The Effect of Acetaminophen on Conformity

Research Thesis

Presented in partial fulfillment of the requirements for graduation with research distinction in Psychology in the undergraduate colleges of The Ohio State University

by

Erika Sulecki

The Ohio State University
April 2013

Project Advisor: Dr. Baldwin Way, Department of Psychology

Abstract

Why do certain individuals feel the pressure of social influence, and thus conform to their peers, more than others? Normative conformity postulates that it is due to individuals' fears of being deviant from the group. Consistent with this hypothesis, neuroimaging studies have shown that greater conformity is associated with activity in brain areas that are involved in processing the emotional pain of social rejection. Since the physical pain-killer acetaminophen reduces activation in these brain areas as well as reduces hurt feeling associated with rejection, we sought to determine if acetaminophen also reduced conformity. If acetaminophen can reduce social pain, can it also lessen the submission to social pressure?

This hypothesis was tested using a between-subjects design that compares the performance of an acetaminophen (test) group to the placebo (control) group on a commonly used social influence task (Berns et al., 2005). Participants are presented with two 3D shapes and asked to determine whether they are mirror images of each other or the same image merely rotated. Then, they are presented with the decision of their "peers" and asked again what kind of transformation is related between the two shapes. Although there were no significant differences in conformity between groups in the rotation judgment condition, there was a significant difference in the preference condition and several significant correlations within the survey data. There were no significant differences in conformity between the placebo and drug condition.

A secondary hypothesis was to explore the degree to which collectivism, a psychological construct related to rejection sensitivity, was related to conformity. A significant positive correlation between dispositional sensitivity to rejection and collectivistic orientation was found.

The Effect of Acetaminophen on Conformity:

Most of us have endured the uncomfortable feeling of not fitting in. During middle school, cliques form, and while some teenagers are included, others are excluded to the point of being ridiculed and bullied. This exclusion does not stop in middle school; we feel the pressure to belong in all areas of life—with colleagues, in an organization, or even within our own families (Leary and Baumeister, 1995). How do we, as human beings, resolve this pressure? Peer pressure influences us to conform to the group by adopting the group values, beliefs, and actions in order to be accepted and well liked. This is called normative conformity and is likely to be a reason that groups form.

Normative conformity may result from a fear of being rejected. Because humans are such social beings and throughout evolutionary history often required social interactions for survival, the fear of being rejected by a group is great. When rejected, there is a decrease in chances of survival for the individual, so he or she may resolve this rejection by conforming to be accepted by the group. Once accepted, they have a social support group to help find food, reproduce, and have protection.

To better understand conformity, studies have sought to identify brain areas that are activated during social influence. Berns et al (2010) conducted a study evaluating participants' ratings of popular songs before and after they are presented with the opinion of others. When participants changed their answer after seeing the ratings of others, the anterior cingulate cortex (ACC) and anterior insula showed greater activation. Furthermore, those who were more inclined to match their answer with the popularity of the song had greater activation in these areas of the brain.

Activation of the ACC and anterior insula during social influence potentially provides insight into the psychological processes occurring during conformity. These two brain areas are also reliably activated during an experience of social rejection (Eisenberger et al., 2003). Similarly, viewing paintings of rejection-related themes also activates these areas (Kross et al., 2011). Therefore, because the ACC and anterior insula seem to be reliably activated during the experience of rejection as well as social conformity, they may be performing a similar psychological operation: concern over social rejection.

This brain-based data may also provide further insight into the cognitive computations performed by the ACC and anterior insula. The anterior cingulate cortex and anterior insula are key areas of the brain that are involved in responding to the affective cocmponent of physical pain. Patients with lesions in these areas report less unpleasantness to physical pain, although they are still aware it is there (Berthier, Starkstein, & Leiguarda, 1988; Foltz & White, 1962; Hebben, 1985). A meta-analysis of physical pain neuroimaging studies showed that these two areas were the most reliably associated with physical pain (Apkarian et al., 2005). In terms of the psychological correlates of this neural activity, it appears that these areas are primarily associated with the emotional distress of the pain, as oppose to its location or type (Rainville et al., 1998). This similarity in brain areas activated during physical pain and social rejection may suggest that social rejection can be considered a form of pain, which has been termed social pain (Eisenberger & Lieberman, 2005; MacDonaled & Leary, 2005) and that there are common underlying processes.

Based on the theory that social pain and physical pain rely on similar brain processes, researchers have tried to investigate whether physical pain-killers can reduce social pain. DeWall et al. (2010) investigated this question using acetaminophen, a common pain-killer,

which exerts analgesic effects in the central rather than peripheral nervous system. DeWall et al.

chronic acetaminophen decreased activation in the dACC and anterior insula during an

experience of social rejection. They also reported that chronic acetaminophen reduced hurt

feelings elicited by social situations. Because taking acetaminophen reduces self-reports of

sensitivity to social rejection while simultaneously reducing activity in the dACC and anterior

insula, areas of the brain associated with both social pain and conformity, we hypothesized that

acetaminophen would also reduce conformity. To test this hypothesis, this study evaluated the

effect of acetaminophen on participants' responses to a 3D shape rotation task adapted from

Berns et al. (2005). In this task, participants were asked to provide an answer and were then

presented with the responses of a group of individuals and asked to indicate their own response

again. The amount of times they switched their answer to the group response is a measure of

conformity.

A secondary goal of the study was to determine of acetaminophen moderated the

relationship between the psychological construct of collectivism and conformity. Conformity

has been found to be higher in collectivistic societies. Collectivism can be defined using the

words teamwork, in-group, society, and interdependence, which is a mutual necessity for other

people. Conversely, individualism can be defined by self-reliance, reaching for one's own goals,

and self-success, independence,. Traditionally, these have been attributed to East Asian and

Western cultures, respectively. These can be related to independence and interdependence

(Singelis, 1994). Singelis describes independent self-construal having four different aspects:

"internal abilities, thoughts, and feelings," "being unique and expressing the self," "realizing

internal attributes and promoting one's own goals," and "being direct in communication." He

also describes interdependent self-construal, which consists of: "external, public features such as

statuses, roles, and relationships," "belonging and fitting in," "occupying one's proper place and engaging in appropriate action," and "being indirect in communication and 'reading others' minds." Comparing these two definitions, independent self-construal can be related to individualism, while interdependent self-construal can be related to collectivism. We will be using Singelis' self-construal scale to evaluate the degree of interdependence and independence in participants and further evaluate collectivism and individualism.

So what does this have to do with conformity? Due to the highly dependent nature of collectivistic societies, people are more likely to care about what others think about their actions and decisions. When faced with a discrepancy between the actions and behaviors of an individual and the thoughts of the society as a whole, those with a collectivistic orientation tend to conform more because they find more hardship in not following society than those in individualistic cultures.

Several researchers have examined what exactly causes people to succumb to the pressure of peer influence. Asch (1951) has been one of the pioneers in conformity research and a variant of his paradigm forms the foundation of the study performed here. In his study, he invited participants to partake in a "visual task." The group of participants consisted of several confederates in addition to the individual subject of the study. For each trial run, the experimenter would show the group a line and ask each individual in the group to say in sequential order which of three differing length lines was equivalent to a target line. The confederates each specified their answer before the subject, who always answered last. At first, the confederates responded correctly, which provided an opportunity for the participant to be familiar with the task without the pressure of social influence. However, as the trials continued, the confederates started naming the clearly wrong line as the answer. Faced with the pressure to

conform to what the group thought was the right answer, the participant had to decide between going with the clearly wrong answer and conforming to the group or going with the answer they know is right. Asch found that when participants are faced with an incorrect answer, they are more likely to answer incorrectly as well, demonstrating that they are conforming to what their peers have decided.

Researchers in East Asian cultures and Western societies alike have used Asch's line test to examine differences in conformity associated with relative differences in collectivism or individualism. Bond and Smith (1996) have done a meta-analysis of these studies in order to see whether levels of conformity actually differ cross-culturally and if this has held up over time. They performed an analysis of 133 studies from 17 countries and compared the degree of individualism-collectivism to conformity. They found that collectivistic countries tended to

This idea that collectivism and conformity is related to a greater sensitivity to social rejection was tested in our study. We hypothesized that those who think more holistically, which is indicative of a collectivistic worldview, would also report greater sensitivity to social rejection. This was evaluated using multiple tasks and surveys evaluating: interdependence, holistic cognition, and similarity-based decision-making. Additionally, because taking acetaminophen causes a reduction in the dACC and anterior insula, areas of the brain associated with both sensitivity to social rejection and conformity, we predict it will also come with behavioral differences. Acetaminophen both reduces physical pain and social pain, making participants feel less socially rejected. A lessened sensitivity towards this rejection may cause participants to feel like they can stay with their own response rather than switching it to the group's. Our hypothesis is when participants take acetaminophen, they are less likely to conform to the group.

Methods

Participants

We recruited fifty-four (M=28, F=26) participants from the introductory psychology REP

pool. All participants were over the age of 18. The median age was 19.

Design

The study was a two-group design comparing the effects of acetaminophen and placebo

on social conformity. The primary dependent variable was the amount of times participants

conformed to the answer of the group, while the primary independent variable was

acetaminophen.

Materials

We used a computer program of the 3D shape rotation paradigm adapted from Berns et al

(2005). There are two conditions in this task: the mental rotation judgment condition and the

preference condition. Every participant is exposed to each condition—there are 3 sets of 28

examples with roughly half from the mental rotation judgment condition and half from the

preference condition. The mental rotation judgment condition has participants determine if two

shapes on the screen are the same shape, however rotated, or if they are mirror images of each

other. Participants have a limited amount of time (three seconds) to answer through indicating

their choice on the keyboard. Afterwards, they are told what three previous "peers," which is

actually a computer-generated response, have decided the right answer is. In half of these

instances, the majority gives the right answer and in half, they give the wrong answer. Then,

participants are asked to determine which answer they believe to be correct. In the preference

condition, they are shown two 3D shapes (the same ones as in the other condition) and told that

these may be statues seen around campus and to pick which they prefer. Again, they are shown

the average of their three previous peers' responses and asked to make a final decision.

The way the 3D shape rotation task is quantified is somewhat different in each of the

conditions. In the preference condition, we only looked at the sets where the participant

originally answered differently than the subsequent group response. This is because in the sets

where the participant answered the same as the group, he or she did not have the opportunity to

conform to the answer in the group. For example, if the participant indicated they preferred the

left shape, and then were presented that the group also preferred the left shape, we could not

determine whether their final answer was due to their own preference or the preference of the

group. Thus, we can only look at sets that originally had a discrepancy. For these, we calculated

a proportion: the number of times the participant *changed* their response to the group response

divided by the number of times the participant had the *opportunity* to change their answer (total

amount of times their answer was originally different than the group). By taking this proportion,

we are controlling for the fact that, by chance, some participants may have always originally

given the same response as the subsequent group response, while some participants may have

always originally answered differently. The proportion of changed responses between the

placebo and drug group were compared with a t-test.

The mental rotation judgment task was quantified in two ways. The first is identical to

the preference task. The second method for quantifying the results incorporated the extra

dimension of accuracy because there were right and wrong answers to the questions. While in

the preference condition, we only evaluated the sets in which the participant was different than

the group, in the mental rotation judgment condition, we evaluated the sets in which the

participant originally stated the right answer and was presented with the group answer (which

was wrong). Just as in the preference condition, we took a proportion. In the numerator, we counted the times the participant originally state the right answer, was presented with the wrong group answer, and subsequently changed it to the group answer, despite it being wrong. This was divided by, again, the number of times they had the *opportunity* to change their answer (the amount of times they stated the right answer and were presented with the wrong group answer). This eliminates confounds that could result from the dimension of accuracy. For example, one definition of conformity is changing one's answer to match the group answer, regardless if it is right or wrong. But, this could be due to realizing the correct answer (i.e. originally states wrong answer, presented with the group response, which is correct, and changes their answer to the correct group answer). However, we cannot say whether this is conformity or rather just a realization of the correct answer. We again took the mean of the proportions in each group (acetaminophen and placebo) and did a t-test.

Additionally, we had participants perform two other tasks taken from a cross-cultural study by Uskul et al (2008): a task measuring decision-making when sorting objects and one measuring holistic cognition. The first (10 sets) is used to see whether participants group objects using a holistic similarity approach or by using a definite rule. In other words, do they focus on the entire object or one specific aspect of the object to categorize. To do this, the decision-making task presents two groups of four objects. In one group, all of the objects have many similarities, although not one characteristic is shared by the entire group, emphasizing a holistic view of grouping. In the other group, there is a defining characteristic to all four objects, but the rest of the characteristics are random, showing they are grouped using a rule. On the same sheet is the test object, which is the focus of the participant. He or she needs to decide whether the test

object goes with group one or group two, which will show how the participant is grouping the objects.

3D Shape Rotation Task

Mental Rotation Judgment Condition

Initial Response

Group Response

Same   Different   Same   Different
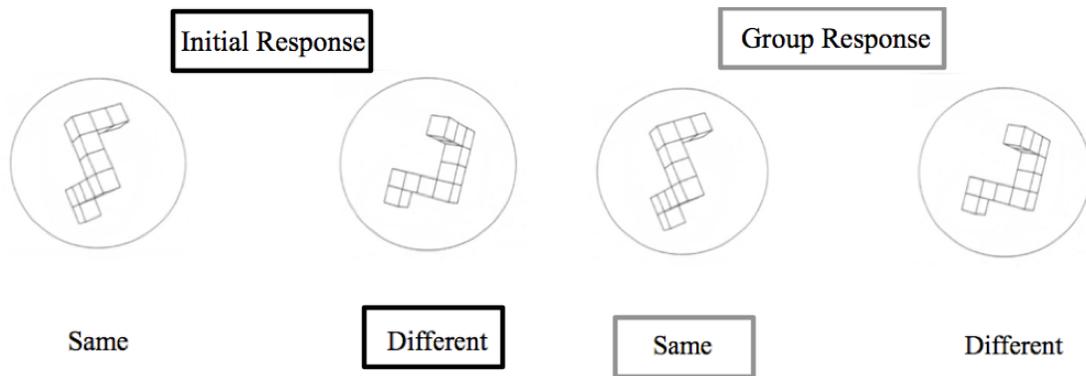
Figure 1a   Figure 1b

Preference Condition

Initial Response

Group Response

Left   Right   Left   Right

Figure 1c   Figure 1d
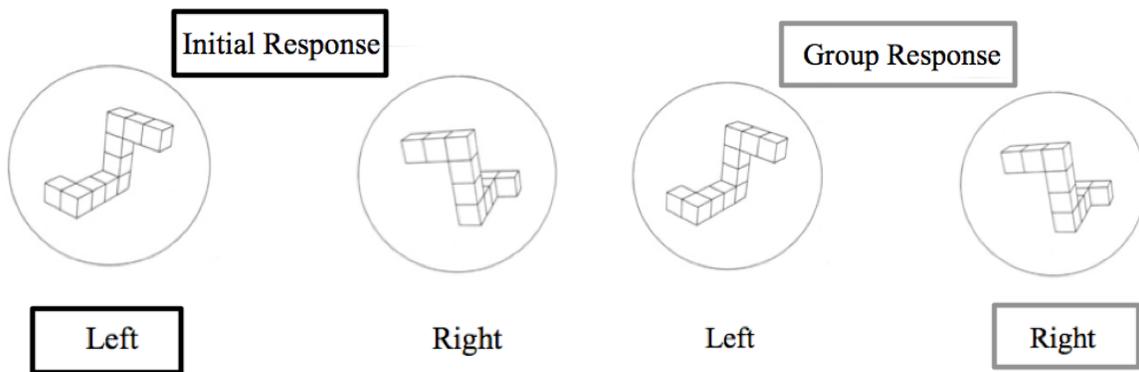
The holistic cognition task (18 triads) is used to evaluate whether participants pair objects according to their relationship or to their categories. Again, they are presented with two objects, A and B, and a test object. They are asked whether the test object goes with A or B. For example, object A is a pair of pants, object B is a button, and the test object is a shirt. If the

participant chooses object A, it indicates the categorical pairing of clothing. If the participant chooses object B, it indicates a relational pairing because the button is physically attached to the shirt.

In this study, we had participants fill out the first half of both of the first two tasks before acetaminophen takes full effect and had them complete the second half after acetaminophen takes full effect. This was done to perform a within subject test of whether or not acetaminophen had any effect on holistic analytical perception.

We also had participants fill out several surveys, including: Mehrabian's (2004) Sensitivity to Rejection Scale (MSR; 24 items; $\alpha = .231$); Singelis's (1994) Independence and Interdependence Scale (24 item; $\alpha = .308$); Cross's (2000) Relational Interdependent Self Construal Scale (RISC; 11 item; $\alpha = .385$); Downey & Feldman's (1996) Rejection Sensitivity Questionnaire (RSQ; 18 item; $\alpha = .583$); The Twenty Statements Test; The Socioeconomic Status Objective and Subjective Questionnaire (SES); and general demographics. All of the questionnaires are listed in the appendix.

Procedure

After participants were recruited from the REP subject pool, they were asked to come in for a 1.5 hour session. Upon arrival, they were given a brief overview of the procedures and asked to sign the consent form and safety form. Participants were run in groups of 2 to 5. Next, they were given a small cup with 1000 mg (a standard extra strength dose) of either acetaminophen or placebo. While waiting for the acetaminophen to take effect, they were asked to complete a set of pen-and-paper tasks and surveys. They were given a packet of all surveys and tasks and asked to complete them in order: 1) 1st half of the holistic cognition task, 2) 1st half of decision-making task, 3) MSR, 4) Singelis Independence/Interdependence Scale, 5) RISC, 6)

RSQ, 7) Twenty Statements Task, 8) SES, and 9) general demographics. After completing the packet, they were asked to sit and wait quietly until 50 minutes after the last participant took either the acetaminophen or placebo. This waiting period was to allow the acetaminophen to be absorbed. They were told they could do homework or use their phone as long as they did not leave the room. After a total of 50 minutes had passed, they were asked to start the 3D shape rotation task on the computer screen, which lasted approximately 25 minutes. Lastly, they were asked to complete the second half of both the decision-making and holistic thinking tasks. When they were finished, they were debriefed orally with a description of the purpose of the study and told they would receive 1.5 hours for their participation.

Results

It was hypothesized that participants who took acetaminophen would conform less than those in the control group. Specifically, in the 3D Shape Rotation Task, they would change their answer to the group answer less frequently than the control group. When conformity was measured as the number of times changed when others were wrong, there was not a significant difference of amount of changed answers between the group who took acetaminophen and the group that took the placebo ($t(52)=.244$, $p >.808$; Graph 1a). The acetaminophen group did not even display less conformity than the placebo group in the mental rotation judgment condition. The drug group changed their answer 11.5 percent of the time, while the placebo group changed their answer on 11 percent of the trials. In the mental rotation judgment condition, there was not a significant difference in the amount of times participants changed to the group answer in general, regardless if the group was right or wrong ($t(52)=-1.071$, $p =.289$). However, in the preference task, there was a significant effect of the drug condition ($t(52)=-2.104$, $p =.04$). While the participants in the acetaminophen group changed their answer to the group answer an

average of 6 percent of the time, those in the placebo group changed an average of 11 percent of the trials.

There was no relationship between MSR and conformity in the preference condition within either the entire sample or just looking at the placebo condition (r(52)= .201, p=.148) There was no relationship between Singelis collectivism and conformity in either the entire sample or the placebo condition only (r(52)= .086, p= .535).

To determine if the drug condition moderated the relationship between the trait measures and conformity, a regression analysis was performed with conformity as the dependent variable and drug condition, the psychological trait, and the product of drug condition and the trait as the independent variables. The models for MSR, Collectivism, nor Rejection Sensitivity were not significant (p's>.33).

To determine if there was a relationship between the MSR and Singelis measure of collectivism, a correlation analysis was performed. Those who reported greater sensitivity to social rejection indicated they were more interdependent as well (r(52)=.677 p<.001; Table 1 & Graph 2a). This suggests that those who report feeling hurt more often to rejection also report depending on others in their lives. There was also a significant correlation between RSQ and Singelis, which further supports this notion (r(52)=.328, p=.015; Table 1 & Graph 2b).

If participants who are higher in sensitivity to social rejection are self-reporting a view attributed to collectivistic thought, are they displaying in through implicit tasks as well? Results show there is not a correlation between rejection sensitivity and the holistic cognition task, which is where they either chose to pair objects based on their relationship or their category. However, results show there is a relationship between MSR and the decision-making task, where the participants assigned an object to a group based on either the holistic similarities or on a specific

rule. There was a significant negative correlation between the decision-making task and MSR

($r(52)=-.284$, $p=.028$; Table 1 & Graph 3). This indicates that those higher in rejection

sensitivity are more likely to pick the rule-based group when assigning the object, which is the

opposite of what was hypothesized.

<div align="center">Discussion</div>

While the results from the 3D Shape Rotation Task were not significant in the mental

rotation judgment condition, they were in the direction of our hypothesis that when one takes

acetaminophen, he or she is less likely to conform to the group. In the preference, those who

took acetaminophen changed their answers to the group's wrong answer 6 percent of the time

they were presented with this opportunity while those who took the placebo changed their

answers 11 percent of the time (Graph 1a). The significance in the preference condition

indicates participants may feel the pressure of social influence more often when they are forced

to present their opinions rather than answer a question objectively.

The interesting significance was between Mehrabian's Sensitivity to Rejection Scale

(MSR) and Singelis' independence/interdependence scale (Graph 2a & 2b). There was a positive

correlation between MSR and interdependence, which was hypothesized. This suggests that

those who self-report more sensitivity to social rejection are more likely to view the world in a

collectivistic manner, while those who are less sensitive to social rejection are more likely to be

individualistic. This supports previous evidence that has shown higher levels of collectivism are

correlated to greater sensitivity to social rejection using MSR (Yamaguchi, 1994).

Another interesting result is the significant correlation between the decision-making and

MSR (Graph 4). However, the significance was in the opposite direction than expected. As the

score on the MSR decreased, meaning the participants have less self-reported sensitivity to social

rejection, the more they sorted the object in the holistic group. We hypothesized that when one thinks more holistically, as is typical in a collectivistic culture, he or she is more sensitive to rejection.

There are several possibilities the lack of significance in the 3D shape rotation task evaluating conformity. For one, our participants are a majority first year, white, western, upper-middle class university students. This homogeneity may have skewed the results because although some of the participants took a placebo, they are not likely to conform to the group due to their ideals. The more independent thinking may have caused them to refuse to conform to the group, regardless of the condition they were placed in.

Another possibility is the nature of the task. The 3D Shape Rotation Task lasted about 25 minutes, and by the end, many of the introductory students may have gotten tired of completing the task. This may have led to the arbitrary choosing of whether or not to switch their answers. For example, some in the acetaminophen condition may have switched their answers without thinking or some in the placebo condition may have kept their answers without a care about what the group thought. This may have contributed to the great variance in responses.

The 3D Shape Rotation Task may have been flawed additionally due to its impersonal nature. Participants are not faced with actual peers to whose answers they would conform but rather told what previous students had chosen. Because they would not be faced with the consequences of deviating from the group, participants may have not been influenced by the group answer when choosing for the second time.

A third potential flaw in the task is the use of 3D shapes. There are individual differences in spatial ability, which may have caused a difference in answering. Additionally, in the preference condition, participants were told these 3D shapes could be statues around their

campus and to choose which they preferred. Because it is unlikely that these 3D shapes become statues on campus, participants may have not cared as much about the answer they indicated.

Future Direction

As the study of acetaminophen on cognitive and social processes is in its infancy, there are multiple paths for future direction. One such way is to have the participants rate objects other than 3D Shapes, such as faces or something more relevant to daily life. Another possibility is to perform a long-term analysis similar to DeWall (2010) to evaluate the longevity of acetaminophen on conformity. This will allow us to ensure the Tylenol has been completely absorbed and is exerting a full analgesic effect on the body. Lastly, one could conduct an imaging study to see which brain areas are moderated by acetaminophen during social influence. We already know the ACC plays a role in social influence, but an imaging study with Tylenol would indicate whether the acetaminophen contributes to a decrease of activity in that area.

References

Asch, S. E. (1951). Effects of group pressure upon the modification and distortion of judgment.

In H. Guetzkow (ed.) *Groups, leadership a3nd men*. Pittsburgh, PA: Carnegie Press.

Berns, G.S., Chappelow, J., Zink, C.F., Pagnoni, G., Martin-Skurski, M.E., & Richards, J.

(2005). Neurobiological Correlates of Social Conformity and Independence During

Mental Rotation. *Biological Psychiatry, 58*: 245-253.

Berthier, M., Starkstein, S., & Leiguarda, R. (1988). Asymbolia for pain: A sensory-limbic

disconnection syndrome. Annals of Neurology, 24, 41–49.

Bond, R. & Smith, P.B. (1996). Culture and Conformity: A Meta-Analysis of Studies Using

Asch's (1952b, 1956) Line Judgment Task. *Psychological Bulletin, 119.1,* 111-137.

Chiao, J., Blizinsky, K. (2010). Culture-gene coevolution of individualismc ollectivism and the

serotonin transporter gene. Proceedings of the Royal Society B, 277(1681), 529–37.

Cross, S. E., Bacon, P. L., & Morris, M. L. (2000). The relational-interdependent self-

construal and relationships. *Journal of Personality and Social Psychology*, 78, 791–808.

Downey, G. & Feldman, S.I. (1996). Implications of Rejection Sensitivity for Intimate

Relationships. *Journal of Personality and Social Psychology*, 70, 1327-1343.

Eisenberger, N.I., Lieberman, M.D., Williams, K.D. (2003). Does rejection hurt? An FMRI study

of social exclusion. Science, 302(5643), 290–2.

Eisenberger, N.I., Way, B.M., Taylor, S.E., Welch, W.T., Lieberman, M.D. (2007).

Understanding genetic risk for aggression: clues from the brain's response to social

exclusion. Biological Psychiatry, 61(9), 1100–8.

Falk, E. B., Way, B. M., & Jasinska, A. J. (January 01, 2012). An imaging genetics approach to

understanding social influence. *Frontiers in Human Neuroscience, 6.*

Foltz, E.L., & White, L.E., Jr. (1962). Pain "relief" by frontal cingulumotomy. Journal of

Neurosurgery, 19, 89–100.

Ginovart, N., Meyer, J.H., Boovariwala, A., et al. (2006). Positron emission tomography

quantification of [11C]-harmine binding to monoamine oxidase-A in the human brain.

Journal of Cerebral Blood Flow and Metababolism, 26(3), 330–44.

Hadland, K.A., Rushworth, M.F.S., Gaffan, D., & Passingham, R.E. (2003). The effect of

cingulate lesions on social behavior and emotion. Neuropsychology, 41, 919–931.

Hebben, N. (1985). Toward the assessment of clinical pain. In G.M. Aronoff (Ed.), Evaluation

and treatment of chronic pain (pp. 451–462). Baltimore: Urban & Schwarzenburg.

Kitayama, S., Duffy, S., Kawamura, T., & Larsen, J. T. (2003, January 1). Perceiving an object

and its context in different cultures: a cultural look at new look. *Psychological

Science, 14*(3), 201-6.

Klucharev, V., Hytonen, K., Rijpkema, M., Smidts, A., and Fernandez, G. (2009).

Reinforcement learning signal predicts social conformity. *Neuron* 61, 140–151.

MacLean, P.D., & Newman, J.D. (1988). Role of midline frontolimbic cortex in production of

the isolation call of squirrel monkeys. Brain Research, 450, 111–123.

Mehrabian, A. (1994). Evidence bearing on the Affiliative Tendency (MAFF) and Sensitivity to

Rejection (MSR) scales. *Current Psychology,13,*97-116.

Robinson, B.W. (1967). Vocalization evoked from forebrain in Macaca mulatta. Physiology &

Behavior, 2, 345–354.

Shih, J.C., Chen, K., Ridd, M.J. (1999). Monoamine oxidase: from genes to behavior. Annual

Review of Neuroscience, 22, 197–217.

Singelis, T.M. (1994). The Measurement of Independent and Interdependent Self-Construals.

    Personality and Social Psychology Bulletin, 580-591.

Smith, W.K. (1945). The functional significance of the rostral cingular cortex as revealed by its

    responses to electrical stimulation. Journal of Neurophysiology, 8, 241–255.

Uskul, A. (2008). Ecocultural basis of cognition: Farmers and fishermen are more holistic than

    herders. *Proceedings of the National Academy of Sciences of the United States of*

    America, 105(25), 8552-8556.

Way, B.M., Taylor, S.E., Eisenberger, N.I. (2009). Variation in the-opioid receptor gene

    (OPRM1) is associated with dispositional and neural sensitivity to social rejection.

    Proceedings of the National Academy of Sciences, 106(35), 15079–84.

Way, B. M., & Lieberman, M. D. (January 01, 2010). Is there a genetic contribution to cultural

    differences? Collectivism, individualism and genetic markers of social sensitivity. *Social*

    Cognitive and Affective Neuroscience, 5, 2-3.

Yamaguchi, S. (1994). Collectivism among the Japanese: a perspective fromthe self. Cross-

    cultural Research and Methodology Series, 18, 175.

Appendix A: Tasks

Holistic cognition task

A   B
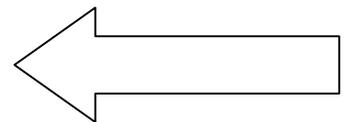
What goes with this ? A or B

Decision-making task
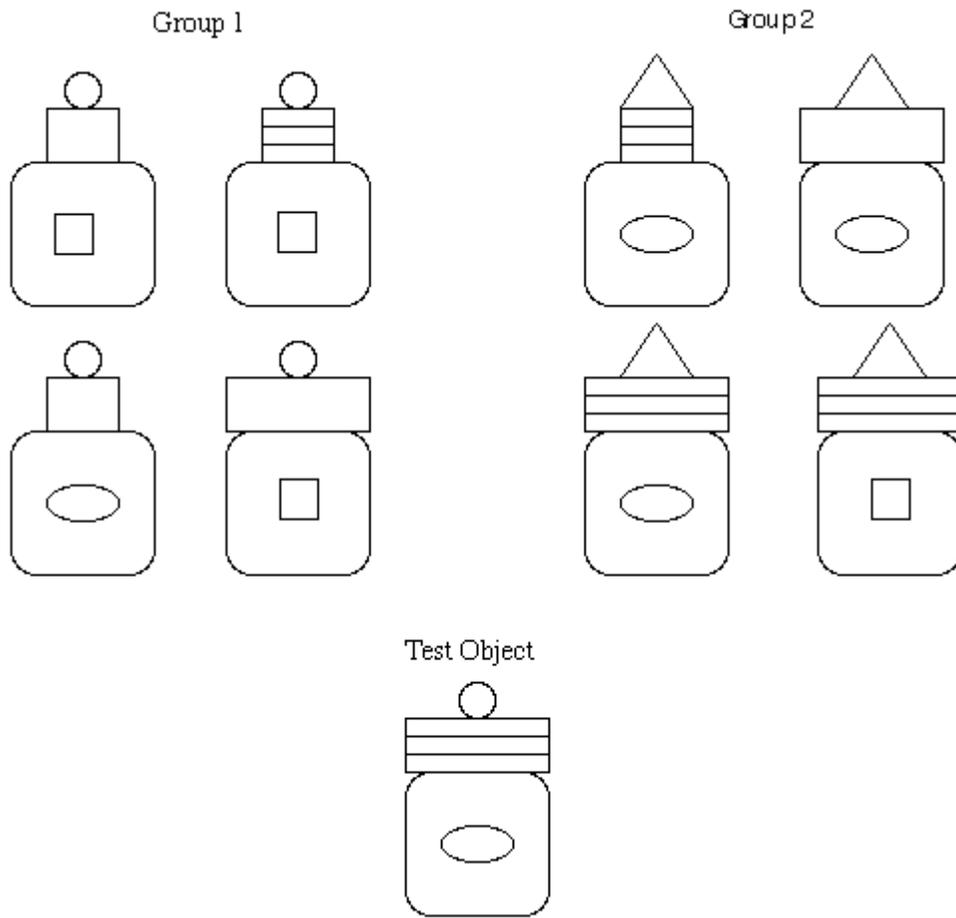
Is the test object MORE SIMILAR TO Group 1 or Group 2?   1   2

Appendix B: Data

Correlations		MSR	Singelis	RISC	RSQ	CT1	CT2
MSR	Pearson Correlation	1	.677**	.210	.387**	-.041	-.284*
	Sig. (2–tailed)		.000	.127	.004	.768	.038
	N	54	54	54	54	54	54
Singelis	Pearson Correlation	.677**	1	.321*	.329*	-.010	-.182
	Sig. (2–tailed)	.000		.018	.015	.945	.187
	N	54	54	54	54	54	54
RISC	Pearson Correlation	.210	.321*	1	.090	.290*	-.004
	Sig. (2–tailed)	.127	.018		.516	.034	.976
	N	54	54	54	54	54	54
RSQ	Pearson Correlation	.387**	.329*	.090	1	-.026	-.156
	Sig. (2–tailed)	.004	.015	.516		.853	.260
	N	54	54	54	54	54	54
CT1	Pearson Correlation	-.041	-.010	.290*	-.026	1	.120
	Sig. (2–tailed)	.768	.945	.034	.853		.388
	N	54	54	54	54	54	54
CT2	Pearson Correlation	-.284*	-.182	-.004	-.156	.120	1
	Sig. (2–tailed)	.038	.187	.976	.260	.388	
	N	54	54	54	54	54	54

**. Correlation is significant at the 0.01 level (2–tailed).
*. Correlation is significant at the 0.05 level (2–tailed).

Table 1
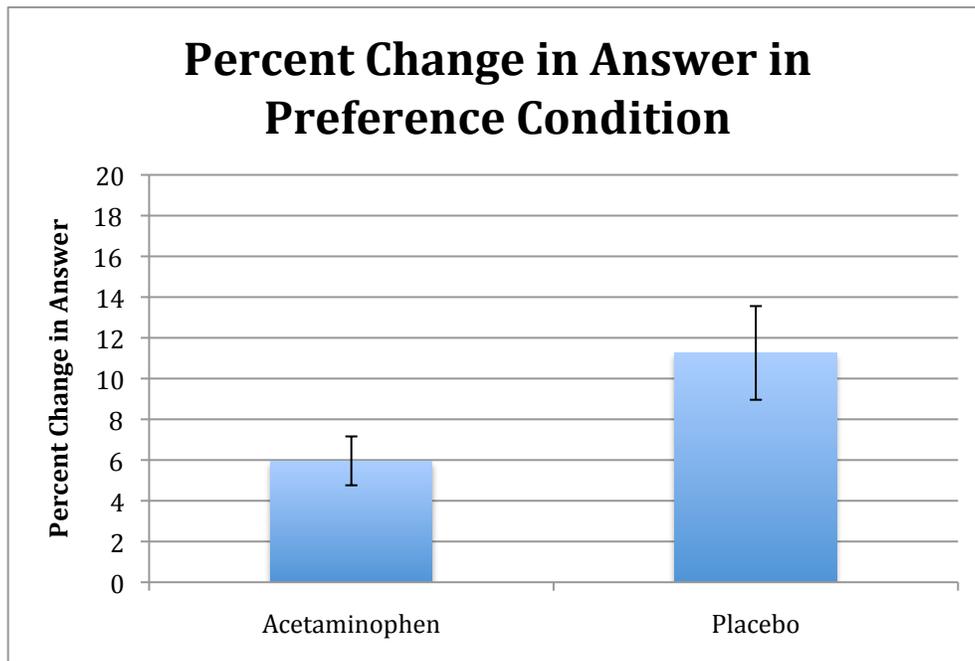
Graph 1a

Graph 1b

Graph 1c

Correlation Between Interdependence Score and Sensitivity to Social Rejection

R^2 Linear = 0.458

Interdependence Score (y-axis: 3.00, 3.50, 4.00, 4.50, 5.00, 5.50)

MSR (x-axis: 2.00, 3.00, 4.00, 5.00, 6.00, 7.00)

Graph 2a

Correlation Between Interdependence and Rejection Sensitivity

R^2 Linear = 0.108

Interdependence (y-axis: 3.00, 3.50, 4.00, 4.50, 5.00, 5.50)

RSQ (x-axis: 2.00, 4.00, 6.00, 8.00, 10.00, 12.00, 14.00)
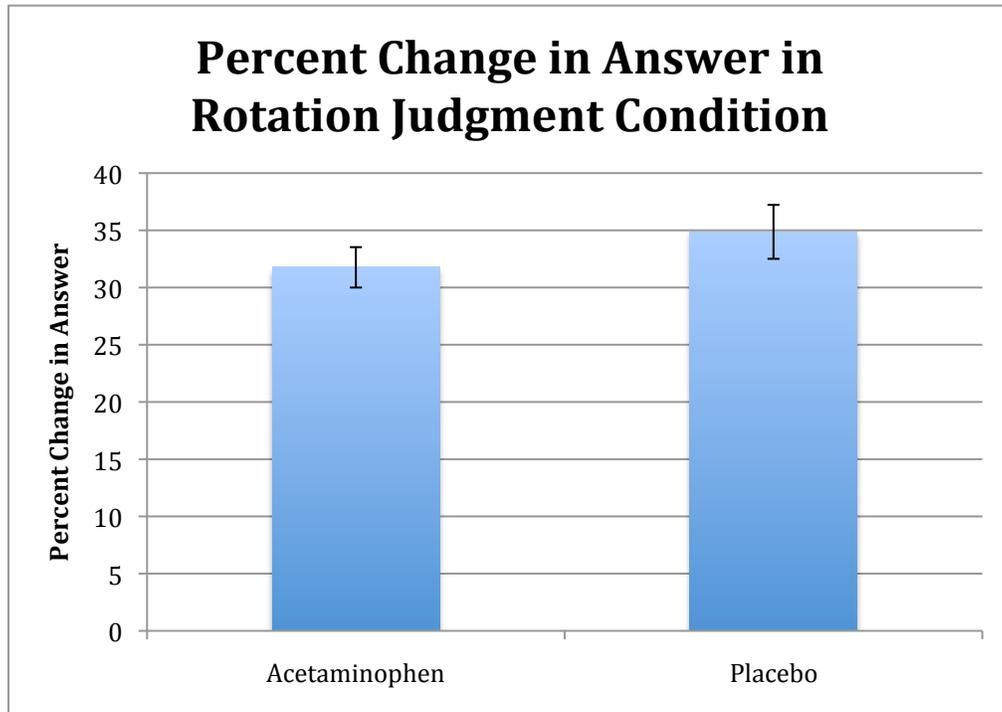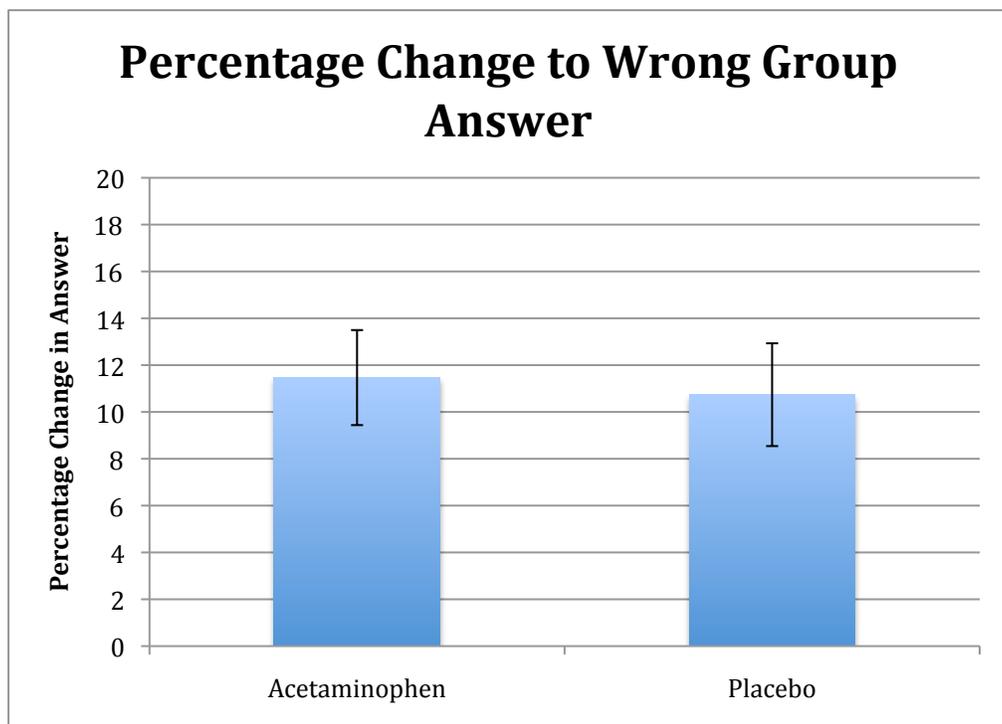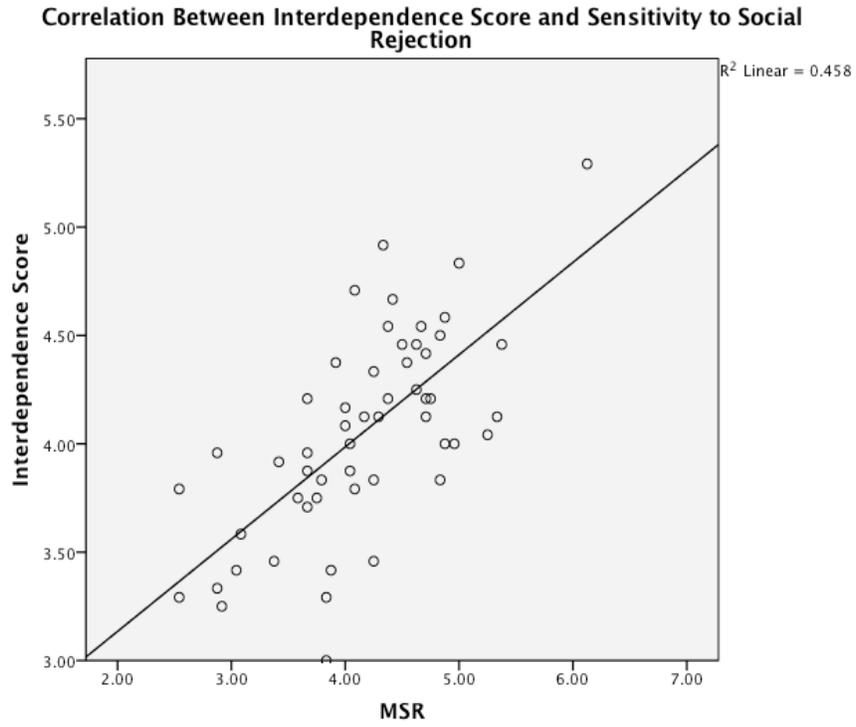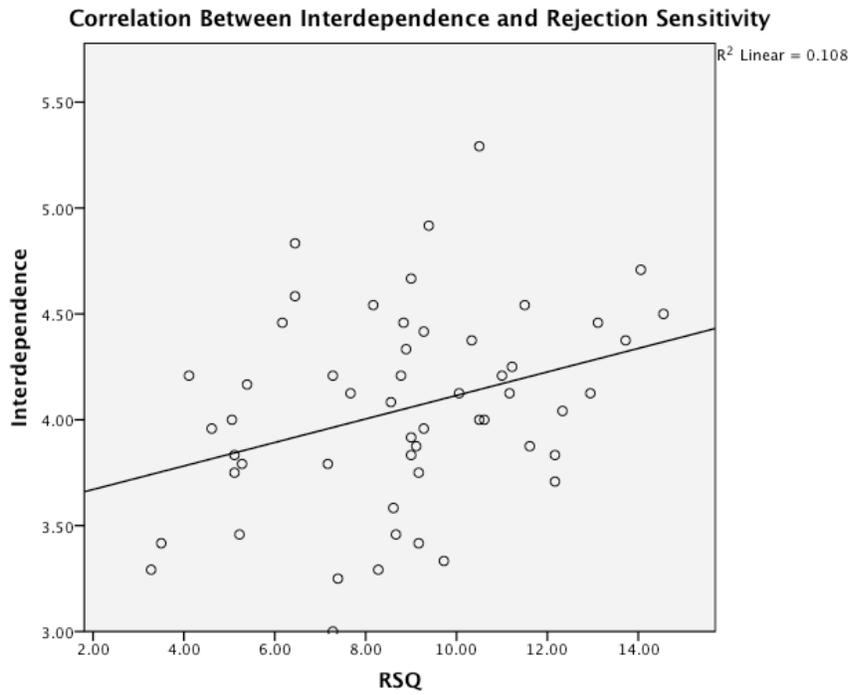
Graph 2b
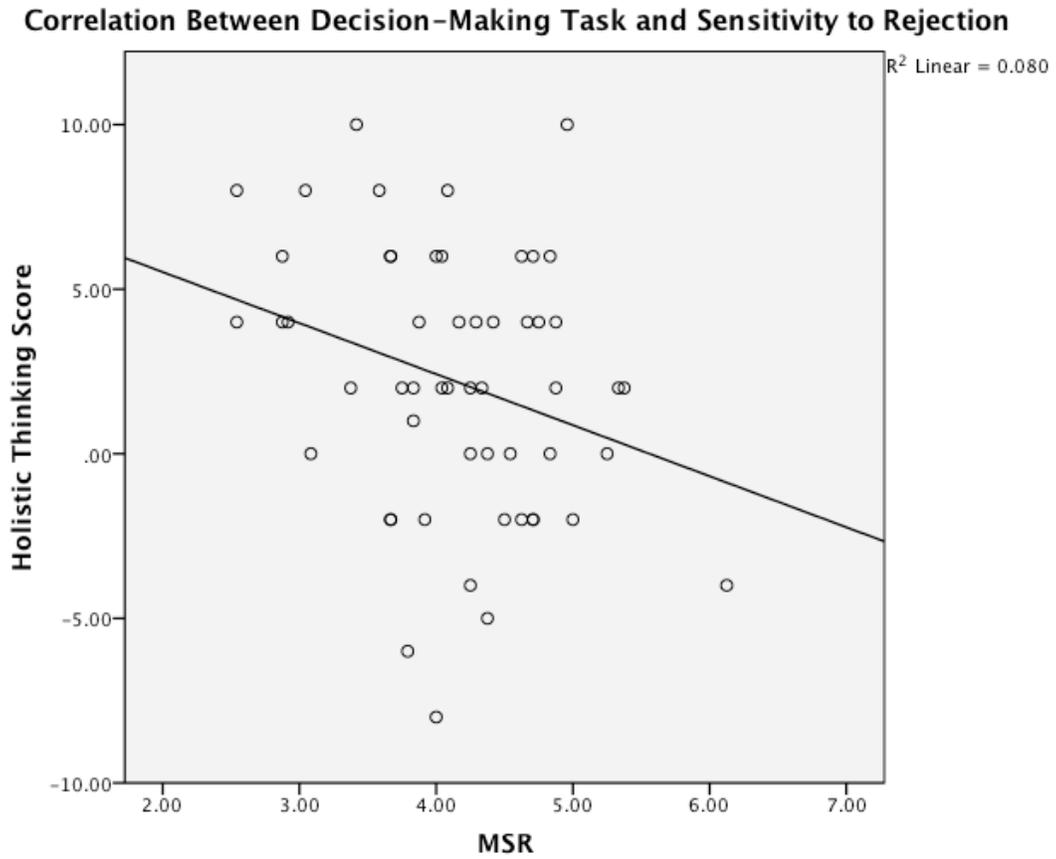
Graph 3

Appendix C: Surveys

Mehrabian's Sensitivity to Rejection Scale (MSR)
Please use the following scale to indicate the degree of your agreement or disagreement with each of the statements. Circle the number by each statement:

1	2	3	4	5	6	7
Very Strongly Disagree	Strongly Disagree	Moderately Disagree	Niether Disagree or Agree	Moderately Agree	Strongly Agree	Very Strongly Agree

1. I sometimes prefer being with stranger than with familiar people   1   2   3   4   5   6   7

2. If I don't enjoy a party, I don't mind being the first one to leave   1   2   3   4   5   6   7

3. I would be very hurt if a close friend contradicted me in public   1   2   3   4   5   6   7

4. When a group is discussing an important matter, I like my feelings to be known. 1   2   3   4   5   6   7

5. I tend to associate less with people who are critical   1   2   3   4   5   6   7

6. I often visit people without being invited   1   2   3   4   5   6   7

7. I don't mind going someplace even if I know that some of the people there don't like me   1   2   3   4   5   6   7

8. I try to feel a group out before I take a definite stand on a controversial issue   1   2   3   4   5   6   7

9. When two of my friends are arguing, I don't mind taking sides to support the one I agree with   1   2   3   4   5   6   7

10. If I ask someone to go someplace with me and they refuse, I am hesitant to ask them again   1   2   3   4   5   6   7

11. I am cautious about expressing my opinions until I know people quite well   1   2   3   4   5   6   7

12. If I can't understand what someone says in a discussion, I will let it pass rather than interrupt to ask them to repeat it   1   2   3   4   5   6   7

Mehrabian's Sensitivity to Rejection Scale (MSR) continued

1 Very Strongly Disagree	2 Strongly Disagree	3 Moderately Disagree	4 Niether Disagree or Agree	5 Moderately Agree	6 Strongly Agree	7 Very Strongly Agree

13. I enjoy discussing controversial topics like politics and religion	1	2	3	4	5	6	7
14. I feel uneasy about asking someone to return something they borrowed from me.	1	2	3	4	5	6	7
15. I criticize people openly and expect them to do the same	1	2	3	4	5	6	7
16. I can still enjoy a party even if I find that I am not properly dressed for the occasion	1	2	3	4	5	6	7
17. I sometimes take criticism too hard	1	2	3	4	5	6	7
18. If someone dislikes me, I tend to avoid him/her	1	2	3	4	5	6	7
19. It seldom embarrasses me to ask someone for a favor	1	2	3	4	5	6	7
20. I seldom contradict people for fear of hurting them	1	2	3	4	5	6	7
21. I am very sensitive to any signs that a person might not want to talk to me	1	2	3	4	5	6	7
22. Whenever I go somewhere where I know no one, I always like to have a friend come along	1	2	3	4	5	6	7
23. I often say what I believe, even when it alienates the person with whom I am speaking	1	2	3	4	5	6	7
24. I enjoy going to parties where I don't know anyone.	1	2	3	4	5	6	7

Singelis's Interdependence and Independence Scale

Please indicate your agreement or disagreement with each of the items from 1 to 7, where *1 = strongly disagree* and *7 = strongly agree*.

_____   1. I have respect for the authority figures with whom I interact

_____   2. I'd rather say "No" directly, than risk being misunderstood

_____   3. It is important for me to maintain harmony within my group

_____   4. Speaking up during class is not a problem for me

_____   5. My happiness depends on the happiness of those around me

_____   6. Having a lively imagination is important to me

_____   7. I would offer my seat in a bus to my professor

_____   8. I am comfortable with being singled out for praise or rewards

_____   9. I respect people who are modest about themselves

_____ 10. I am the same person at home that I am at school

_____ 11. I will sacrifice my self-interest for the benefit of the group I am in

_____ 12. Being able to take care of myself is a primary concern for me

_____ 13. I often have the feeling that my relationships with others are more important than my own accomplishments

_____ 14. I act the same way no matter who I am with

_____ 15. I should take into consideration my parents' advice when making education/career plans

_____ 16. I feel comfortable using someone's first name soon after I meet them, even when they are much older than I am

_____ 17. It is important to me to respect decisions made by the group

_____ 18. I prefer to be direct and forthright when dealing with people I've just met

_____ 19. I will stay in a group if they need me, even when I'm not happy with the group

_____ 20. I enjoy being unique and different from others in many respects

_____ 21. If my brother or sister fails, I feel responsible

_____ 22. My personal identity independent of others, is very important to me

_____ 23. Even when I strongly disagree with group members, I avoid an argument

_____ 24. I value being in good health above everything

Relational Interdependent Self Construal Scale (RISC)

Please indicate the extent to which you agree or disagree with each of these statements:

1. My close relationships are an important reflection of who I am.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

2. When I feel very close to someone, it often feels to me like that person is an important part of who I am.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

3. I usually feel a strong sense of pride when someone close to me has an important accomplishment.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

4. I think one of the most important parts of who I am can be captured by looking at my close friends and understanding who they are.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

5. When I think of myself, I often think of my close friends or family also.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

6. If a person hurts someone close to me, I feel personally hurt as well.

        1   2   3   4   5   6   7
strongly disagree   strongly agree

Relational Interdependent Self Construal Scale (RISC) continued

7. In general, my close relationships are an important part of my self-image.

      1   2   3   4   5   6   7
strongly disagree   strongly agree

8. Overall, my close relationships have very little to do with how I feel about myself.

      1   2   3   4   5   6   7
strongly disagree   strongly agree

9. My close relationships are unimportant to my sense of what kind of person I am.

      1   2   3   4   5   6   7
strongly disagree   strongly agree

10. My sense of pride comes from knowing who I have as close friends.

      1   2   3   4   5   6   7
strongly disagree   strongly agree

11. When I establish a close friendship with someone, I usually develop a strong sense of identification with that person.

      1   2   3   4   5   6   7
strongly disagree   strongly agree

The Rejection Sensitivity Questionnaire (RSQ)

Each of the items below describes things college students sometimes ask of other people. Please imagine that you are in each situation. You will be asked to answer the following questions:

  1) How concerned or anxious would you be about how the other person would respond?

  2) How do you think the other person would be likely to respond?

1.   You ask someone in class if you can borrow his/her notes.

| How concerned or anxious would you be over whether or not the person would want to lend you his/her notes? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that the person would willingly give me his/her notes. | very unlikely 1 2 3 4 5 6 very likely |

2.   You ask your boyfriend/girlfriend to move in with you.

| How concerned or anxious would you be over whether or not the person would want to move in with you? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that he/she would want to move in with me. | very unlikely 1 2 3 4 5 6 very likely |

3.   You ask your parents for help in deciding what programs to apply to.

| How concerned or anxious would you be over whether or not your parents would want to help you? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that they would want to help me. | very unlikely 1 2 3 4 5 6 very likely |

4.   You ask someone you don't know well out on a date.

| How concerned or anxious would you be over whether or not the person would want to go out with you? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that the person would want to go out with me. | very unlikely 1 2 3 4 5 6 very likely |

5.   Your boyfriend/girlfriend has plans to go out with friends tonight, but you really want to spend the evening with him/her, and you tell him/her so.

| How concerned or anxious would you be over whether or not your boyfriend/girlfriend would decide to stay in? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that the person would willingly choose to stay in. | very unlikely 1 2 3 4 5 6 very likely |

6.   You ask your parents for extra money to cover living expenses.

| How concerned or anxious would you be over whether or not your parents would help you out? | very unconcerned 1 2 3 4 5 6 very concerned |
| I would expect that my parents would not mind helping me out. | very unlikely 1 2 3 4 5 6 very likely |

The Rejection Sensitivity Questionnaire (RSQ) continued

7. After class, you tell your professor that you have been having some trouble with a section of the course and ask if he/she can give you some extra help.

How concerned or anxious would you be over whether or not your professor would want to help you out?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that my professor would want to help me out.

very unlikely — very likely
1 2 3 4 5 6

8. You approach a close friend to talk after doing or saying something that seriously upset him/her.

How concerned or anxious would you be over whether or not your friend would want to talk with you?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that he/she would want to talk with me to try to work things out.

very unlikely — very likely
1 2 3 4 5 6

9. You ask someone in one of your classes to coffee.

How concerned or anxious would you be over whether or not the person would want to go?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that the person would want to go with me.

very unlikely — very likely
1 2 3 4 5 6

10. After graduation, you can't find a job and ask your parents if you can live at home for a while.

How concerned or anxious would you be over whether or not your parents would want you to come home?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect I would be welcome at home.

very unlikely — very likely
1 2 3 4 5 6

11. You ask your friend to go on a vacation with you over Spring Break.

How concerned or anxious would you be over whether or not your friend would want to go with you?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that he/she would want to go with me.

very unlikely — very likely
1 2 3 4 5 6

12. You call your boyfriend/girlfriend after a bitter argument and tell him/her you want to see him/her.

How concerned or anxious would you be over whether or not your boyfriend/girlfriend would want to see you?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that he/she would want to see me.

very unlikely — very likely
1 2 3 4 5 6

13. You ask a friend if you can borrow something of his/hers.

How concerned or anxious would you be over whether or not your friend would want to loan it to you?

very unconcerned — very concerned
1 2 3 4 5 6

I would expect that he/she would willingly loan me it.

very unlikely — very likely
1 2 3 4 5 6

The Rejection Sensitivity Questionnaire (RSQ) continued

14. **You ask your parents to come to an occasion important to you.**

How concerned or anxious would you be over whether   very unconcerned   very concerned
or not your parents would want to come?   1   2   3   4   5   6

I would expect that my parents would want to come.   very unlikely   very likely
                                                                                    1   2   3   4   5   6

15. **You ask a friend to do you a big favor.**

How concerned or anxious would you be over whether   very unconcerned   very concerned
or not your friend would do this favor?   1   2   3   4   5   6

I would expect that he/she would willingly do   very unlikely   very likely
this favor for me.   1   2   3   4   5   6

16. **You ask your boyfriend/girlfriend if he/she really loves you.**

How concerned or anxious would you be over whether   very unconcerned   very concerned
or not your boyfriend/girlfriend would say yes?   1   2   3   4   5   6

I would expect that he/she would answer yes sincerely.   very unlikely   very likely
                                                                                    1   2   3   4   5   6

17. **You go to a party and notice someone on the other side of the room and then you ask them to dance.**

How concerned or anxious would you be over whether   very unconcerned   very concerned
or not the person would want to dance with you?   1   2   3   4   5   6

I would expect that he/she would want to dance with me.   very unlikely   very likely
                                                                                    1   2   3   4   5   6

18. **You ask your boyfriend/girlfriend to come home to meet your parents.**

How concerned or anxious would you be over whether   very unconcerned   very concerned
or not your boyfriend/girlfriend would want to meet   1   2   3   4   5   6
your parents?

I would expect that he/she would want to meet my   very unlikely   very likely
parents.   1   2   3   4   5   6

The Twenty Statements Task

Instructions:

There are twenty numbered blanks on the page below. Please write twenty answers to the simple question, "Who am I?" in the blanks. Just give twenty different answers to this question. Answer as if you were giving the answers to yourself, not to somebody else. Write the answers in the order that they occur to you. Don't worry about logic or importance. Go along fairly fast. Please do not repeat your responses. Your answers will be confidential.

1. I am _____

2. I am _____

3. I am _____

4. I am _____

5. I am _____

6. I am _____

7. I am _____

8. I am _____

9. I am _____

10. I am_____

11. I am_____

12. I am_____

13. I am_____

14. I am_____

15. I am_____

16. I am_____

17. I am_____

18. I am_____

19. I am_____

20. I am_____