1.2.1 Participants and design

Participants were recruited through the Utrecht University shared lab. People come to shared lab to participate in studies and are assigned to a study based on the amount of time they have and what kind of reward (money or course credit) they want to receive. A total of 83 participants participated in this study. Due to a number of missing subject-numbers on forms, we only have demographic variables for 59 of the participants. For these 59 participants the mean age was 21.41 ($SD = 3.19$), with a total of 21 male and 38 female participants. In return for participation the participants were reward either a sum of money (€ 3,-) or participation credit required for bachelor psychology students. They were randomly assigned to the cooperative or the competitive condition. This study thus consisted of a one-way between groups design, with mindset (cooperative or competitive) as the independent variable and the scores on the Prisoner's Dilemma Task, Dictator Game and face choice task as the dependent variables.

1.2.2 Tasks

1.2.2.1. Mindset Manipulation

Participants played a game in which the goal was to press the spacebar on the keyboard as fast as possible. Every correct button-press yielded them one point. The goal was to either gather as

The communicative function of facial expressions in cooperation and competition

many points as possible together (cooperative condition) or to gather more points than the other participant (competitive condition), thus inducing the competitive/cooperative mindset. Participants played four trials lasting twelve seconds each, with a three second pause preceding each trial. During every trial participants would see their own score rise with every button press and they would also see their co-players score rise. In the cooperative condition participants could also see the sum of both the scores added together. In reality there was no other participant and participant played against a computer program. This program was programmed to gain roughly as many points as the participant in order to keep them motivated. The program adjusted its speed in real time and slowly speeded up when its score was lower than the participant and slowed down when its score was higher, resulting in a score just lower or higher than the participant. See Appendix B for an example of what the screen looked like during a default trial for both the competitive and the cooperative condition.

1.2.2.2. Prisoner's Dilemma Task

Participants took part in a repeated Prisoner's Dilemma Task (PDT). This task is a well-known measure for cooperativeness and competitiveness (Anshel & Kipper, 1988; Luce & Raiffa 1957). In this task they completed a series of 30 items in which they chose between a cooperating and defecting strategy. They did so by choosing between a 'left' (cooperating) option and a 'right' (defecting) option on the keyboard. They received the following instructions: 'Choose left (A), or right (L). If you both choose left, you both receive 3 points. If you choose right and your co-player chooses left, you receive 5 points and your co-player 0. If you choose left and your co-player chooses right, you receive 0 points and your co-player 5. If you both choose right, you both receive 1 point'. Figure 1 depicts how the screen looked during a trial (the instructions were originally in Dutch and have been translated for this report). This was the same during each of the 30 trials.

The communicative function of facial expressions in cooperation and competition

Participants were instructed that they would be playing this game with the same co-player as before. However, during this task there was no real time feedback about the choices of their co-player.

Choose left (A), or right (L)

If you both choose left, you both receive 3 points

If you choose right and your co-player chooses left, you receive 5 points and your co-player 0

If you choose left and your co-player chooses right, you receive 0 points and your co-player 5

If you both choose right, you both receive 1 point

left

A

right

L

Figure 1, a trial from the PDT.

1.2.2.3. Dictator Game

Participants played a Dictator Game (DG), as described in Brocklebank, Lewis & Bates (2011). This game served as an additional measure for cooperation and fairness. In this game the participant completed six trials in which he/she needed to divide a sum of points between himself and the (suggested) other player. In these trials there was always a pro-social and a non-social option, though they were not clearly presented this way. First, participants were instructed that they would be completing a series of trials in which they would need to make a decision resulting in the division of an amount of points between them and their co-player. Subsequently, participants would start the first trial and see the following instructions: 'In this task, you are player B. You may choose B1 or B2. Player A has no choice in this game. If you choose B1, you would receive 600 and player A would receive 600. If you choose B2, you would receive 700 and player A would receive 200.' For each of the trials the instructions would be the same, the only difference being the amounts of points both

The communicative function of facial expressions in cooperation and competition players would receive. These amounts were always divided so that there was a pro-social option (where the total amount of points for both players was highest) and a non-social option. The participant was player B in all the six trials and would make the decision every time. The outcome variable for this measure is the amount of pro-social decisions. See figure 2 for an example of a trial (the instructions were in Dutch during the experiment and have been translated for this report).

In this task, you are player B.
 You may choose B1 or B2. Player A has no choice in this game.
 If you choose B1, you would receive 375 and player A would receive 750.
 If you choose B2, you would receive 400 and player A would receive 400.

Click on B1 or B2 to make your choice.

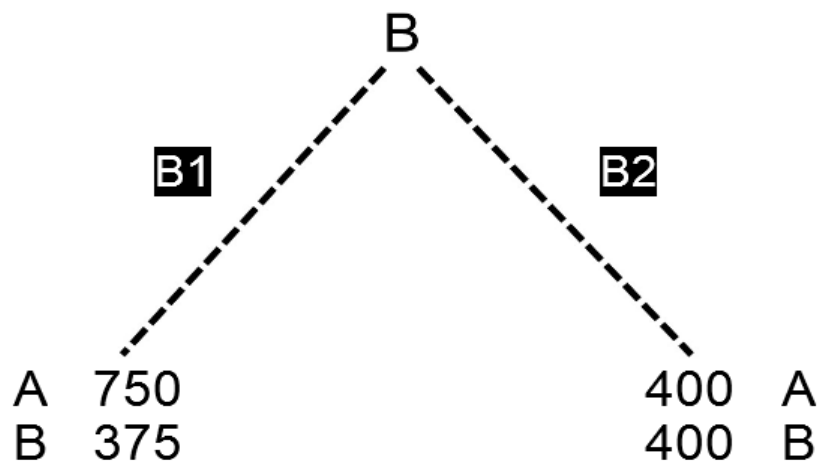


Figure 2, a trial from the DG.

1.2.2.4. Face Choice Task (FCT)

Participants were shown two faces and were asked which face they expected to look more like their co-player. There was one cooperative face and one competitive face. These faces were generated by reverse correlation, for which a pilot was conducted. In reverse correlation, participants are shown base-faces with a distortion projected on them in different places and sizes. Participants were subsequently asked to choose the faces that looked most like a given characteristic. In the pilot study we asked participants to choose between two faces: one group was

The communicative function of facial expressions in cooperation and competition

asked to choose the most competitive face, another group chose the most cooperative face. A complete report of this pilot can be found in Appendix A.

1.2.2.5. Belief in co-player

Three questions were added to test the participants' belief in the authenticity of the co-player. First, participants were asked two open questions: whether they noticed something in the experiment, and whether they noticed anything remarkable about their co-player. Finally we asked to what extent they believed they were playing with a real person, on a scale of 1 (Completely believed it) to 7 (did not believe it at all).

1.2.3 Procedure

Participants were seated in a room with a desk and a computer, and they were asked to sign an informed consent form. They were informed that they would be participating with another participant and they were asked to wait until the computer signaled that the other participant was ready (though in reality the computer always signaled them after one minute). After this the experiment would commence.

First, participants were instructed for the mindset manipulation task. In this instruction the cooperative or competitive goal was emphasized and then the mindset manipulation task began. Thereafter the participants completed (in this order) the PDT, DG, FCT and finally the belief in co-player questionnaire. For the last part participants were asked to fill in a demographic variables questionnaire. Lastly participants were informed that there was no other player and they were further debriefed.

The communicative function of facial expressions in cooperation and competition

1.3 Results

1.3.1. *Belief in co-player*

77% of participants answered a 5 or higher, on a scale of 1 (completely believed it) to 7 (did not believe it at all, indicating that they did not believe they were playing with a real co-player. There was no significant interaction effect between condition and belief in the co-player. Since there could still be an effect of the mindset manipulation task even when participants did not believe they were playing with a real co-player we continued the analysis normally. We also conducted the analyses separately for the believer and the non-believer group. These results can be viewed in section 1.3.5.

1.3.2 *PDT*

To analyze whether our mindset manipulation affected decisions in the PDT we conducted a logistic regression. As the dependent variable the number of cooperative choices on the PDT was used. When the participant cooperated, the value for this PDT trial was coded one, when the participant did not cooperate, it was zero. Each participant conducted 30 of these trials and thus yielded 30 values for PDT. There was a significant effect of mindset (coded 0 for competitive and 1 for cooperative) on the PDT ($B = 0.53$, $df = 1$, $p < .001$, R^2 (Nagelkerke) = .02) with the participants in the cooperative condition choosing the cooperative option 1.70 times more often than participants in the competitive condition.

1.3.3 *DG*

A *t*-test was conducted to compare the mean scores on the DG for the cooperative and competitive mindset condition. There was a significant effect of mindset on the DG score ($t(78) = 3.06$, $p < .01$, $\eta_p^2 = .107$) with participants in the cooperative condition choosing the pro-social option in the DG ($M = 3.28$, $SD = 1.62$) more often than the participants in the competitive condition ($M = 2.26$, $SD = 1.62$).

The communicative function of facial expressions in cooperation and competition

1.3.4 FCT

A logistic regression was conducted to analyze the effect of mindset on which face the participant chose. In the outcome variable the cooperative face was coded zero and the competitive face was coded one. This effect was marginally significant ($B = 1.22$, $df = 1$, $p = 0.086$) in the expected direction, with participants in the cooperative condition choosing the cooperative face 3.38 times more often than participants in the competitive condition.

1.3.5. Believers and non-believers

The analyses above were conducted on the data of all participants. For explorative reasons the analyses on the PDT, DG and FCT were also conducted separately for the participants that believed they were playing with a real co-player (those who score 1-4 on the belief in co-player question) and those that did not believe they were playing with a real co-player (those who answered a 5-7 on the belief in co-player question). Introducing the belief variable into the analyses for interaction analysis would result in an unbalanced design, so we chose to conduct the analyses separately for the belief and non-belief groups.

1.3.5.1 PDT

The results for of the separated analyses on the PDT, as seen in Table 1, indicate that the manipulation works similarly for the believers and the non-believers.

Table 1

Results of the logistic regression analyses on the PDT with mindset as the independent variable, separated for believers and non-believers

	B	Wald	df	Sig.	Exp(B)	N
Believer	-.688	14.797	1	.000	.503	18
Non-believer	-.601	39.183	1	.000	.548	61

The communicative function of facial expressions in cooperation and competition

1.3.5.2. DG

The analysis on the DG was also conducted separately for the believers and the non-believers. The results, as seen in Table 2, indicate that the manipulation is still effective for the non-believer group, but not for the believer group

Table 2

Results of the t-test on DG with mindset as the independent variable, separated for believers and non-believers

	T	df	p	η_p^2	N
Believer	0.41	16	.687	.01	18
Non-believer	3.08	59	.003	.14	61

1.3.5.3. FCT

The analysis on the FCT was also conducted separately for the believers and the non-believers. The results, as seen in Table 3, indicate that the manipulation is no longer effective for both the believer and the non-believer group.

Table 3

Results of the logistic regression analyses on the FCT with mindset as the independent variable, separated for believers and non-believers

	B	Wald	df	Sig.	Exp(B)	N
Believer	19.82	.000	1	.999	403868702.4	18
Non-believer	0.97	1.68	1	.20	2.63	61

1.4 Discussion

The goal of this study was to test the effectiveness of our mindset manipulation task in inducing a cooperative or a competitive mindset. To test this, three tasks measuring various aspects of cooperation were used: a PDT, a DG and a FCT. We expected an effect of mindset on the number of cooperative choices in the PDT, with participants in the cooperative condition choosing the cooperative option more than participants in the competitive condition. This was indeed the case. The PDT was the most important outcome variable in this study, since it is designed to measure cooperation and competition directly (Luce & Raiffa, 1967; Rapoport & Chammah, 1965).

The communicative function of facial expressions in cooperation and competition

Secondly, we expected an effect of mindset on the number of prosocial choices in the DG, with participants in the cooperative condition choosing the prosocial option more times than participants in the competitive condition. We found this effect as well.

The effect on the FCT was only marginally significant, in the predicted direction. We cannot conclude that participants mentally viewed their co-player as more competitive or cooperative.

The results showed that a majority of participants did not believe they were playing with a real co-player. It would be interesting to test in future research if the manipulation would be more effective if more participants would believe they were playing with a real person. However, it turned out that the manipulation was still effective, even when participants did not believe their co-player was real. That being said, increasing belief would still be informative and should future research attempt to accomplish this, we have a number of recommendations. Future research could only let participants take part if they could start simultaneously with a co-player (that they don't know personally). Another option would be to employ a confederate to serve as the co-player. This confederate could either only act as the co-player during introduction and be shown taking place in a lab room, or be seen taking place and actually play the game against the real participant, for increased realism in the task.

The results indicate that there was no difference in the strength of the mindset manipulation on the PDT between the group that believed they were playing with a real co-player and the group that didn't. This suggests that the manipulation is not dependent on whether people believe in the authenticity of their co-player or not. An explanation would be that this manipulation induces a cooperativeness or competitiveness that is not necessarily aimed at a specific other, but is more a general mindset or 'mood'. This general mindset could explain why participants still chose the cooperative or competitive option more often in the PDT. Results on the DG indicate that the effect of the mindset manipulation task is still effective for the non-believer group, but no longer for the believer group. This finding was not expected. This can probably be attributed to the low power of the analysis on the believer group, since the number of participants in that group was very low.

The communicative function of facial expressions in cooperation and competition

Another explanation could be that the mindset priming effect only lasts a limited amount of time, most of the effect being lost after the first task. This would also explain that we only found a marginally significant effect on the FCT. Being the last task to be completed, it is possible that the prime is no longer effective after this amount of time.

The sample for this study consisted mostly of students in their early twenties. To be able to generalize these results to a bigger population a more varied sample is needed. However, since the follow-up study would be using a similar sample from a similar population this was not an issue for the follow-up research. Furthermore, because of the absence of a control group we cannot compare the cooperative and competitive condition to a neutral condition. It cannot be stated with certainty that cooperativeness and competitiveness are induced, opposed to strong competitiveness and medium competitiveness. The addition of a control group would greatly increase the value and interpretation of similar research. However, a significant difference between these groups has been effectively induced, with the competitive condition at least inducing a more competitive mindset than the cooperative condition.

With our two most important outcome measures indicating the effectivity of the mindset manipulation task for a relevant population, we can conclude that this task was effective in inducing a cooperative or competitive mindset in participants. We chose to use the mindset manipulation task to induce a competitive or a cooperative mindset in Study 3.

Study 2. Testing videos for emotion elicitation

2.1 Introduction

Study 2 aimed to validate a commonly used method of emotion induction for the current time and population. Emotion elicitations using videos has been widely researched and has been proven effective (Gross & Levenson, 1995; Philippot, Schaefer & Herbette, 2003; Rottenberg, Ray &

The communicative function of facial expressions in cooperation and competition

Gross, 2007; Schaefer, Nils, Sanchez & Philippot, 2010). Studies conducted by Gross and Levenson (1995), and Rottenberg, Ray and Gross (2007) yielded multiple videos that effectively induced several of the base emotions, including sadness and amusement. However, since these studies were conducted several years ago and were conducted in a different population in a different country, we re-tested some of their most relevant recommendations and added our own suggestions, based on what videos we expected to elicit amusement or sadness from our own experience. This will enable us to give a contemporary and relevant overview of which videos elicit which emotions and to what extent. We expected the videos selected for amusement to elicit amusement and not sadness. We expected the emotions selected for sadness to elicit sadness and not amusement.

2.2 Method

2.2.1. *Participants & design*

A total of twenty participants participated in this study. Seven of the original twenty participants had to be excluded because of corrupted data-files. The remaining thirteen participants had a mean age of 21.69 ($SD = 1.89$) (1 male and 12 female participants). Participants were recruited through Utrecht University. In return for participation the participants were reward either a sum of money (€ 3,-) or participation credit required for bachelor psychology students. This study consisted of a six-group repeated measures design with video as the within subjects variable.

2.2.2. *Videos*

The six video fragments we tested were the following, separated by which emotion they were expected to induce.

The communicative function of facial expressions in cooperation and competition

2.2.2.1. Amusement induction

When Harry Met Sally

This fragment was the recommendation of Gross and Levenson (1995) for inducing amusement. This clip, lasting two minutes and 39 seconds, depicts a man and a woman in a diner. They are discussing casual sexual encounters, which leads to the woman loudly faking an orgasm in the busy diner. This fragment is taken from the movie *When Harry Met Sally* (1989).

The fragment begins when the woman (Sally) says 'I'm so glad I never got involved with you' and ends with a different woman remarking 'I'll have what she's having'.

Statoil

This fragment was originally a commercial for Statoil titled 'Bad Morning'. The fragment lasts 42 seconds and was released in 2007. It depicts a man struggling to remove snow and ice from his car, only to find out it was not his car. The fragment was edited to not include the commercial text over the ending, shortening the fragment to 33 seconds.

Big Hero 6

This fragment was taken from the movie *Big Hero 6* (2014). The clip, lasting 2 minutes and 32 seconds, depicts a boy trying to get a big sentient robot with low battery (suggesting drunkenness) to his charging station without his mother noticing. It starts with the robot saying 'low battery' and ends when the robot steps into his charging station.

2.2.2.2. Sadness induction

The Champ

This fragment was the recommendation of Gross and Levenson (1995) for inducing sadness. This clip, lasting 2 minutes and 19 seconds, depicts a young boy crying over the death of his father,

The communicative function of facial expressions in cooperation and competition

who was a boxer. This fragment is taken from the movie *The Champ* (1979) and starts when we see the boxer lying on a table and the doctor examining says 'I'm sorry' and ends with the young boy saying 'He's not gone, he's not'.

Crash

This fragment was taken from the movie *Crash* (2004). The clip, lasting 1 minute and 47 seconds, depicts a man threatening another man at gunpoint, demanding his money back. It ends with the second man's daughter running towards the two men and seemingly being shot. The fragment starts a van pulling up a driveway and ends with the second man crying with his daughter in his arms.

Pictures of You

This fragment was taken from TAC's anti-speeding TV ad campaign (2008). It depicts several different people looking sadly at pictures of people they lost. The clip was edited to exclude the text about speeding displayed on the screen, shortening the clip to 2 minutes and 27 seconds.

2.2.3. *Emotions Questionnaire*

The emotions questionnaire used in this study was based on the emotions questionnaire used by Gross and Levensons (1995). Participants were asked to indicate to what extent they felt the following 16 emotions: amusement, anger, arousal, confusion, contempt, contentment, disgust, embarrassment, fear, happiness, interest, pain, relief, sadness, surprise and tension. They did so on a scale of 1 (not at all) to 7 (very much). They were also asked to rate the audibility and comprehensibility of the fragment on a scale of 1 (not at all audible/comprehensible) to 7 (perfectly audible/comprehensible). Finally they were asked if they had seen the video before (yes/no/I don't know).

The communicative function of facial expressions in cooperation and competition

2.2.4. Procedure

First participants were seated in a room with a desk and a computer, and they were asked to sign an informed consent paper, after which they could start the computer task by pressing a key. Participants were shown the six videos (in random order). After each of these clips they filled in the emotions questionnaire. Finally, participants were asked to fill in a demographic variables questionnaire, on paper.

2.3. Results

Table 4 and 5 show the mean judgements of each of the clips, separated by which emotion they were expected to elicit (sadness and amusement).

2.3.1. Sadness

Table 4

Experienced emotion for videos inducing sadness, mean (standard deviation)

	Crash M (SD)	Pictures of You M (SD)	The Champ M (SD)
Amusement	1.69 (0.95)	2.08 (1.41)	1.85 (1.21)
Anger	3.62 (2.10)	1.62 (0.96)	2.08 (1.38)
Arousal	2.92 (2.18)	1.46 (0.66)	1.77 (1.17)
Confusion	3.23 (1.83)	3.31 (1.49)	2.54 (1.39)
Contempt	4.15 (1.46)	1.54 (1.13)	2.00 (0.91)
Contentment	1.31 (0.75)	2.46 (1.50)	1.54 (0.97)
Disgust	3.08 (1.85)	1.23 (0.44)	1.69 (0.94)
Embarrassment	1.31 (0.63)	1.31 (0.48)	1.23 (0.44)
Fear	4.62 (1.81)	1.69 (0.86)	2.15 (1.35)
Happiness	1.23 (0.44)	1.85 (1.07)	1.23 (0.44)
Interest	2.92 (1.98)	3.23 (1.83)	3.38 (1.71)
Pain	4.92 (1.80)	2.92 (1.85)	3.23 (1.83)
Relief	1.15 (0.38)	1.23 (0.44)	1.15 (0.38)
Sadness	5.46 (1.27)	4.69 (1.44)	5.00 (1.73)
Surprise	3.23 (2.09)	1.77 (0.83)	1.69 (1.11)
Tension	5.46 (1.27)	2.31 (1.38)	3.08 (1.75)
Audibility	6.54 (0.52)	6.38 (0.65)	5.54 (1.27)
Comprehensibility	5.85 (0.80)	5.00 (1.68)	5.85 (0.90)

The communicative function of facial expressions in cooperation and competition

As can be seen in Table 4, the videos expected to induce sadness did indeed induce sadness in the participants, with Crash scoring the highest on sadness ($M = 5.46, SD = 1.27$), The Champ second highest ($M = 5.00, SD = 1.75$) and Pictures of You scoring lowest of the three on sadness ($M = 4.69, SD = 1.44$). However, the difference between Crash and the Champ was non-significant ($F(1,12) = 1.57, p = .24, \eta_p^2 = .12$) and the difference between Crash and Pictures of You only marginally significant ($F(1,12) = 3.80, p = .075, \eta_p^2 = .24$). It is also noteworthy that Crash, though scoring highest on sadness, also scored high on multiple other emotions, like contempt ($M = 4.15$), fear ($M = 4.62$), pain ($M = 4.92$) and tension ($M = 5.46$). Because of this diffusion in emotion, we chose not to use this video in the follow-up study. Although The Champ scored lower on sadness (by a non-significant margin) than Crash, it didn't score above average on any of the other emotions. We can state that The Champ elicited sadness more purely than Crash. Therefore, we chose to use The Champ for inducing sadness in the follow-up study.

2.3.2. Amusement

As can be seen in Table 5, the videos expected to induce amusement did indeed induce amusement in the participants, with When Harry Met Sally scoring highest on amusement ($M = 6.00, SD = .816$), Big Hero 6 scoring second highest ($M = 5.38, SD = 1.193$) together with Statoil ($M = 5.38, SD = 1.387$). The difference between When Harry Met Sally and Statoil was non-significant ($F(1,12), p = .28, \eta_p^2 = .10$) and the difference between When Harry Met Sally and Big Hero 6 was only marginally significant ($F(1,12) = 3.46, p = .088, \eta_p^2 = .22$). Because When Harry Met Sally scored highest (although by a non-significant margin) and was already verified by Gross and Levenson (1995) we chose to use this video in the follow-up research.

The communicative function of facial expressions in cooperation and competition

Table 5

Experienced emotion for videos inducing amusement, mean (standard deviation)

	Statoil M (SD)	When Harry Met Sally M (SD)	Big Hero 6 M (SD)
Amusement	5.38 (1.39)	6.00 (0.82)	5.38 (1.19)
Anger	1.54 (0.66)	1.38 (0.65)	1.15 (0.38)
Arousal	1.69 (1.18)	3.15 (1.86)	2.15 (1.68)
Confusion	2.62 (1.50)	2.00 (1.41)	1.77 (0.83)
Contempt	1.23 (0.44)	1.69 (0.86)	1.15 (0.38)
Contentment	2.85 (1.57)	3.54 (1.94)	4.23 (1.79)
Disgust	1.15 (0.38)	1.69 (0.86)	1.15 (0.38)
Embarrassment	1.54 (0.78)	3.46 (1.66)	1.31 (0.86)
Fear	1.31 (0.63)	1.23 (0.44)	1.23 (0.60)
Happiness	2.38 (0.96)	3.46 (1.85)	4.08 (1.89)
Interest	3.08 (1.44)	3.62 (1.56)	4.23 (1.36)
Pain	1.38 (0.65)	1.15 (0.38)	1.15 (0.38)
Relief	1.46 (1.13)	1.69 (1.18)	2.00 (1.23)
Sadness	1.31 (0.63)	1.15 (0.38)	1.15 (0.38)
Surprise	4.00 (1.87)	3.46 (2.03)	3.31 (1.70)
Tension	1.69 (1.25)	3.54 (2.03)	1.92 (1.38)
Audibility	6.23 (1.30)	6.38 (0.77)	6.46 (0.66)
Comprehensibility	6.00 (1.16)	6.00 (1.16)	6.46 (0.66)

2.3.3 Comparing sad and amusing videos

We expected the videos selected for inducing sadness to elicit more sadness in participants than the videos selected for inducing amusement. To test this, a repeated measures analysis of variance (ANOVA) was conducted to compare the average elicited sadness by videos selected for inducing sadness to the average elicited sadness by videos selected for inducing amusement. The expected effect was found ($F(1,12) = 68.49, p < .001, \eta_p^2 = .85$).

Additionally, we expected the videos selected for inducing amusement to elicit more amusement in participants than the videos selected for inducing sadness. To test this, a repeated measures ANOVA was conducted to compare the average elicited amusement by videos selected for inducing amusement to the average elicited amusement by videos selected for inducing sadness. The expected effect was found ($F(1,12) = 336.40, p < .001, \eta_p^2 = .97$).

The communicative function of facial expressions in cooperation and competition

The selected videos (When Harry Met Sally for inducing amusement and The Champ for inducing sadness) were also compared, to test if When Harry Met Sally did indeed induce more amusement than The Champ, and if The Champ induced more sadness than When Harry Met Sally. This was indeed the case for amusement ($F(1,12) = 97.20, p < .001, \eta_p^2 = .89$) and sadness ($F(1,12) = 68.49, p < .001, \eta_p^2 = .85$).

2.4. Discussion

This study aimed to validate and update a commonly used method of inducing emotions in participants and to gain validated videos for emotion induction in the follow-up study. We can conclude that the recommendations Gross and Levenson (1995) gave are still effective and relevant. They recommended a scene from When Harry Met Sally for inducing amusement and a scene from The Champ for inducing sadness. We found that these videos indeed induced the expected emotions and we chose to use these two videos for emotion elicitation in the follow-up study.

Because of the seven participants we had to exclude as a result of the corrupted data, the sample size for this study was smaller than originally intended. The population sampled in this study was also quite specific, with all participants between the age of 18 and 24, and 92,3 percent studying psychology. Furthermore, the movies we picked to test - in addition to the recommendations - were chosen based on our own experience. Any study further researching a similar question would do well to conduct a pilot study to gain more insight in what videos to consider for testing.

Since we chose to use the recommendations of Gross and Levenson (1995) and validated them for the current time and populations, these issues are not a problem for the current research. The follow-up study used a similar population. However, it is recommended to validate this study with a larger sample size and a more diverse population, for increased generalizability.

The communicative function of facial expressions in cooperation and competition

Study 3. The effect of mindset on facial expressions

3.1 Introduction

The goal of this study was to answer the following main question: What is the effect of mindset (cooperative or competitive) on the production of facial expressions while experiencing amusement and sadness? To test this, participants first completed the mindset manipulation task, validated in Study 1, followed by watching both a sad and an amusing video, validated in Study 2, during which they were filmed. Later, these films were rated by three independent raters on the displayed amusement and sadness, and visibility of the face and these scores were used as the outcome measure for displayed emotion. Ekman's (1972) theory would predict no differences between the cooperative and competitive conditions, while Fridlund's (1994) Behavioral Ecology View predicts that difference may occur due to tactical use of facial expressions. We have no strong prediction. The results will tell us which of the predictions is true.

3.2 Method

3.2.1 Participants and design

A total of 83 participants (30 male and 53 female, age between 18 and 34 with $M = 21.88$, $SD = 2.56$) participated in this study. In return for participation they were compensated with either a sum of money (€ 3,-) or participation credit required for bachelor psychology students. Participants were recruited through Utrecht University. They were randomly assigned to the cooperative or the competitive condition. This study thus consisted of a 2 (mindset: cooperative vs competitive) x 2 (emotion: amusement vs sadness) mixed design with the last variable as a within subjects variable. The dependent variables that we used were the average amusement, sadness and visibility of the face during the recordings, as rated by three independent raters.

Five (of the original 83) participants had to be excluded because of various reasons: one participant did not complete the experiment because he found out halfway through he had already

The communicative function of facial expressions in cooperation and competition

participated in Study 1, which uses a similar manipulation. Three participants had to be excluded because their recordings were stopped prematurely and one participant had to be excluded because the wrong camera was set to record. Two participants did not give us permission to use their video recordings, they were also excluded and their recordings were immediately deleted, leaving us with 76 participants.

3.2.2 Procedure

Participants were seated in a room with a desk and a computer, and were asked to sign an informed consent form in which they were asked to agree with being filmed during some parts of the experiment (none of the participants refused). They were informed that they would be participating with another participant, currently present in a different room. They were asked to wait until the computer signals that the other participant is ready. In reality there was once again no co-player.

Subsequently participants completed the mindset manipulation task, as described in study 1. Thereafter the participants viewed (in random order) the two videos verified in study 2 for inducing emotion: a scene from *When Harry Met Sally* inducing amusement and a scene from *The Champ* inducing sadness. Before viewing the clips the participants were informed that their co-player would be watching the same clips at the same time in a different room (studies by Jacobs et al. (2001) and Fridlund (1993) have shown that this manipulation yields an effect that was not as strong as a real audience, but is still sufficient for inducing a social mindset). During the viewing of these clips (the faces of) participants were unobtrusively filmed by a hidden camera.

After the two clips the participant were asked to fill in a small questionnaire about to what extent they experienced the emotions amusement and sadness during each of the videos.

Afterwards the participants were asked if they agreed to the usage of the recorded film for analytical

The communicative function of facial expressions in cooperation and competition

and/or presentational purposes. This protocol has been approved by the ethical committee of the Faculty of Social Sciences at Utrecht University.

Finally these recordings were rated by three raters (2 male, 1 female, mean age = 22.33 $SD = 1.53$), blind to experimental conditions. They viewed all 76 films, separated per emotional condition (amusement and sadness), but the videos were not labeled as such and were shown in random order. For every video they were asked to rate the participant on three scales: how happy he/she was on a scale of 1 (not at all happy) to 9 (very happy) , how sad he/she was on a scale of 1 (not at all sad) to 9 (very sad) and how visible his/her face was during the video on a scale of 1 (not at all visible) to 5 (completely visible).

3.3. Results

3.3.1. Manipulation check

To verify if the emotion manipulation worked and the emotions amusement and sadness were induced as expected, we asked participants to what extent they experienced these emotions during the viewing of the videos. The mean scores (and standard deviations) can be viewed in Table 6.

Table 6

Mean scores for experienced amusement and sadness for each video

Video	Amusement M (SD)	Sadness M (SD)
When Harry Met Sally	5.66 (1.05)	1.64 (1.09)
The Champ	2.51 (1.37)	5.11 (1.15)

As can be seen in table 6, The videos did indeed induce the expected emotions: When Harry Met Sally induced more amusement than the Champ ($t(75) = 16.10, p < .001, \eta_p^2 = .77$), while The Champ induced more sadness than When Harry Met Sally ($t(75) = 19.64, p < .001, \eta_p^2 = .84$). The videos induced amusement and sadness in roughly the same amounts as in Study two.

The communicative function of facial expressions in cooperation and competition

3.3.2. Reliability analysis

To check if the three independent raters rated the displayed emotions consistently we conducted a reliability analysis. The reliability for amusement was good ($\alpha = .809$). The reliability for sadness was poor ($\alpha = .408$). The reliability for visibility was good as well ($\alpha = .745$). The implications of the low value for Cronbach's alpha for sadness will be discussed in the discussion.

3.3.3. Analysis

We conducted a mixed design ANOVA with mindset (cooperative or competitive) and sequence (0 = When Harry Met Sally was displayed first, 1 = The Champ was displayed first) as the between subjects variables and video (The Champ or When Harry Met Sally) as the within subjects variable. We conducted this analysis three times, for the three different outcome variables: sadness judgments, amusement judgments and visibility judgments. For the outcome variables we used the mean score of the three raters.

3.3.3.1 Sadness

Table 7

Average sadness judgements during the viewing of The Champ and When Harry Met Sally, separated for mindset and sequence

Video	Sequence	Cooperative M (SD)	Competitive M (SD)	Total M (SD)
The Champ	0	2.73 (0.79)	2.96 (0.96)	2.84 (0.87)
	1	2.58 (0.51)	2.57 (1.05)	2.57 (0.86)
	Total	2.67 (0.69)	2.76 (1.02)	2.71 (0.87)
When Harry Met Sally	0	1.78 (0.85)	2.00 (0.79)	1.88 (0.82)
	1	2.29 (0.66)	2.22 (0.78)	2.25 (0.72)
	Total	1.99 (0.81)	2.12 (0.78)	2.06 (0.79)

Table 7 shows the average sadness judgements during the viewing of The Champ and When Harry Met Sally, separated for mindset and sequence. There was a main effect of video on sadness, with more sadness displays during the sad video (The Champ) than during the amusing video (When Harry Met Sally) ($F(1,72) = 38.30, p < .001, \eta_p^2 = .35$). There was no significant between subjects

The communicative function of facial expressions in cooperation and competition

effect of mindset on sadness ($F(1,72) = 0.35, p = .56, \eta_p^2 = .01$) and no significant between subjects effect of sequence on sadness ($F(1,72) = 0.08, p = .77, \eta_p^2 = .00$). There was a significant interaction effect of video and sequence ($F(1,72) = 9.60, p < .01, \eta_p^2 = .12$), with more sadness displays during The Champ when The Champ was displayed first. There was no significant interaction effect of mindset and video ($F(1,72) = 0.31, p = .86, \eta_p^2 = .00$).

3.3.3.2 Amusement

Table 8

Average amusement judgements during the viewing of The Champ and When Harry Met Sally, separated for mindset and sequence

Video	Sequence	Cooperative M (SD)	Competitive M (SD)	Total M (SD)
The Champ	0	1.63 (1.07)	1.58 (0.66)	1.61 (0.89)
	1	1.58 (0.50)	1.67 (0.72)	1.63 (0.63)
	Total	1.61 (0.86)	1.62 (0.69)	1.62 (0.77)
When Harry Met Sally	0	4.41 (1.70)	4.16 (1.80)	4.30 (1.73)
	1	3.22 (1.72)	3.46 (1.68)	3.36 (1.61)
	Total	3.92 (1.72)	3.79 (1.75)	3.85 (1.73)

Table 8 shows the average amusement judgements during the viewing of The Champ and When Harry Met Sally, separated for mindset and sequence. There was a main effect of video on amusement, with more amusement displays during the amusing video (When Harry Met Sally) than during the sad video (The Champ) ($F(1,72) = 129.06, p < .001, \eta_p^2 = .64$).

There was no significant between subjects effect of mindset on amusement ($F(1,72) = 0.00, p = .99, \eta_p^2 = .00$). There was a marginally significant between subjects effect of sequence on amusement ($F(1,72) = 3.89, p = .53, \eta_p^2 = .05$), with more amusement displays when When Harry Met Sally was displayed first. There was a significant interaction effect of video and sequence ($F(1,72) = 6.14, p < .02, \eta_p^2 = .08$), with even more amusement displays during When Harry Met Sally when When Harry Met Sally was displayed first. There was no significant interaction effect of mindset and video ($F(1,72) = 0.00, p = .95, \eta_p^2 = .00$).

The communicative function of facial expressions in cooperation and competition

3.3.3.3 Visibility

Table 9

Average visibility judgements during the viewing of The Champ and When Harry Met Sally, separated for mindset and sequence

Video	Sequence	Cooperative M (SD)	Competitive M (SD)	Total M (SD)
The Champ	0	4.33 (0.87)	3.93 (0.98)	4.14 (0.94)
	1	4.47 (0.59)	4.43 (0.55)	4.44 (0.56)
	Total	4.39 (0.76)	4.19 (0.81)	4.29 (0.79)
When Harry Met Sally	0	4.33 (0.75)	4.21 (0.74)	4.28 (0.74)
	1	4.40 (0.79)	4.59 (0.55)	4.51 (0.65)
	Total	4.36 (0.75)	4.40 (0.66)	4.39 (0.70)

We had no predictions for the effects of video, mindset and sequence on visibility. The ANOVA on the judgments reported in Table 9 showed that there was a significant interaction effect of video and mindset on visibility ($F(1,72) = 4.60, p = .04, \eta_p^2 = .06$), with less visibility of the face in the competitive condition, but only during the sad videos². There was no significant within subjects effect of video on visibility ($F(1,72) = 2.50, p = .12, \eta_p^2 = .03$). There was no significant between subjects effect of mindset on visibility ($F(1,72) = 0.34, p = .56, \eta_p^2 = .01$). There was no significant between subjects effect of sequence on visibility ($F(1,12) = 2.78, p = .10, \eta_p^2 = .04$).

3.4 Discussion

The goal of this study was to test whether there is an effect of mindset (cooperative or competitive) on displayed emotion during the viewing of emotional videos (validated in Study 2). Mindset was induced by letting participants complete the mindset manipulation task validated in Study 1. The displayed emotion was measured by filming the participants during the viewing of the

² We conducted the analyses on sadness and amusement while ruling out the participants low on visibility (average visibility < 4). This did not significantly alter the results. We still found a significant within subjects effect on both sadness and amusement, and no significant between subjects effect of mindset or sequence on both sadness and amusement.

The communicative function of facial expressions in cooperation and competition

videos. These recordings were later rated by independent raters on three outcome variables: displayed sadness, displayed amusement and visibility of the face.

Based on Ekman's (1972) theory, we would expect no between subjects effect of mindset. Based on the Behavioral Ecology View (Fridlund, 1994) we might expect a significant between subjects effect of mindset on displayed sadness of amusement. We had no strong prediction. The results show that there are no significant effects of mindset on both displayed sadness and displayed amusement. There is, however, a significant interaction-effect between mindset and induced emotion on visibility of the face, with less visibility of the face in the competitive condition, but only during the sad videos.

No effect was found of mindset on both displayed amusement and displayed sadness. There are a number of possible explanations for this. It could be that the manipulations (either the mindset manipulation or the emotion elicitation) were not strong enough to accurately test the effect. An alternative explanation would be that the effect of the mindset prime does not last for the duration of the videos. It is possible that this effect fades away even before the first video is finished, diminishing the influence of mindset on facial expressions during the watching of these videos. We recommend for future research to test for what time the mindset prime remains effective. Alternatively, it could be that the power of this experiment was not sufficient to observe subtle between subjects effects. Another possible explanation would be that displayers did not differentiate between cooperative and competitive others, when displaying facial expressions during amusement and sadness. This could mean there is a more direct connection between internal emotion and facial display, since this link is not influenced by the mindset of the displayer.

There was a significant interaction effect of sequence and video on sadness, with more sadness displays during the sad video when this video was displayed first, and a significant interaction effect of sequence and video on amusement, with more amusement displays during the sad video when this video was displayed first. During the videos that were displayed first a stronger

The communicative function of facial expressions in cooperation and competition

effect of the emotion induction was observed. A possible explanation for this is that participants had a limited attention span, and could still focus properly during the first video, but less so during the second video. An alternative explanation would be that the induction of the first emotion interferes with the induction of the second emotion. It is possible that during the second video, participants were still feeling the effects of the first video, leading to mixed emotion and less displays of emotion. We propose that future research either induces one emotion per session, or lets the participants recover after inducing an emotion (though it might be necessary to induce the involved mindset again).

There was an interaction effect of mindset and induced emotion on visibility of the face, with less visibility of the face during sad videos, but only in the competitive condition. A possible explanation for this, in line with our theorizing, would be that participants do not want to show their sadness to a competitor. Because they cannot suppress their emotions sufficiently they hide their face using other means, like covering it with their hands. Since this effect is not present when amusement was induced this effect seems to be specific for sadness. This could be because sadness is considered vulnerability and is preferably not shown to competitors. An alternative explanation would be that participants are conforming to societal display rules of emotion, like Ekman (1972) proposes. Only they do so not by inhibiting their facial expressions (like Ekman suggested) but by covering their face. However, Ekman does not specify that display rules would differ between cooperative and competitive situations. This theory does not explain why people would hide their face only in the competitive condition.

There were some difficulties that could be obviated in future research. First, the reliability for the ratings of sadness was poor³. One way to avoid this in the future would be to use more

³ We wondered if the low reliability for the sadness ratings could be the result of the lower visibility in the competitive condition, so we conducted the reliability analysis for sadness separately for the competitive and cooperative conditions, resulting in a reliability of $\alpha = .39$ for the competitive condition and $\alpha = .42$ for the cooperative condition. The reliability for the cooperative condition is slightly higher than the competitive condition. Nevertheless, both reliability are still poor and the low reliability for the sadness rating cannot be contributed to the lower visibility of the face in the competitive condition.

The communicative function of facial expressions in cooperation and competition

independent raters during the rating phase (the current research used three). More strict guidelines for rating sadness displays could also be implemented. An alternative explanation would be that the participants did not display enough sadness to be accurately noticed by raters, or that the quality of the recordings was not sufficient for the raters for a reliable interpretation of sadness displays.

Another way to avoid this problem altogether would be to use rating software instead of human raters. For the current study this was actually considered and tried, but the quality of the recordings of facial expressions turned out to be insufficient for facial recognition software (like Facereader; Noldus, 2014) for an accurate analysis. The footage used in this study was filmed slightly from the right side of participants' faces, but facial recognition software requires that the participant is facing camera directly. Also the footage was shot with a camera with a slight fish-eye effect, distorting the images in a way that made the footage harder to analyze. In future research it would be advisable to shoot high quality images from a straight angle, with a camera and lens that do not distort the footage, so these recordings can be accurately and more objectively analyzed.

In this study participants were asked before participating if they agreed with being filmed during parts of the experiment. Therefore participants were aware that they were being filmed and thus might be imagining the researcher as an audience, instead of their co-player. Also, more than half of the participants did not believe their co-player was a real person, and so sociality may not have been sufficiently induced by suggesting that the co-player would be watching the same videos at the same time. We advise that in future research consent for filming is asked only after the experiment, so participants will not be aware of the filming. Of course this would require careful ethical handling of the recordings and deleting them instantly without them being watched by anyone, should they refuse to give consent for filming.

The population sampled in this study was also quite specific, with most participants being female university students in their early twenties, making generalization to a larger population difficult.

The communicative function of facial expressions in cooperation and competition

This study did not include a control group for a non-social condition. Because of this, we cannot check if sociality was sufficiently induced. Cooperation and competition is a characteristic of communication presumed to be aimed at another person. Someone is in a competitive or cooperative relation with somebody else. If sociality is not significantly induced there is no other person to be the object of cooperation or competition. There could still be the possibility that this mechanism works mainly through a more general mindset (as the results of the believer and non-believer analyses in Study 1 lead to suspect), but it is still important to state with certainty whether sociality is sufficiently induced or not.

4. Summary & General Discussion

Three studies were conducted to answer the following main question: What is the effect of a cooperative or competitive mindset on the displays of happiness and sadness when amusement and sadness were induced? Study 1 tested a newly developed method, based on a button press effort task, for inducing a cooperative or competitive mindset in participants. Results showed that for the used population this manipulation was indeed effective. Study 2 aimed to validate and update a method of emotion elicitation using videos, based on previous research by Gross and Levenson (1995). It was found that the recommended videos by Gross and Levenson for inducing amusement or sadness were still valid in the current population. Study 3 used the manipulations validated in Study 1 and 2 to test whether there was an effect of a cooperative or competitive mindset on the displays of happiness and sadness, and visibility of the face, when amusement and sadness were induced. This study showed no effect of cooperation and competition on sadness and amusement displays. However, there was an interaction effect between mindset and emotion on visibility of the face, with visibility of the face being lower when sadness was induced, but only in the competitive condition.

The communicative function of facial expressions in cooperation and competition

The discussed studies tested the effect of cooperation and competition on facial displays of sadness and amusement. Previous studies have shown that different emotions are influenced differently by the same manipulation (Parkinson, (2005); Reisenzein et al., 2013). It cannot be concluded that the test results for sadness and amusement can be extrapolated for other emotions.

For future research, we recommend that the emotions sadness and amusement be retested with a more diverse sample, with the inclusion of a (non-social) control group and with asking consent for filming when the experiment is concluded, and not beforehand. We also recommend testing other primary emotions, since these emotions are not necessarily similarly affected. It could be argued that because an emotion like disgust has clear biological basis (closing orifices) the effects of sociality and the nature of the relation between expresser and receiver might be of less importance for displays of disgust. This would be an interesting question for future research to test.

Ekman's (1972) theory of facial expressions and Fridlund's (1994) Behavioral Ecology View lead to different predictions of how facial expressions are influenced by cooperation and competition. No effect was found of cooperation and competition mindsets on sadness and amusement displays, disproving the predictions one would make on the basis of the Behavioral Ecology View. The findings are more in line with Ekman's theory. However, Ekman's theory cannot explain the effects of sociality on happiness and sadness displays. It seems there is need for a different theory, including aspects of both Fridlund's and Ekman's theories, for explaining facial expressions altogether.

We did find an interaction effect between mindset and emotion on visibility of the face, with visibility of the face being lower when sadness was induced, but only in the competitive condition. This could possibly be explained by participants not wanting to show their sadness to a competitor. Nevertheless, participants did not hide their sadness display by inhibiting their facial expressions, but by hiding their face. This suggests that facial expressions serve a communicative function which was adjusted not by altering facial expressions themselves (like Fridlund predicted), but by hiding the

The communicative function of facial expressions in cooperation and competition face itself, effectively hiding their facial expressions altogether. However, this finding needs to be replicated before any accurate conclusions can be drawn. It is a very interesting starting point for further research analyzing the interaction between facial expressions and the hiding of facial expressions, under the influence of different factors. By conducting such research we will be able to find out how large of a role the hiding of the face plays in communication in cooperative and competitive situations and situations with other features.

In future research, when researching purely the effect of facial expressions, we recommend that participants are forbidden or at least discouraged to cover up their face, with their hands or otherwise. Participants could be instructed not to put their hands near their face, or, to not give anything away, they could be given a simple task to do with their hands, like holding down a key on the keyboard.

If we presume that the absence of a between subjects effect of mindset is the result of underlying mechanisms and not methodological limitations, this would have a number of implications for cooperation and competition. Since people do not manipulate their facial expressions according to whether they are cooperating or competing more trust in facial expressions during competition could be justified. People do not limit the amount of information their facial expressions itself communicate to competitors, but they do limit the visibility of their face, at least during sadness. This would suggest that people try to hide information about their internal state (when this internal state suggests vulnerability) from competitors, in this way inhibiting self-disclosure. On the other hand, the results suggests that, when the face can be clearly seen, the shown facial expressions are not affected by cooperation or competition and can be trusted even when in competition. However, generalizability of these studies to a non-lab situation is still very limited. We recommend field-research to further explore the effect of mindset on facial expressions in real-life situations.

The communicative function of facial expressions in cooperation and competition

The results of the conducted studies could help in the training of both healthy people and patients with deficiencies in interpreting facial expressions (like people with autism spectrum disorders). If facial expressions are unaffected by a cooperative or competitive mindset, it should not be necessary to incorporate cooperative and competitive situations in these trainings, since facial expressions would not intrinsically differ between these situations.

Hess (1995) proposes a different view on the basis of facial expressions. She proposes to see facial displays as messages with both an intrinsic emotional basis and a communicative goal, with the nature of the relation between displayer and receiver as a condition influencing the relative balance between these components. This view could explain the findings where Ekman's and Fridlund's theories fail to do so. However, the nature of the relation between experienced emotion and facial display would be influenced by a multitude of conditions, like (the previously researched factors of) sociality, the relationship between expresser and audience (e.g. friend or stranger) and intensity of the stimulus (the underlying emotion). Based on the current research it can be concluded that a cooperative or competitive relation between expresser and audience does not play a role in emotional displays when sadness or amusement was induced.

The communicative function of facial expressions in cooperation and competition

Reference List:

- Anshel, A. & Kipper, D. A. (1988). The influence of group singing on trust and cooperation. *Journal of Music Therapy, 25*(3), 145-155.
- Barclay, P., & Willer, R. (2007). Partner choice creates competitive altruism in humans. *Proceedings of the Royal Society of London B: Biological Sciences, 274*(1610), 749-753.
- Blair, R. J. R. (2003). Facial expressions, their communicatory functions and neuro-cognitive substrates. *Philosophical Transactions of the Royal Society B: Biological Sciences, 358*(1431), 561-572.
- Bohnet, I. & Frey, B. S. (1999). The sound of silence in prisoner's dilemma and dictator games. *Journal of economic behavior & organization, 38*(1), 43-57.
- Bornstein, G., Gneezy, U. & Nagel, R. (2002). The effect of intergroup competition on group coordination: an experimental study. *Games and Economic Behavior, 41*, 1-25.
- Brocklebank, S., Lewis, G. J. & Bates, T. C. (2011). Personality accounts for a stable preferences and expectations across a range of simple games. *Personality and Individual Differences, 51*(8), 881-886.
- Cooper, R., DeJong, D. V., Forsythe & Ross, T. W. (1992). Communication in cooperation games. *The Quarterly Journal of Economics, 107*(2), 739-771.
- Cornelissen, G., Dewitte, S. & Warlop, L. (2011). Are social value orientations expressed automatically? Decision making in the DG. *Personality and Social Psychology Bulletin, 1*-11.
- Devereux, P. G., & Ginsburg, G. P. (2001). Sociality effects on the production of laughter. *The Journal of General Psychology, 128*(2), 227-240.
- Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. In J. Cole (Ed.), *Nebraska Symposium on Motivation* (pp. 207-283). Lincoln: University of Nebraska Press.
- Etcoff, N. L., & Magee, J. J. (1992). Categorical perception of facial expressions. *Cognition, 44*(3), 227-240.

The communicative function of facial expressions in cooperation and competition

Gross, J. J. & Levenson, R. W. (1995). Emotion Elicitation Using Films. *Cognition and Emotion*, 9(1), 87-108.

Henrich, J., & Henrich, N. (2007). *Why humans cooperate: A cultural and evolutionary explanation*. Oxford University Press, USA.

Hess, U., Banse, R. & Kappas, A. (1995). The intensity of facial expression is determined by underlying affective state and social situation. *Journal of Personality and Social Psychology*, 69(2), 280-288.

Fernández-Dols, J. M. & Ruiz-Belda, M. A. (1995). Are Smiles a Sign of Happiness? Gold Medal Winners at the Olympic Games. *Journal of Personality and Social Psychology*, 69(6), 1113-1119.

Fridlund, A. J. (1993). The new ethology of human facial expressions. In Russell, J. A. & Fernández-Dols, J. M. (Eds.), *The psychology of facial expression*, (pp. 103-132). Cambridge: Cambridge University Press.

Fridlund, A. J. (1994). *Human facial expression: An evolutionary view*. San Diego, CA: Academic.

Frijda, N. H. (1953). The understanding of facial expression of emotion, *Acta Psychologica*, 9, 294-362.

Frith, C. (2009). Role of facial expressions in social interactions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1535), 3453-3458.

Gollwitzer, P. (2012). Mindset theory of action phases. In P. van Lange (Ed.), *Theories of social psychology* (pp. 526-545). Los Angeles: Sage.

Hess, U., Banse, R. & Kappas, A. (1995). The intensity of facial expression is determined by underlying affective state and social situation. *Journal of Personality and Social Psychology*, 69, 280–288.

Jakobs, E., Manstead, A. S. & Fischer, A. H. (2001). Social context effects on facial activity in a negative emotional setting. *Emotion*, 1, 51–69.

Jäncke, L. (1996). Facial EMG in an anger-provoking situation: individual differences in

The communicative function of facial expressions in cooperation and competition

directing anger outwards or inwards. *International Journal of Psychophysiology*, 23(3), 207-214.

Kaplan, H., Hill, K., Cadeliña, R. V., Hayden, B., Hyndman, D. C., Preston, R. J., ... & Yesner, D. R. (1985). Food sharing among Ache foragers: Tests of explanatory hypotheses [and comments and reply]. *Current anthropology*, 223-246.

Kraut, R. E. & Johnston, R. E. (1979). *Journal of Personality and Social Psychology*, 37(9). 1539-1553.

Luce, R. D. & Raiffa, H. (1957). *Games and decisions*. New York: John Wiley.

Meyer, D. E., & Schvaneveldt, R. W. (1971). Facilitation in recognizing pairs of words: evidence of a dependence between retrieval operations. *Journal of experimental psychology*, 90(2), 227.

Mokros, A., Menner, B., Eisenbarth, H., Alpers, G. W., Lange, K. W. & Osterheider, M. (2008).

Diminished cooperativeness of psychopaths in a prisoner's dilemma game yields higher rewards. *Journal of abnormal psychology*, 117(2), 406.

Noldus (2014). *Facereader*. <http://www.noldus.com/human-behavior-research/products/facereader>

Parkinson, B. (2005). Do facial movements express emotions or communicate motives?

Personality and Social Psychology Review, 9, 278–311.

Philippot, P., Schaefer, A., & Herbette, G. (2003). Consequences of specific processing of emotional information: Impact of general versus specific autobiographical memory priming on emotion elicitation. *Emotion*, 3(3), 270.

Reisenzein, R., Studtmann, M. & Horstmann, G. (2013). Coherence between Emotion and Facial Expression: Evidence from Laboratory Experiments. *Emotion Review*, 5(1), 16-23.

Rapoport, A., & Chammah, A. M. (1965). *Prisoner's dilemma: A study in conflict and cooperation* (165). University of Michigan press.

Rottenberg, J., Ray, R. D. & Gross, J. J. (2007). Emotion Elicitation Using Film. In J. A. Coan & J. J. B. Allen (Eds.), *The handbook of emotion elicitation and assessment*. London: Oxford University Press.

The communicative function of facial expressions in cooperation and competition

Sassenberg, K., & Moskowitz, G. B. (2005). Don't stereotype, think different! Overcoming automatic stereotype activation by mindset priming. *Journal of Experimental Social Psychology, 41*(5), 506-514.

Schaefer, A., Nils, F., Sanchez, X., & Philippot, P. (2010). Assessing the effectiveness of a large database of emotion-eliciting films: A new tool for emotion researchers. *Cognition and Emotion, 24*(7), 1153-1172.

Smith, E. A. (2003). Human Cooperation: Perspectives from behavioral ecology. In P. Hammerstein (Ed), *Genetic and Cultural Evolution of Cooperation*. Cambridge: MIT Press.

Wichman, H. (1970). Effect of isolation and communication on cooperation in a two-person game. *Journal of Personality and Social Psychology, 16*(1), 114-120. Human Cooperation

The communicative function of facial expressions in cooperation and competition

Appendix A. Research report Pilot 1: Reverse Correlation for cooperation and competition

1. Introduction

The goal of this study was to analyse the internal representations people have of cooperative and competitive faces. Reverse correlation (RC) techniques provide a data-driven approach to model internal representations in an unconstrained way (Dotsch & Todorov, 2012). In this technique, participants are repeatedly shown a number of pictures faces (2 or more) and are asked which of the faces fits a certain criteria best. These faces are generated by adding randomized noise to a base face, thus generating a large number (in this case 600) faces with noise over them. By averaging the faces the participants chose we can analyse the internal representations people have of a certain concept.

As a pilot for our main study, looking into the effect of cooperativeness and competitiveness on facial expressions, we conducted a RC experiment to model participants' internal representations of a cooperative and competitive face.

2. Method

2.1 participants & design

Participants were recruited through the Utrecht University shared lab, where people come to participate in studies and are assigned to a study based upon the amount of time they have and what kind of reward (money or course credit) they want to receive. A total of 35 participants participated in this study. Because of some inattention on the part of a substitute lab-worker we only have demographic variables for 32 of these participants. For these 32 the mean age was 21.53 ($SD = 3.00$), with a total of 10 male and 22 female participants. In return for participation the participants were rewarded either a sum of money or participation credit required for bachelor psychology students. They were randomly assigned to the cooperative or the competitive condition.

The communicative function of facial expressions in cooperation and competition

2.2 Materials & procedure

The materials used in this study were generated according to the method of Dotsch & Todorov (2012) and made with Ron Dotsch' (2014) Reverse correlation image classification toolbox.

The stimuli in the RC task all consisted of the same base face with different superimposed random noise on each trial. The base face was a gray scale average of all male faces in the Karolinska Face Database (Lundqvist, Flykt, & Öhman, 1998). The noise consisted of superimposed truncated sinusoid patches of 2 Cycles in 6 Orientations (0, 30, 60, 90, 120, and 150), 5 Spatial scales (2, 4, 8, 16, and 32 cycles per image), and 2 Phases (0, $\pi/2$), with random contrasts. In sum, the random noise was a function of 4092 parameters, each defining the contrast value of one truncated sinusoid spanning two cycles. Stimulus size was 512x512 pixels. In a single trial two stimuli were presented side by side. One stimulus was the base face with a random noise pattern superimposed and the other the base face with the negative of the random noise pattern superimposed. We chose to use the negative of the random noise pattern as opposed to just another random noise pattern to maximize the differences between the two presented images, to minimize the number of possible stimulus pairs to be presented, and to simplify data analysis. This procedure has been successfully employed by Dotsch et al. (2008), Dotsch, Wigboldus, and van Knippenberg (2011), Imhoff, Dotsch, Bianchi, Banse, and Wigboldus (2011), and Karremans, Dotsch, and Corneille (2011). Participants in the first condition were instructed to select the stimulus that most resembled a cooperative face, and participants in the second condition were instructed to select the stimulus that most resembled a competitive face. Participants completed three sets of 100 trials, with a 30 second break in between the sets. The presented stimuli were drawn per set without replacement from one the three 100 original (and 100 matching negative) noise patterns. The placement of the facial images with original and negative noise on the screen (negative noise on the left vs. on the right) was counterbalanced across trials. A 1,000-ms centered fixation cross preceded each trial. After participants completed the task they filled in a demographic variables questionnaire on paper and were subsequently debriefed (Dotsch & Todorov, 2012; Dotsch, 2014)

The communicative function of facial expressions in cooperation and competition

2.3 Data processing

To generate the classification images, we calculated the mean of all noise patterns a participant selected as most trustworthy (untrustworthy, dominant, and submissive), by averaging the parameters on which those noise patterns were based. This resulted in 4,092 mean parameters per participant. We then averaged the mean parameters across participants for each cell of the design and generated the classification patterns based on cell average parameters. Finally, we superimposed the classification patterns on the original base image to generate the classification images.

The communicative function of facial expressions in cooperation and competition

3. Results

3.1 Cooperation

The resulting classification image for cooperation is depicted in figure 1. Visual inspection of the cooperative classification image show that a cooperative face involves a smiling mouth and open eyes and a rather small chin.



Figure 1. The resulting classification image for cooperation.

The communicative function of facial expressions in cooperation and competition

3.2 Competition

The resulting classification image for cooperation is depicted in figure 1. Visual inspection of the cooperative classification image show that a cooperative face involves a slightly downturned mouth and frowning eyebrows and a quite square-shaped head. The face makes a slightly angry and surly impression.



Figure 1. The resulting classification image for competition.

The communicative function of facial expressions in cooperation and competition

Discussion

As can be seen in figures 1 and 2, the generated face for the cooperative condition looks happy, where the competitive face looks angry. An interesting next step in reverse correlation research on cooperation and competition would be to carry out a similar experiment with 'friendly' and 'angry' as the criteria. Subsequently we could compare the results, or even subtract the results to see if there is still information in cooperative or competitive faces after friendliness and hostility are removed.

All in all, it is clear that the images differ, and thus can be used as a small aspect of the main-study.

The communicative function of facial expressions in cooperation and competition

References:

Dotsch, R., & Todorov, A. (2012). [Reverse correlating social face perception](#). *Social Psychological and Personality Science*, 3 (5), 562-571.

Dotsch, R. (2014). rcicr: Reverse correlation image classification toolbox. R package version 0.3.0.

Dotsch, R., Wigboldus, D. H., & van Knippenberg, A. (2011). Biased allocation of faces to social categories. *Journal of personality and social psychology*, 100(6), 999.

Dotsch, R., Wigboldus, D. H., Langner, O., & van Knippenberg, A. (2008). Ethnic out-group faces are biased in the prejudiced mind. *Psychological Science*, 19(10), 978-980.

Imhoff, R., Dotsch, R., Bianchi, M., Banse, R., & Wigboldus, D. H. (2011). Facing Europe Visualizing Spontaneous In-Group Projection. *Psychological science*, 0956797611419675.

Karremans, J. C., Dotsch, R., & Corneille, O. (2011). Romantic relationship status biases memory of faces of attractive opposite-sex others: Evidence from a reverse-correlation paradigm. *Cognition*, 121(3), 422-426.

The communicative function of facial expressions in cooperation and competition

Appendix B. An example of what a trial of the mindset task looked like

Cooperative condition



Competitive condition

