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DOES BOTOX BUFFER THE NEGATIVE EFFECTS OF SOCIAL REJECTION?: A
TEST OF THE FACIAL FEEDBACK HYPOTHESIS

THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science
in the College of Arts and Sciences at the University of Kentucky

By
Vicki Sharif

Lexington, Kentucky

Director: C. Nathan DeWall, Ph.D., Professor of Psychology

Lexington, Kentucky

2013

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ABSTRACT OF THESIS

DOES BOTOX BUFFER THE NEGATIVE EFFECTS OF SOCIAL REJECTION?: A TEST OF THE FACIAL FEEDBACK HYPOTHESIS

Can a common facial cosmetic procedure buffer against the negative impact of adverse social interactions? This pilot tested the hypothesis that an injection of botulinum toxin (Botox) to the corrugator supercilii muscles used in anger, compared to a placebo injection to the same location, will reduce the impact of social rejection on mood, self-esteem, control, meaningful existence, and aggression. Freezing facial musculature was hypothesized to alter the first physical signal of negative emotional reactions, thereby reducing the impact of social rejection on distress and aggression. This was the first study using Botox to examine the effects of reduced facial feedback on felt emotions during social interactions. While the findings in this pilot were not statistically significant, a trend in the data suggests that the effect was in the opposite direction of the prediction such that participants in the Botox (vs. saline) condition experienced greater feelings of rejection. Further investigation is needed.

KEY WORDS: facial feedback hypothesis, Botox, social emotion, social rejection, aggression

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May 3, 2013

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Chapter 1

Does Cosmetic Botox Buffer the Negative Effects of Social Rejection?: A Test of the Facial Feedback Hypothesis on Social Emotion

“...from the time that the infant can experience sensations and starts to register emotions, the facial muscles portray the various passions on his face. The muscles most often used by these early gymnastics of the soul became better developed and their tonic force increases proportionately.” (Duchenne, 1870)

Facial expressions convey our emotions to others. We smile when we want others to approach us, we frown to show our sadness, and we grimace to show others our anger. As Duchenne (1870) noted, these outward expressions originate with how our facial muscles relax, constrict, and sustain movement. But do our facial expressions color how we experience negative social events, such as social rejection? Neuroimaging research suggests that social rejection causes people to feel pain, and that physical and social pain share common neural pathways (Eisenberger, Liberman, & Williams, 2003). Behavioral research also demonstrates that social rejection produces emotional and behavioral responses similar to those that people encounter when they experience physical pain, such as emotional distress (Gerber & Wheeler, 2009) and aggression (Twenge et al., 2001). To date, no work has examined whether reducing the ability to generate a facial emotional expression would buffer people from the pain of social rejection. The current study fills this gap in the literature.

To test this hypothesis, I propose an experiment to test whether injection of botulinum toxin (Botox) to the corrugator supercilii muscle used in anger, compared to a placebo injection to the same location, can reduce the negative impact of social rejection. I hypothesize that altering facial musculature’s ability to demonstrate negative affect—the first physical signal of negative emotional reactions—will buffer participants from the

negative consequences of social rejection, as measured by reduction in four basic human needs (lower mood, self-esteem, meaningful existence, and control) and increased aggression. Next, I provide an overview of the facial feedback hypothesis and recent research using Botox to extend the facial feedback hypothesis. I then relate these lines of work to the pain of social rejection.

Facial Feedback Hypothesis

The “facial feedback hypothesis” asserts that facial muscle changes, or expressions, both convey emotion and *produce* emotion. In this model, facial expressions influence emotional experience (Tourangeau & Ellsworth, 1979). Darwin asserted that intensifying or suppressing facial expressions modulates the intensity of the emotion (Darwin, 1872). In his influential Theory of Emotion, William James (1890) proposed that facial expressions contribute to subjective feelings by contributing to a cascade of peripheral bodily changes, including muscle activity, that combine to produce subjective feelings.

Though this model had received some support (Tourangeau & Ellsworth, 1979), the mechanism underlying facial expressions in feeling emotion was uncertain for many years. However, there were two schools of thought regarding the mechanisms of the effects of facial feedback on emotion. One group supported the notion that facial feedback can moderate our affective experience but cognition drives emotions (Laird, 1974). Another group (Ekman, 1983; Izard 1977; Tomkins, 1962, 1979) held that involuntary facial expressions, often outside of our awareness, drive our emotional experience and that cognitive mediation is not necessary for the facial feedback to occur.

In response to this uncertainty, Strack and colleagues (1988) used a clever design to test the role of cognition in facial feedback. Strack et al. believed that previous work was “contaminated” by cognitive mediation and sought to control for it. Previous studies had used posing, or intentional imitation of an emotion, followed by measuring emotional states. Their study procedures minimized possible inferences made by subjects with the first manipulation that used a study technique other than intentional posing. By holding a pencil in either the lips or the teeth, facial muscles involved in smiling were either inhibited or facilitated. Results indicated that facilitating versus inhibiting facial muscles associated with the expression of positive affect increased the intensity of humor in two studies. The findings demonstrated that an understanding or recognition of the meaning of an emotion was not necessary to interpret it. Strack et al. concluded that “facial feedback operates on the affective but not on the cognitive component of the humor response” (1988, p. 768).

Further support for the modulating effects of facial feedback was provided by Soussignan (2002). In this investigation, precise differences in emotions resulted from two different facial configurations of smiling. This study examined the Duchenne smile versus the non-Duchenne smile using the pencil-holding technique. Participants were asked to facilitate or inhibit smiling while watching negative or positive video clips. Duchenne, or real, smiles have been defined as prototypical for “happy” and include wrinkling by the eyes compared to non-Duchenne, or false, smiles (Ekman, 1989). Soussignan found that a Duchenne smile had a greater impact on the emotional experience of positive feelings and was associated with a different pattern of autonomic arousal. He concluded that facial feedback prototypes have the greatest impact when they

match corresponding emotions. He also found support for Strack et al.'s (1988) conclusions and stated that "...unconscious facilitation of one form of human smile reliably affects the rating of emotional experience" (p. 68).

These two investigations focused on support for the facial feedback hypothesis but have not tried to undermine its effect. The popular use of cosmetic Botox offers a unique opportunity to do just that by giving investigators a way to temporarily freeze facial feedback. This has been previously referred to as a reversible lesion model.

Botox: "An Ideal Reversible Lesion Model"

The facial prototype for many negative emotions, like anger, includes pulling the eyebrows together and down (Jancke, 1996; Brown & Schwartz, 1980). The corrugator supercilii muscles (frown muscles) that are located between the eyebrows are responsible for this action. Plus, anger has a distinct neural signature associated with activation in the amygdala (Carr et al., 2003; Wild et al., 2003; Dapretto et al., 2006; Lee et al., 2006) and brain stem regions (LeDoux, 2000). Imaging studies have shown the corresponding activity in the limbic brain regions during imitation of angry faces. The role of facial feedback, however, was unclear.

Hennenlotter et al. (2009) tested the neurological mechanism in healthy participants who imitated or observed angry or sad faces before and after Botox treatment to the corrugator supercilii muscles. Botulinum toxin, or Botox, is commonly used to treat facial wrinkles as it produces temporary muscle denervation resulting in frozen facial muscles. Hennenlotter et al. state that Botox "...provides an ideal reversible lesion model to investigate the effects of facial feedback on brain activation" (p. 537). This investigation coupled neuroimaging with Botox to confirm the role of facial feedback on

the neural signatures associated with the imitation of anger and sadness. Subjects either observed or imitated angry or sad faces in an MRI scanner. They found that Botox, compared to the control group, impaired brow lowering actions during the imitation of angry and sad faces and confirmed that Botox treatment modulated the effect of imitated facial expressions in the associated limbic regions of the brain, including the amygdala and brainstem. These findings offer additional evidence regarding the importance of facial feedback on felt emotion and how Botox can be used to reduce felt emotion. While not conclusive, this first investigation provides clues to the physiological basis for the role of facial feedback in “felt” emotions.

In a study on emotion and language, Havas et al. (2010) investigated the potential for facial movement to mediate language. In this language comprehension study, it was discovered that as participants silently read emotional language, their facial muscles became spontaneously active with corresponding emotional expressions. Using Botox injected into the corrugator supercilii muscles, temporarily freezing facial muscles used in frowning, slowed understanding of negative, but not positive emotional language. These findings offered evidence that facial feedback may be critical to emotion regulation and that involuntary facial expressions evoke emotions. It further links prototypical facial expressions with the experience of emotion and understanding the emotion of language.

If, as the facial feedback hypothesis states, facial expressions not only convey emotion but also produce it, then it follows that blocking negative expressions should offer some protection against chronic negative affect. In a small pilot study, Finzi & Wasserman (2006) found just that. Ten patients with treatment-resistant major depressive disorder received Botox to the frown muscles. Two months later, nine of ten patients

were re-evaluated and no longer met DSM-IV criteria for major depressive disorder, and the tenth patient reported an improvement in mood. However, much more work is needed as methodological problems exist with this study that include the lack of a control group, the possibility of a placebo effect, and the validity of these results in light of the episodic nature of major depressive disorder.

These recent studies using Botox offer interesting insights into the role of facial expression on negative emotion. Because negative emotion and a cascade of negative consequences are associated with exclusion, the pain of social rejection offers opportunities to explore the role of facial expressions used in emotion regulation.

The Pain of Social Rejection

One of the most basic needs that drives our behavior and contributes to our well-being and health is the need to belong (Baumeister & Leary, 1995). If feelings of belongingness are not satisfied, people often develop physical health problems (e.g. Cacioppo & Hawkley, 2005) and are even at higher risk of death (Lynch, 1979). Social rejection also results in emotional distress including lowered self-esteem, mood, meaningful existence and control (e.g. van Beest & Williams, 2006). Further, rejection increases aggressive tendencies (Twenge et al., 2001). Domestic violence, school violence, and laboratory experiments all reveal social rejection as a reliable predictor of increased aggression (e.g. Twenge et al., 2001).

With a host of such negative effects, common descriptions of social rejection are related to pain. People use words related to physical pain when they discuss the pain of rejection. Divorce “hurts,” getting fired “stings,” and being ignored by friends can make a

person's heart "ache." A growing body of work suggests that social and physical pain share common overlap in regions associated with both the affective component (e.g., dorsal anterior cingulate cortex, anterior insula; Eisenberger et al., 2003) and more recently in regions that support the sensory component (e.g., secondary somatosensory cortex; dorsal posterior insula; Kross et al., 2011) of physical pain. Because our brains rely on common regions to encode social rejection and physical pain, it is no surprise that additional work demonstrates that Tylenol (acetaminophen) can reduce the pain of social rejection (DeWall et al., 2010).

The current work seeks to determine whether Botox may represent another way to reduce the pain of social rejection. If the facial feedback hypothesis is correct, then Botox may dull the pain of rejection by altering the brain's perception of the associated emotional distress. An exploratory aim includes a glimpse into the timing and role of cognition in the underlying process of social emotion. Specifically, Botox should reduce the emotional consequences of rejection, but previous work in the facial feedback literature suggests that it should not influence cognitive perceptions of the rejection experience (e.g., Strack et al., 1988).

Overview of Current Research

This investigation tested four study objectives. The first was to show that injection of botulinum toxin (Botox) to the corrugator supercilii muscle used in anger, compared to a placebo injection of saline to the same location, can reduce the impact of social rejection on the four basic needs that it commonly threatens, as measured by the Need Threat Scale, that include self-reported mood, self-esteem, control, and meaningful existence. The second was to demonstrate that Botox (vs. saline) will buffer aggression,

using a computerized competitive reaction-time task, in response to social rejection. Third, this investigation intended to demonstrate that Need Threat (emotional distress, as measured by collapsing across the 4 aspects of Need Threat) mediated the relationship between Botox (vs. saline) and aggression. Fourth, an exploratory aim examined the role of cognition by investigating whether Botox (vs. saline) influenced cognitive appraisals of acceptance and rejection.

This investigation used a double-blind, two-condition between-subjects design. Half of the participants were randomly assigned to receive an injection of Botox, whereas the other half of the participants were randomly assigned to receive an injection of saline (placebo).

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Chapter 2

Method

Participants

Participants included 16 Botox-naive adults aged 35-65 that were seeking Botox for cosmetic purposes at UK Healthcare. No racial or ethnic groups were excluded. Proposed enrollment dates are November 15, 2012 to November 15, 2013. Participants were randomly assigned to the Botox or placebo condition.

Measures

Demographic Variables. For descriptive purposes, participants were asked to provide their age, gender, race, weight and height.

Need Threat Scale. Threatened needs were assessed on a 7-point Likert scale from 1 (do not agree) to 7 (agree). Higher scores on the Need Threat Scale correspond with *less* distress. This is a 20-item questionnaire intended to assess social distress due to social rejection (van Beest & Williams, 2006). The four needs that are threatened during social rejection and measured by this scale include belongingness, control, self-esteem and meaningful existence (see Appendix A).

Positive and Negative Affect Schedule (PANAS). Positive and negative affect were measured using 20 items from the PANAS (Watson, Clark & Tellegen, 1988). Completion of the PANAS requires participants to rate, on a scale of 1 to 5 (where 1 is very slightly or not at all, and 5 is extremely), the extent to which they are experiencing a given affective state at the present moment (e.g., afraid, distressed, determined, proud, interested, irritable). In a sample of undergraduates, positive and

negative affect scales demonstrated acceptable internal consistency. The PANAS has convergent validity with other mood measures (Watson, Clark, & Tellegen, 1988). In the present study, the PANAS was administered to measure the effects of the experimental conditions on affect and rule out any possibility that changes in affect are responsible for results (see Appendix B).

Materials and Procedures

Participants arrived for Part 1 of the three-part study at the University of Kentucky Clinic: Ear, Nose, and Throat division and completed a consent form and authorization/assignments forms. The physician of record completed a full, documented medical exam including a pregnancy test. All participants qualified to continue after passing the health screening. After obtaining a signed Informed Consent, reviewing Botox Injection instructions, and collecting general demographic information, the facial plastic surgeon took “before” photographs and proceeded to administer either Botox or 0.9% saline solution injections to the glabella utilizing the following methods and techniques: With a 1 cc syringe, the facial plastic surgeon injected 1 to 3 units of either Botox or saline via a 30 gauge needle to 3 to 5 sites spaced 1 cm apart on each side of the midline in the glabellar region. By random assignment, half of the participants received an injection of Botox, whereas the other half of the participants received an injection of placebo (i.e., saline). Following the completion of the injections, the participants were instructed to comply with the post-injection directions and to schedule a follow-up exam in 10 to 14 days. The participants were scheduled for an appointment for Part 2 of the study.

For Part 2, participants returned to the clinic. They first scheduled a time to return for Part 3 of the study. Next, they were escorted to an examination room, where they underwent a follow-up evaluation to determine the effectiveness of the injection manipulation. Upon follow-up examination(s), the facial plastic surgeon assessed and documented the effect on muscle paralysis via visual assessment to verify the presence or lack of vertical skin dimpling with attempted contraction of the corrugator supercillii muscle. The clinician then took the “after” photographs. Note that none of the participants that received the Botox manipulation required further injections.

Next, participants completed two rounds of a virtual ball-tossing task against two ostensible other participants in the study, which is the social rejection manipulation. The two-part virtual ball-tossing game (‘Cyberball’; Williams et al., 2000) was introduced to participants as a computer task with two same-sex partners (in another room at the University of Kentucky Clinic: Ear, Nose, and Throat division) in which the goal was to practice mentally visualizing an event that is happening in a virtual environment. In reality, participants were playing with a preset computer program. Participants played one round of the virtual ball-tossing game, in which they were socially included for the entire duration of the game, receiving an equal third of the tosses. After completing the first round, participants completed a set of questionnaires designed to assess their feelings of self-esteem, mood, meaningful existence, and control during the game (See Appendix A and B: Need Threat scale and Positive and Negative Affect Scale or PANAS; attached). In the second round, participants played another round of the virtual ball-tossing game, in which they were socially excluded after receiving the ball three times, at which point the other players stopped throwing the ball to them. Exclusion always occurs

second in the order to prevent concerns over being potentially excluded from contaminating the inclusion round, which would occur if we counterbalanced the order of the two conditions (e.g., Eisenberger et al., 2003; DeWall et al., 2010). After completing the second round, participants completed the Need Threat scale and PANAS again.

Once the second round concluded, participants completed a competitive reaction-time task designed to measure aggressive behavior, a paradigm developed by Taylor (1967), in which each participant was told that they will be playing against one of their partners from Cyberball. In the competitive reaction-time task, participants attempt to press a button as fast as possible, and ostensibly, whichever player is slower receives an uncomfortable (but not harmful) noise blast. Each participant was permitted to set in advance the intensity of the noise (0 to 105 decibels) the partner would receive. All noise levels were set so that, although the noise is unpleasant, no damage to the ear would occur. A PC computer controlled the events in the reaction time task and records the noise levels the participant sets for the “other person.” Finally, participants were informed that Part 2 of the study had ended. At this point, the experimenter informed participants whether they received Botox or saline during Part 1. If they received placebo during Part 1, then they received a dose of Botox at the end of the study. All participants were asked to return for a brief follow up with the clinician. At the end of Part 3, all participants were debriefed and dismissed. As an added precaution, all participants received a 30 day post-screening telephone call. This was a quick phone call to confirm that no adverse reactions or effects had occurred. (Copyright@VickiSharif 2013)

Chapter 3

Results

Descriptive Statistics

Means and standard deviations of primary study variables by condition can be found in Table 1.

Hypothesis Tests

First, I tested the hypothesis that Botox (vs. saline) injections to the corrugator supercillii would reduce need threat. Condition was coded 0 for saline and 1 for Botox. Degree of reduction in need threat across all 4 types of need threat (averaged across types) was calculated by subtracting time 2 scores (after rejection) from time 1 scores (after acceptance), where higher change scores indicate a decrease in need threat. In this first analysis, I regressed reduction in need threat on condition. I predicted that Botox, compared to placebo, would buffer need threat in response to social rejection (see Figure 1, Path A). Contrary to prediction, I did not find a statistically significant effect of condition on change in Need Threat ($B = 13.50, t(15) = 1.35, p = .19$). A graph of mean levels of need threat after acceptance and after rejection in each condition can be found in Figure 2 and a graph of the change in need threat by condition can be found in Figure 3. While not statistically significant, notably, there was a medium effect size ($d = .70$) in the change in need threat such that a trend is evident in the opposite direction of the prediction. This trend indicates a greater increase in need threat in the Botox (vs. saline) condition.

The second hypothesis was that Botox (vs. saline) injections to the corrugator supercillii would buffer aggression (as measured by the TAP) in response to social

rejection. The second analysis was regressing aggression (as measured by the TAP) on condition. I predicted that Botox (vs. saline) would result in lower levels of aggression (see Figure 1, Path C). Again, there was no statistically significant effect of condition on any of the three measures of aggression of the TAP (Total Aggression: $B = .23$, $t(15) = .22$, $p = .82$; Unprovoked Aggression: $B = -.16$, $t(15) = -.17$, $p = .86$; Extreme Aggression: $B = -.62$, $t(15) = -.18$, $p = .85$). See Figure 4 for a graph of aggression findings by condition.

The third mediational hypothesis was that Botox (vs. saline) injections would buffer the effects of need threat following social rejection and therefore would result in lower levels of aggression. Since the link between condition and change in need threat was not significant, further tests of this hypothesis were not conducted.

An exploratory hypothesis was to investigate if Botox (vs. saline) injections affect cognition. To test this, I used a self-report measure that asked each participant to estimate the number of times that they caught the ball in the acceptance and rejection conditions of the Cyberball game (Williams, Cheung, & Choi, 2000). I predicted that cognitive appraisal of acceptance and rejection would not differ by condition which would be revealed in two ways; first, the change in perceived rejection from the acceptance to the rejection sections of the experiment should not differ by condition and second, that all participants would accurately perceive rejection (i.e., percentage of time the ball was thrown to them) regardless of condition.

To investigate the first question, I regressed change in cognitive appraisal on condition and did, in fact, find that there was no statistically significant difference between conditions where $B = .12$, $t(15) = .03$, $p = .97$. See Figure 5 for a graph of the

mean change in each condition. This suggests that condition had no effect on the extent to which the rejection manipulation was perceived as *more* rejecting than the acceptance manipulation.

To investigate the second question, I also conducted one-sample t-tests to evaluate the accuracy of each conditions' (Botox vs. saline) assessments of receiving the ball in both the acceptance round (actually received it 33% of the time) and the rejection round (actually received it 7% of the time). The only group that correctly assessed how often they received the ball were the participants in the saline condition in the rejection round where $t(7) = -.263, p = .80$. The participants in the saline condition during the acceptance round did not accurately estimate getting the ball where $t(7) = -2.56, p = .038$ such that they underestimated how many tosses went to them. The participants in the Botox condition did not accurately assess their receipt of the ball by underestimating in both the acceptance condition where $t(7) = -2.53, p = .039$ and the rejection condition where $t(7) = -3.27, p = .01$. In spite of part 1 of my analysis, these results seem to indicate that participants in the Botox condition did a poorer job of accurately appraising the receipt of the ball and that Botox does, in fact, affect cognition after rejection.

Table 1.

Means and standard deviations of primary study variables by condition

MEASURE	Saline (N=8)	Botox (N=8)
	M (SD)	M (SD)
Age	47.88 (11.24)	51.63 (8.48)
Need Threat 1	96.13 (21.28)	103.00 (16.66)
Need Threat 2	64.13 (23.04)	57.50 (15.46)
Need Threat Accept Minus Reject	32.00 (18.33)	45.50 (21.47)
Unprovoked Aggression	.08 (1.79)	-.08 (2.07)
Extreme Aggression	3.75 (8.24)	2.50 (3.80)
Total Aggression	-.12 (2.17)	.12 (1.86)
Cognitive Appraisal (CA) 1	27.38 (6.23)	24.00 (10.00)
Cognitive Appraisal (CA) 2	6.63 (4.03)	3.13 (3.36)

Figure 1. Hypothesized Mediation Model.

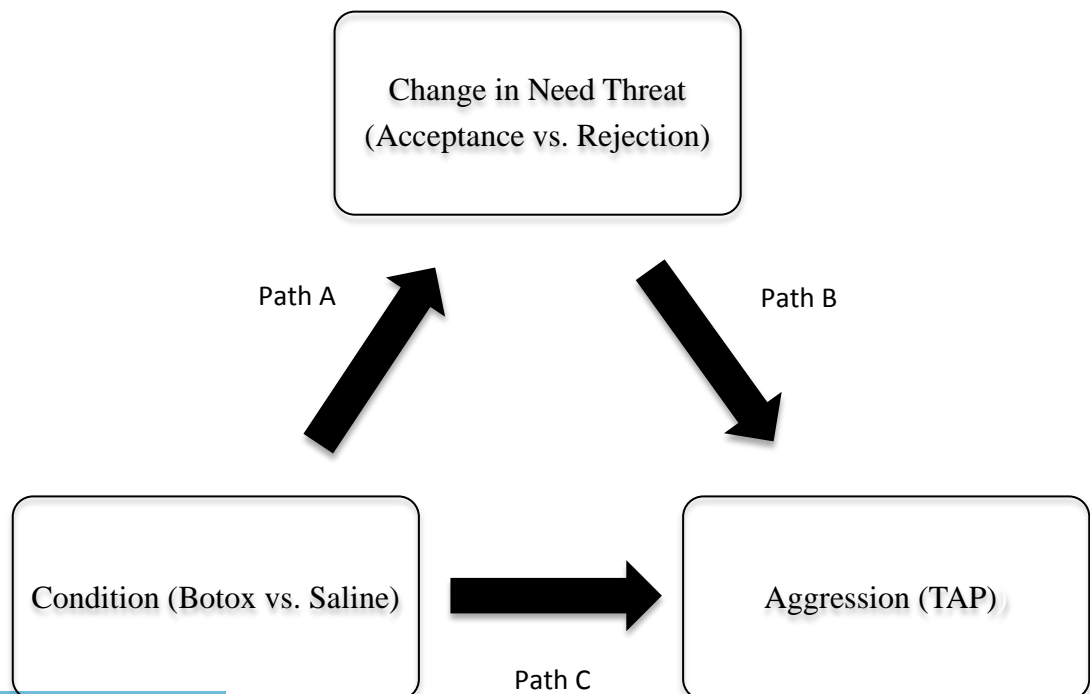


Figure 2. Mean levels of need threat after acceptance and after rejection by condition.

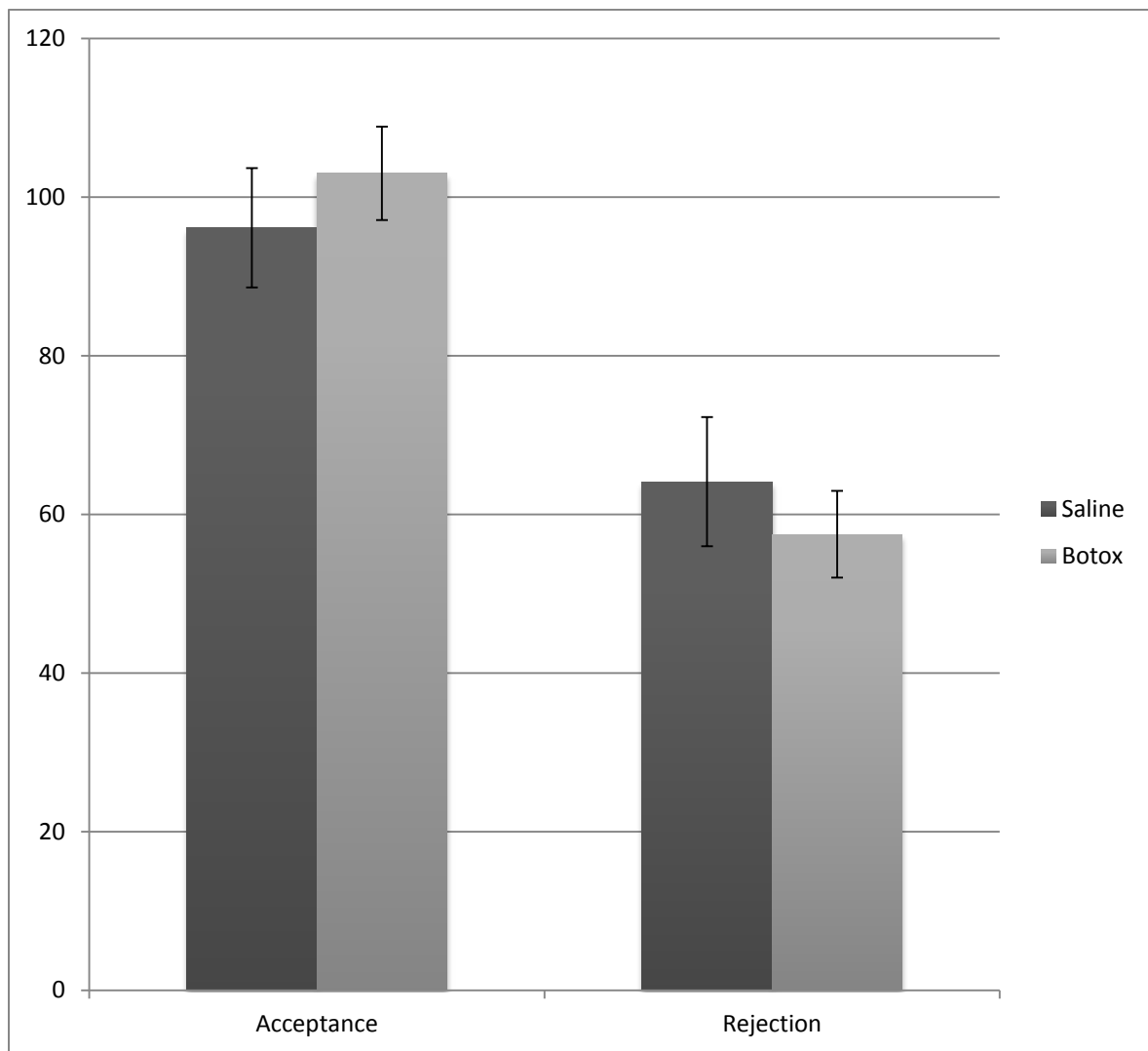


Figure 3. Mean difference scores (acceptance minus rejection) in need threat by condition

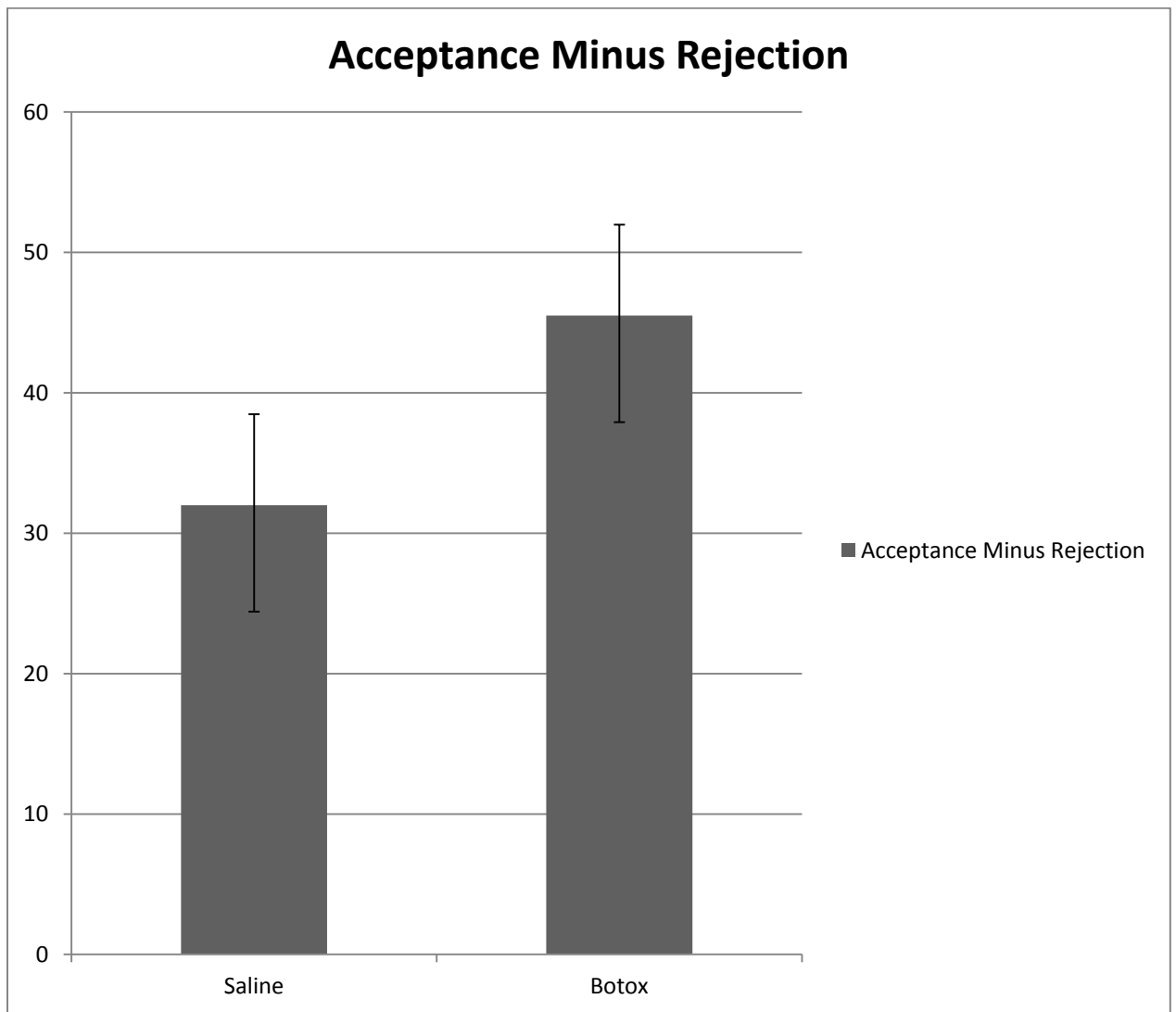


Figure 4. Aggression findings by condition.

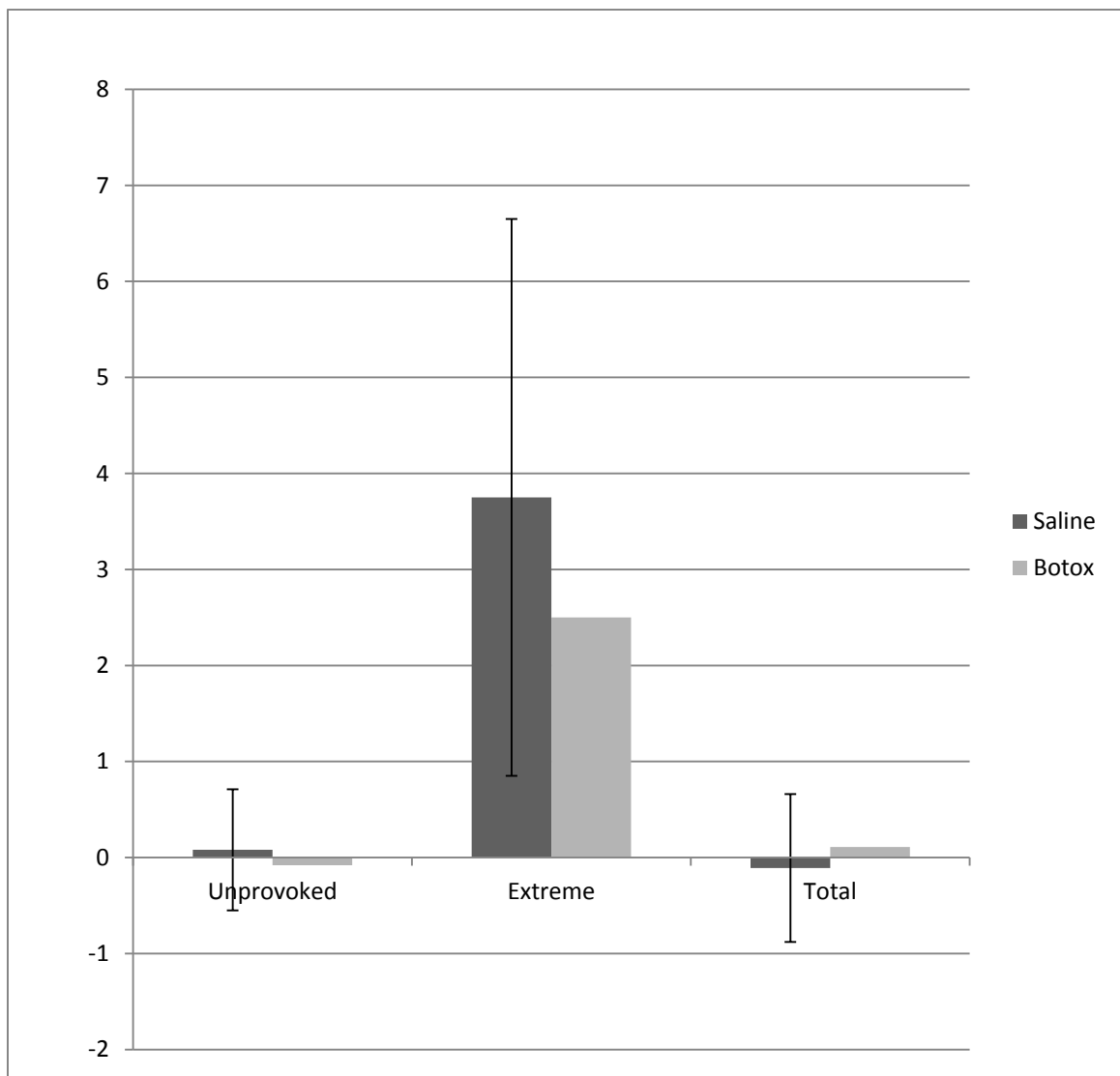
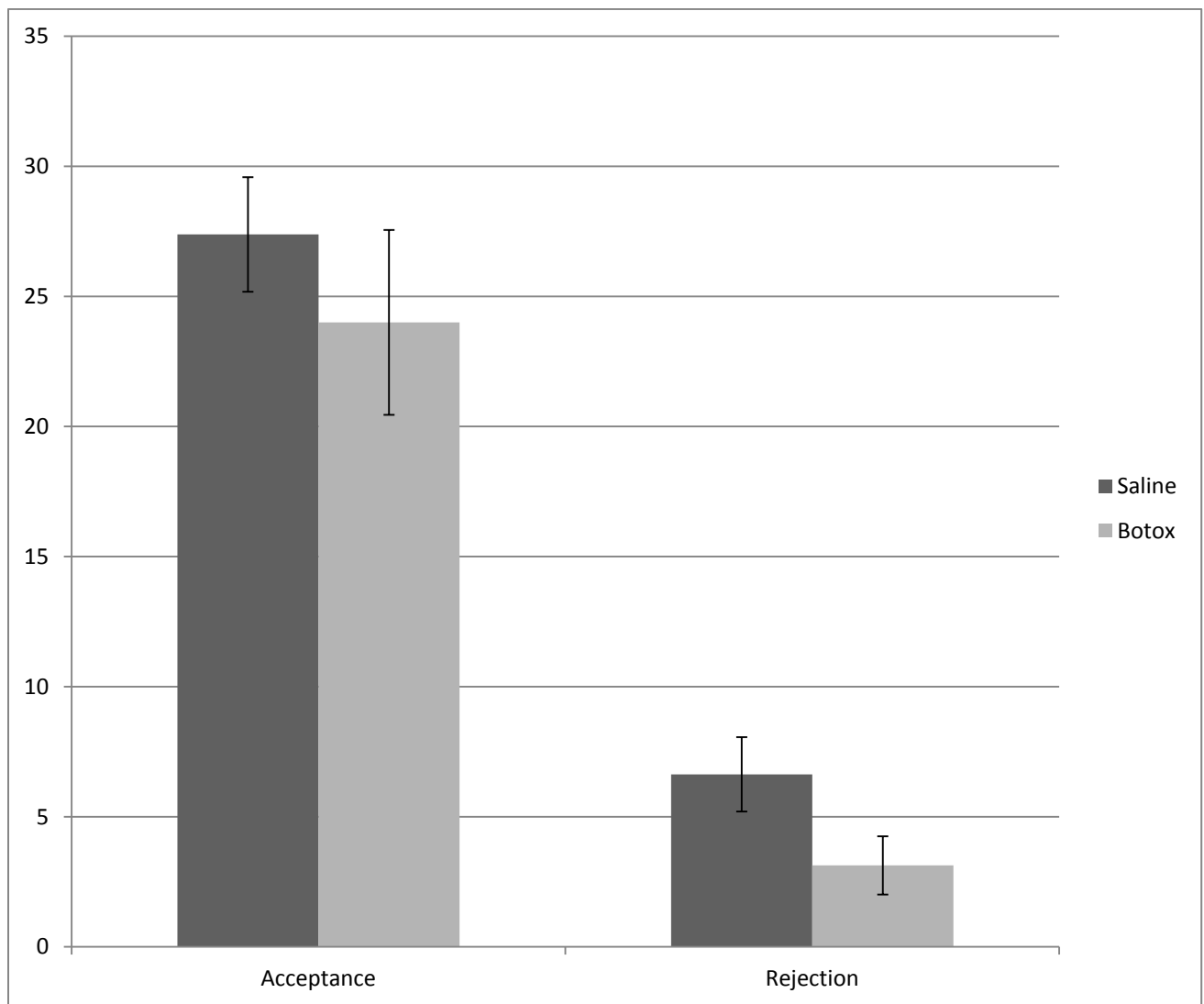


Figure 5. Mean change in cognitive appraisal by condition.



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Chapter 4

Discussion

I expected to find support for the hypothesis that Botox (vs. saline) injections buffer the pain of social rejection and therefore reduce the aggression that typically follows. In this pilot study, the data failed to support my hypotheses. I did not find statistically significant differences in threatened needs or aggression for the participants in the Botox (vs. saline) conditions. Also contrary to prediction, it appears as though Botox affects cognition after rejection.

An interesting aspect of this study was that, while not statistically significant ($p = .19$), there was a medium effect size ($d = .70$) in the change in need threat that indicated greater increase in need threat in the Botox (vs. saline) condition. This effect is the opposite of my prediction. It appears that this pilot lacked adequate power to detect the effect. With 8 participants per condition, it is likely that a larger sample size would reveal a statistically significant effect for the observed change in need threat where participants experienced increase in need threat after receiving Botox (vs. saline). Notably, the cognitive appraisal manipulation seems to support this trend in the data indicating that Botox affects cognition. After rejection, the participants in the saline condition accurately assessed how many times they received the ball but the participants in the Botox condition did not. They perceived greater rejection as indicated by thinking that they received the ball less than reality. What follows are numerous potential explanations for the findings that Botox (vs. saline) seems to exacerbate the negative feelings of social rejection.

Previous work has suggested that Botox buffers felt emotions. Since this is the first investigation on social emotion, it is possible that conclusions about social emotion cannot be drawn from previous work. Perhaps social emotions, versus non-social, have additional and/or unique mechanisms associated with adaptive behavior to protect and process. First, the observed opposite effect could result from unique processes that are engaged during an interaction with one or more persons. For example, facial expressions could take on the added role of providing a layer of protection much like a wince when punched in the face. A social emotional assault could trigger facial expressions in such a way that they protect us from experiencing emotional damage. If the ability to protect ourselves is muted, or buffered, then perhaps negative consequences cannot be properly processed. Second, another mechanism closely associated with facial expressions that serve as protection may be coping. Facial expressions may be an essential component of healthy coping mechanisms. If buffered then our ability to emotionally cope with negative social interactions, such as rejection, may suffer and lead to greater perceived distress.

The nature and behavior of the pilot participants in this study also must be considered. Most of the participants were women (15 of the 16 participants) in their late 40's (mean age = 48) and primarily healthcare professionals working for the same employer and/or related; two participants were sisters and two were husband and wife. During the debriefing, many admitted that they talked with each other during the course of the experiment and made guesses about the purpose of the study. Some stated they knew if they had received Botox (vs. saline) and several stated they did not know. Several commented that during Cyberball they knew that they were not playing against

another player (the social rejection manipulation) and that they could tell that it was pre-programmed. Some said the same thing about the aggression manipulation. Others said that they knew that we were not investigating Botox and mental visualization and were suspicious about both the social rejection manipulation and the aggression task. Finally, several of the participants stated that they put the same answers for many questions because they wanted to quickly get back to work. If the sample size were larger then perhaps participants that did not attend to the content or engage properly would presumably wash out in the randomizing process.

Before the study, I hypothesized why we might see the predicted effect. Subsequent to the findings, I have examined possible explanations for data from this study that point to an opposite effect. Even with the limitations of this pilot study, the trend in the treatment effect such that Botox (vs. saline) increases need threat, coupled with the exploratory finding that Botox may affect cognition of rejection, are interesting results that warrant further investigation.

Limitations and Future Directions

One of the most significant limitations of this investigation was the lack of statistical power. Future directions include using a larger sample size. Second, external validity may have been an issue. Follow up investigations include aiming for greater participant diversity in age, occupation, socioeconomic status, and relative familiarity among participants. Finally, from the information gleaned during the debriefing, greater experimental control over participant communication is necessary. Incentivizing participants to pay greater attention to the tasks may also be beneficial.

In light of this pilot's trend that reveals an effect in the opposite direction of the prediction, an exciting future direction includes the use of neuroimaging techniques to further understand the underlying mechanisms that may be different in social emotion versus non-social emotion. Previous work used MRI (Hennenlotter, 2009) to examine the neural pathways associated with facial expressions and the relative effects of Botox (vs. placebo) in non-social emotion. Conducting the rejection and aggression tasks in an MRI scanner could provide greater insights into brain activation and neural pathways during social emotion versus those previously observed in non-social emotion. Neuroimaging may reveal neural signatures associated with adaptive mechanisms, like protection and coping, that are uniquely related to social emotion.

Concluding Remarks

This pilot did not support my original hypothesis. In fact, the data suggested a trend in the opposite direction indicating that Botox (vs. saline) increases, rather than buffers, feelings of distress associated with social rejection. Since the prevailing wisdom is that facial feedback drives and modulates affect, future work is needed to clarify the role of the presently held Facial Feedback Hypothesis in social emotion.

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Appendix A

Need Threat Scale

Needs were assessed on 7-point scales ranging from 1 (do not agree) to 7 (agree). Questions ending with an "R" were re-coded.

Belongingness

1. I felt as one with the other players.
2. I had the feeling that I belonged to the group during the game.
3. I did not feel accepted by the other players. (R)
4. During the game I felt connected with one of more other players.
5. I felt like an outsider during the game. (R)

Control

1. I had the feeling that I could throw as often as I wanted to the other players.
2. I felt in control over the game.
3. I had the idea that I affected the course of the game.
4. I had the feeling that I could influence the direction of the game.
5. I had the feeling that the other players decided everything. (R)

Self-Esteem

1. Playing the game made me feel insecure. (R)
2. I had the feeling that I failed during the game. (R)
3. I had the idea that I had the same value as the other players.
4. I was concerned about what the other players thought about me during the game. (R)
5. I had the feeling that the other players did not like me. (R)

Meaningful Existence

1. During the game it felt as if my presence was not meaningful. (R)
2. I think it was useless that I participated in the game. (R)
3. I had the feeling that my presence during the game was important.
4. I think that my participation in the game was useful.
5. I believed that my contribution to the game did not matter. (R)

Appendix B

PANAS Questionnaire

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. **Indicate to what extent you feel this way right now, that is, at the present moment *OR* indicate the extent you have felt this way over the past week (circle the instructions you followed when taking this measure)**

1	2	3	4	5
Very Slightly or Not at All	A Little	Moderately	Quite a Bit	Extremely

_____ 1. Interested	_____ 11. Irritable
_____ 2. Distressed	_____ 12. Alert
_____ 3. Excited	_____ 13. Ashamed
_____ 4. Upset	_____ 14. Inspired
_____ 5. Strong	_____ 15. Nervous
_____ 6. Guilty	_____ 16. Determined
_____ 7. Scared	_____ 17. Attentive
_____ 8. Hostile	_____ 18. Jittery
_____ 9. Enthusiastic	_____ 19. Active
_____ 10. Proud	_____ 20. Afraid

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