Spring 2013

Affective Empathy: Exploring Prosocial Behavior in Neuroscience

Morgan Nitta
Regis University

AFFECTIVE EMPATHY: EXPLORING PROSOCIAL BEHAVIOR IN NEUROSCIENCE

A thesis submitted to
Regis College
The Honors Program
in partial fulfillment of the requirements
for Graduation with Honors

by
MORGAN NITTA

May 2013

TABLE OF CONTENTS

Affective Isomorphy Explored as a Criterion of Empathy in a Rat Model: More to be Explored

Morgan E. Nitta, Katherine Wipfler, Corey Allen, Mark Basham Ph.D,

Regis University

Abstract

Empathy is an emotion that often instigates prosocial actions, so research increasingly focuses on the biological basis of this quality. Because affective empathy develops before the components of cognitive regulation, lower order mammalian species should be able to express empathy from an affective perspective. A rat model of empathy has been developed, showing that a free rat in an arena with a restrained conspecific will act prosocially and open the door of the restrainer. This study explores affective isomorphy as a criterion of affective empathy, by placing the free rats in the restrainer prior to being the free rat in the testing arena. The control condition rats did not experience the previous restraint. Number of door openings and latency to door openings were measured in 60 minute testing sessions. No significant effect of condition was found for number of door openings or latency to door openings. We conclude that affective isomorphy may not strengthen empathetic behaviors.

Introduction

Defining the abstract quality of empathy in the concrete world of research plagues the scientific community. Researchers have extensively investigated the fundamental mechanisms of how humankind operates and functions through animal models, but higher order cognitive functions, such as emotions and sentient feelings, are far more complicated to study. However, these studies are critical to our understanding of the human condition. People vary greatly in their empathetic abilities. Individuals with

autism or psychopathy may not be able to express empathy, whereas social workers or doctors may have incredible empathetic skills. Empathy is an emotion that often instigates prosocial actions, so research increasingly focuses on the biological basis of this quality. However, before empathy can be studied concretely, researchers must come to a general consensus on an operational definition.

Coming up with an operational definition has posed a challenge, and the definition of empathy is often debated among researchers, complicating the formulation of scientific research exploring the neural basis and exploration of this abstract behavior. The simple definition of empathy is "the ability to share another's internal world of thoughts and feelings (Walter, 2012)." Empathy has further been defined as a cognitive trait, the ability to comprehend the emotions of another, as well as an affective trait, the ability to experience the emotional state of another (Jolliffe & Farrington, 2006; Geng, Xia, & Qin, 2012), though some people propose that the quality requires both cognitive and affect traits as well as a regulatory mechanism (Decety & Jackson, 2004).

Cognitive neuroscientists tend to focus on the affective component of empathy. Their definition focuses on an affective reaction to the affective state of someone else (Singer & Lamm, 2009). Walter (2012) clarifies affective empathy by the distinct qualifications of affective behavior, affective experience, affective isomorphy, perspective, distinction between the other and the self, and knowledge of causal relation between the differences in affective states of individuals. To use this model of empathy the individual must experience a feeling or state that is caused by the inferred state of

another. This feeling or state must be similar to something experienced before so that some cognitive appreciation can be identified between the self and the other.

Because empathetic behavior requires the ability to infer the state of the other, many believe empathy to be only a human quality or behavior, claiming that it requires higher cognitive processing abilities (Walter, 2012). Empathy requires a sharing of experience, recognition of another's pain which often (but not always) leads toward a goal-oriented action to help. The human brain has complex neural networks that facilitate these empathetic actions. The middle anterior cingulate cortex (mACC) and anterior insula are referred to as the shared pain network, and have been hypothesized to serve as a bridge between an observer and a victim (Bruneau, Pluta, & Saxe, 2012). The *theory of the mind network*, including the temporo-parietal junction, precuneus, and medial prefrontal cortex, have been significantly linked to identifying and thinking about the emotional experience of another, and only in humans (Walter, 2012).

However, empathy is not specific to the human species, and much of the biological mechanisms are shared with other mammals (Decety, 2011). The *theory of the mind network* has not been studied in mammals. While human empathy studies utilize top-down processing (cognitive empathy), the link between human empathy and mammalian empathy can best be understood by looking from bottom-up perspectives (affective empathy), especially if these are tangible shared networks (Cromwell & Panksepp, 2011).

Science allows us to explore phenomena from multiple directions. In this case, the exploration of empathy does not always have to start from a cellular or structural

basis, and researchers have uncovered vast amounts of knowledge from behavioral observations. What could research uncover by studying empathy from a behavioral perspective rather than from a neural mechanistic prospective, evaluating the shared mechanisms of behavior? The ultimate goal of empathy research requires approaching the questions from a variety of methodologies. Perhaps the direction of studying this quality should begin at behavioral observations, and then specify toward neural mechanisms.

Measures of empathy in humans are most commonly self-report questionnaires (Gerdes, Lietz, & Segal, 2011). These include measures of both cognitive empathy, the Hogan Empathy Scale as one example (Hogan, 1969), and affective empathy, the Questionnaire Measure of Emotional Empathy (Mehrabian & Epstein, 1972) as another.

Affective empathy develops before the cognitive and regulation components, using bottom-up involuntary somato-sensorimotor processes (Decety, 2011). Therefore, if affective empathy is a bottom-up process in the brain, lower order mammalian species should be able to express empathy in an affective perspective. Studies of the primate brain indicate their empathetic capabilities (Palagi, Leone, Mancini, & Ferrari, 2009; Campbell & de Waal, 2011; de Waal, 2012), and elephant cognition allude to empathetic behaviors as well (Byrne, Bates, & Moss, 2009).

One of the preliminary studies of empathy in rodents used a measure of lever-pressing task paired with a shock pain of a conspecific rat to evaluate the rat's reaction to the conspecific's pain (Church, 1959). Conditioned rats decreased lever pressing to reduce the shock inflicted on the conspecific rat, indicating the understanding of a

difference between its previous experience of pain and the shocked rat. Other studies demonstrate the ability of rodents to reduce the distress of other rats in a suspended condition (Rice & Gainer, 1962) or noxious olfactory stimulus (Langford et al., 2006).

These studies have not claimed rats to be empathetic, but rather they explored basic elements of what researchers would consider affective empathetic behavior. A newer and more specific rat model of empathy has been developed and does support empathetic behavior in rats. Freely moving rats will use physical effort to open a restrainer, freeing another restrained rat (Bartal, Decety, & Mason, 2011). This behavior shows the rat's ability to respond to the affective state of another, expressing empathy. The free rats identified the trapped rats' distress and down regulated their own fear in order to exhibit a pro-social behavior. All this combined with the ability to recognize their own freedom compared to the conspecific rats' restraint qualifies this action as an empathetic motivated behavior in a rat model.

However, according to Walter's conditions of empathy, the free rat had never experienced the defining criterion of affective isomorphy, in this case, the same state of having once been restrained. The requirement of affective isomorphy as a criterion of empathy may not be so much as a requirement, but rather it provides an empirical tool in the evaluation of neural mechanisms (Walter, 2012). Can affective isomorphy teach us more about empathy in behavioral research?

This study of empathy in rat models will be designed such that the free rat will be conditioned by being placed in the restrainer (condition restrained- CR) before being placed in the arena as the free rat. This will be our condition of affective isomorphy. It

will then have the opportunity to let its cagemate out of the restrainer. We will evaluate if the CR conditioned rat, having been in the same state before, will open the restrainer at a shorter latency than a rat in the control group, naïve to the restrainer (testing restrained-TR). This will evaluate whether affective isomorphy as a criterion of empathy is necessary to elicit a pro-social, empathetic behavior.

We hypothesize that the rats that had been in the restrainer will open the restrainer at a shorter latency than rats that previously had not been in that state, and will show significantly more door openings than the TR group.

Method

Subjects

Eight pairs of female Sprague-Dawley rats were housed in the Regis University Department of Psychology and Neuroscience's animal facility with a cagemate for two weeks prior to testing. Rats were weighed daily during testing. A color-mark on each rat's tail distinguished cagemates.

Rat Selection

In order to select one of the cagemates to be the free rat and the other to be the restrained rat, the boldness of the rats was evaluated. For each pair, boldness was measured by an approach to the edge test (Bartal, Decety, & Mason, 2011). Once the cage was opened, the rat that first reared up and placed its front paws on the edge of the cage a total of three times was chosen to be the free rat.

Apparatus

The testing arena was 20 in by 10 in. The restrainer was approximately 25 by 8.75 by 7.5 cm. The restrainer was large enough that the restrained rat could make a tight 360° turn. Attached to the top of the door was a lever that the free rat could push down to open the door on a hinge (see Figure 1).

Procedure

Two groups of naïve rats were tested in a 2x2 between subjects design. The free rats in Group 1 were in the condition restrained group (CR). Affective isomorphic conditioning involved placing the free rat in the restrainer for 60 minutes once a day for 5 days prior to testing. The free rats in Group 2 were in the testing restrained condition (TR), and thus were tested with no previous conditioning and served as the control group.

The days on which the free rat opened the restrainer door and the time that the door opening occurred were recorded for next 12 days for each session. The rats were tested in 60 minute sessions and were given 40 minutes to open the restrainer door. If 40 minutes passed without the free rat opening the restrainer, the experimenter opened the door halfway to a 45° angle. The rat and its cagemate remained in the arena for 20 minutes, the remainder of the session. Door-opening was only counted if the rat completely opened the restrainer before the 40 minute point of the session. If the rat opened the restrainer door halfway, the experimenter opened the door fully to prevent the development of learned helplessness in the rats. However, this was not counted as an opening.

Measured Variables:

Number of Door Openings

Latency to Door Opening

Results

The mean latency until opening for the control group was 24.16 minutes. The mean latency until opening for the treatment group was 31.86 minutes. There was not a significant difference in the number of openings for the control (M=6.25, SD=2.62) and treatment (M=4.5, SD=1.29) conditions; t (6)= -1.195, p = .277. An independent samples t-test showed that the number of days until opening was not significantly different between the treatment and control groups, t(6)= -1.852, p = .114. An independent-samples t-test was conducted to compare latency of opening on days 1 in control condition and previously restrained condition. There was not a significant difference t(6)= -1.698, p = .188.

The rats prior experiences in the restrainer did not significantly affect their latency later in the experiment, F(1,11) = 1.03, p = .431). There was no main effect of condition for days 1-3. There was not a significant interaction between days and condition when comparing day 1 to day 3, F(1,2) = 3.176, p = .078. In comparison, no effect of condition on latency to opening was found for the rest of the experimental period of days 4-12, F(1,8) = 1.240, p = .297. However, the effect of CR of condition displayed a trend toward significance, F(1,6) = 4.68, p = .137.

Figure 1. Restrainer used in both conditions.

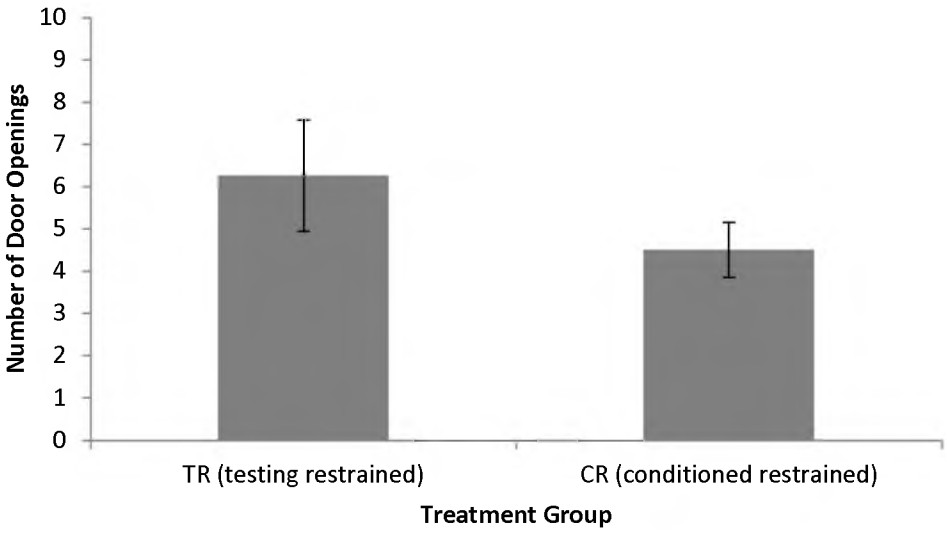

Figure 2. Mean number of door openings after 12 days of testing. Error bars represent standard errors.

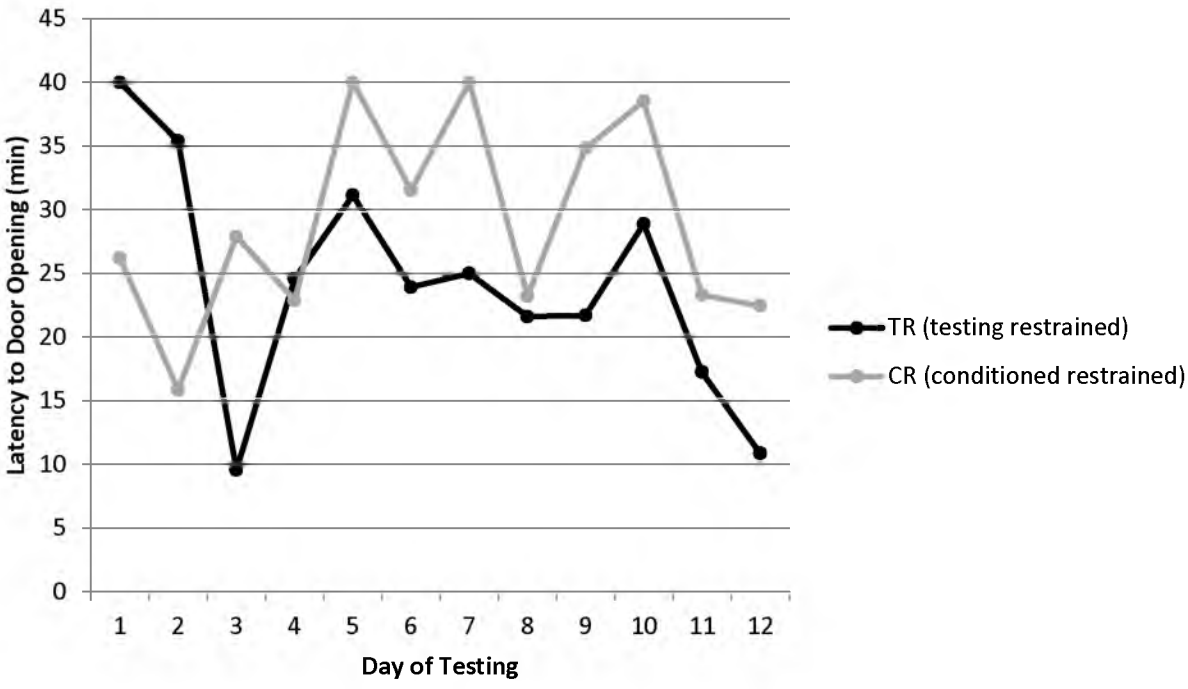

Figure 3. Mean latency of door openings for all 12 days of testing. Max latency to door opening was 40s.

Discussion

Our initial hypothesis was not supported by the data collected. Our experiment may lead to the assumption that affective isomorphy does not have a significant effect on empathetic behavior. Our control condition closely followed the results from the original study (shown in Figure 3). For the control group, latency to door opening began to decrease at day six of the study, whereas, the CR rats latency to door openings were sporadic. This is also seen in the higher number of openings for the TR rats compared to the CR rats. With a larger sample size, we anticipate that these comparisons would be significant, showing that affective isomorphy does not have a significant effect on empathetic behavior, yet the empathetic behavior is still present in the control condition.

We expected that placing the rats in the restrainer prior to testing would elicit an isomorphic state that would be remembered. Instead, we think the isomorphic state introduced a variety of confounding factors that interfered with the expected empathetic behavior.

Rats tend to be social animals, but due to their paired housing, free rats may have habituated to their cagemate's presence. Animals do not typically habituate to social stimuli, but they may habituate to a social stimuli if no other social stimulation is present (Cheal, Klestzick, Domesick, 1982). Our rats could have habituated to their cagemate in the restrainer in both control and treatment conditions. Due to the habituation to cagemate presence, rats in both conditions spent less time near the restrainer, possibly causing a decreased number of door openings. (We look at exploratory behavior because it is essential to the success of this study because it initiates an interaction with the restrainer, and causes learning of how to open the door to occur.) Specifically, the CR rats' longer door opening latencies could have been affected by the lack of novelty with the restrainer as well as stressed caused by the restrainer. Novelty of environment has been shown to motivate exploration of environments (Kakade & Dayan, 2002), such that rats will exhibit less activity if an environment is familiar and are less likely to participate in investigatory activities (Pisula, & Siegel, 2005).

During testing sessions, rats in both conditions exhibited different levels of exploratory behavior. In the study of Bartal, Decety, and Ami (2011), the movement of the rats was analyzed within the testing arena. Our study did not evaluate movement, but Decety, Bartal, and Ami (2011) found that the rats would spend significantly more time

near the restrainer, leading to the hypothesis that the conspecific trapped rats were the reason for the exploratory movement near the restrainer. Rats have the tendency to be thigomotactic, meaning they avoid open spaces and prefer moving near a tactile stimulus such as a wall (Ramos, & Mormede, 1998), which in our case would include the restrainer. Bartal, Decety, and Ami (2011) report their rats biting, digging, and scratching near the restrainer, but this was not seen in our study. It is unknown whether the rats spend more time near the restrainer because it was a tactile stimulus or because it provided a social interaction. Future studies could explore thigomotactic behavior versus social interaction by testing in a larger arena to create more open space and compare that with a restrained cagemate.

Stress also has an effect on exploratory behavior. While the condition of being previously restrained (CR condition) was intended to replicate an affective state, it is possible that one hour a day for five days in the restrainer was not sufficient to create a lasting effect on the treatment group. Though the suggested characteristic of affective isomorphy in empathy was being evaluated in this study, the nonsignificant results suggest that the conditioning of the treatment group was not strong enough to produce the anticipated behavior of shorter latency to door openings. The CR group's restraint could have elicited an unintentional stress that may have affected the free rat's exploratory behavior. Stress decreases exploratory behavior of adolescent and mature rats (Saul, Tylee, Becoats, Guerrero, Sweeney, Helmreich, & Fudge, 2012), causing exploratory behavior in the field to be reduced. The stress of being previously restrained could have gone two different ways. The stress could have caused a decrease in exploratory

behavior (as described above), or the stress could have not been strong enough to elicit a lasting effect on the treatment group.

Additionally, the treatment condition of restraining rats prior to the 12 day testing sessions may not have had a strong enough impact due to the rat's sex. Female rats, in particular, do not show a significant difference in anxiety following a restraint stress (Bowman & Kelly, 2012), similar to the restrainer used in our study. Female rats show a behavior resistance to restraint stress up to and beyond 35 days (Bowman & Kelly, 2012), which is beyond our 1 hour for 5 days restrainer stress. Thus, the CR conditioned rats would have not acted differently than the TR rats due to lack of strength of the treatment. Future studies should use male rats as a comparison of restrainer stress on future prosocial behaviors in rats.

However, female rats show impaired extinction of aversive information and have better emotional memory (Ribeiro, Barbosa, Godinho, Fernandes, Munguba, Melo, & ... Silva, 2010) meaning the effect of the restrainer should have evoked stronger emotional memory. Female rats exhibit more empathetic action compared to male rats (Bartal, Decety, & Mason, 2011), but an over stimulation of emotion and stress for the CR condition could have been inhibitory in this experiment.

The condition-restrained rats (CR) were placed in the same restrainer as the testing-restrained rats (TR), but not within the actual testing arena. Additionally, the CR rats experienced reduced mobility stress in the restrainer, which is not the same state as the TR rats' experience of reduced mobility *paired with* a free roaming, exploratory

cagemate. Simply put, the restrainer condition may not have been similar enough to have a lasting effect on the treatment condition.

The original study did not evaluate olfactory communication between the two rats during training sessions. Odors from stressed mice increase conspecific rat's exploratory behavior, as well as general locomotion. However, these mice still avoid areas saturated with odors from the stressed mice (Zalaquett & Thiessen, 1991). Areas with odor from the stressed restrained rat are avoided by the free rat because they are interpreted as an area marked with danger.

Affective isomorphy may not be a criterion for empathetic action, but it is consistently used in cognitive neuroscience (Walter, 2012). This study suggests the reevaluation of using such a criterion for empathetic motivated behavior. Though our experiment did not show a significant effect of prior restraint on empathy, it is possible that the results obtained from the previous experiment by Bartal, Decety, Ami (2011) required a more specific environment than what was provided by our experimental environment. This further emphasizes the difficulties in empirically studying empathy. Our experiment is one of many that will attempt to quantify and explore the concept. Further research in empathetic abilities will expand scientific understanding of empathetic neural circuitries and therefore the manipulation of those neural processes, but researchers will need to be weary of the intricacy of this abstract, mental quality.

Acknowledgments

I would like to thank the Regis University Department of Psychology and Neuroscience for their constant support, both with providing research resources and keeping me on my intellectual toes. I wish to thank my advisor, Dr. Mark Basham, and reader, Dr. Abigail Gosselin, for their guidance throughout the course of this project, as well as the directors of the Honors Program, Dr. Bowie and Dr. Howe. The completion of this project would not be possible without the undying encouragement of friends and family. Many thanks on thanks on thanks.

References

Ben-Ami Bartal, I., Decety, J., & Mason, P. (2011). Empathy and pro-social behavior in rats. *Science (New York, N.Y.)*, *334*(6061), 1427-1430. doi:10.1126/science.1210789

Bruneau, E. G., Pluta, A., & Saxe, R. (2012). Distinct roles of the 'Shared Pain' and 'Theory of Mind' networks in processing others' emotional suffering. *Neuropsychologia*, *50*(2), 219-231. doi:10.1016/j.neuropsychologia.2011.11.008

Byrne, R. W., Bates, L. A., & Moss, C. J. (2009). Elephant cognition in primate perspective. *Comparative Cognition & Behavior Reviews*, 465-79. doi:10.3819/ccbr.2009.40009

Campbell, M. W., & de Waal, F. M. (2011). Ingroup-outgroup bias in contagious yawning by chimpanzees supports link to empathy. *Plos ONE, 6*(4), doi:10.1371/journal.pone.0018283

Church, R. M. (1959). Emotional reactions of rats to the pain of others. *Journal Of Comparative And Physiological Psychology, 52*(2), 132-134. doi:10.1037/h0043531

Cromwell, H., & Panksepp, J. (2011). Rethinking the cognitive revolution from a neural perspective: How overuse/misuse of the term 'cognition' and the neglect of affective controls in behavioral neuroscience could be delaying progress in understanding the BrainMind. *Neuroscience And Biobehavioral Reviews*, *35*(9), 2026-2035.

Decety, J., & Jackson, P. L. (2004). The Functional Architecture of Human Empathy. *Behavioral And Cognitive Neuroscience Reviews*, *3*(2), 406-412. doi:10.1177/1534582304267187

Decety, J. (2011). Dissecting the neural mechanisms mediating empathy. *Emotion Review, 3*(1), 92-108. doi:10.1177/1754073910374662

de Waal, F. M. (2012). A bottom-up view of empathy. In F. M. de Waal, P. Ferrari (Eds.), The primate mind: Built to connect with other minds (pp. 121-138). Cambridge, MA US: Harvard University Press. doi:10.4159/harvard.9780674062917.c8

Geng, Y., Xia, D., & Qin, B. (2012). The Basic Empathy Scale: A Chinese validation of a measure of empathy in adolescents. *Child Psychiatry And Human Development*, *43*(4), 499-510. doi:10.1007/s10578-011-0278-6

Gerdes, K. E., Lietz, C. A., & Segal, E. A. (2011). Measuring empathy in the 21st century: Development of an empathy index rooted in social cognitive neuroscience and social justice. *Social Work Research, 35*(2), 83-93. doi:10.1093/swr/35.2.83

Hogan, R. (1969). Development of an empathy scale. *Journal of Consulting and Clinical Psychology, 33,* 307-316

Jolliffe, D., & Farrington, D. P. (2006). Development and validation of the Basic Empathy Scale. *Journal Of Adolescence*, *29*(4), 589-611. doi:10.1016/j.adolescence.2005.08.010

Langford, D. J., Crager, S. E., Shehzad, Z., Smith, S. B., Sotocinal, S. G., Levenstadt, J. S., & ... Mogil, J. S. (2006). Social Modulation of Pain as Evidence for Empathy in Mice. Science, 312(5782), 1967-1970. doi:10.1126/science.1128322

Mehrabian, A., & Epstein, N. A. (1972). A measure of emotional empathy. *Journal of Personality, 40,* 525-543

Palagi, E. E., Leone, A. A., Mancini, G. G., & Ferrari, P. F. (2009). Contagious yawning in gelada baboons as a possible expression of empathy. *PNAS Proceedings Of The National Academy Of Sciences Of The United States Of America, 106*(46), 19262-19267. doi:10.1073/pnas.0910891106

Rice, G. E., & Gainer, P. (1962). 'Altruism' in the albino rat. *Journal Of Comparative And Physiological Psychology, 55*(1), 123-125. doi:10.1037/h0042276

Singer, T., & Lamm, C. (2009). The social neuroscience of empathy. *Annals of the New York Academy of Sciences,* 1156, 81–96.

Walter, H. (2012). Social cognitive neuroscience of empathy: Concepts, circuits, and genes. *Emotion Review*, *4*(1), 9-17. doi:10.1177/1754073911421379

AFFECTIVE EMPATHY: EXPLORING PROSOCIAL BEHAVIOR IN NEUROSCIENCE

Thesis Expansion

Chapter 1: Rey Balentun: Entering into Empathy

What I remember most was the mud. The heavy, humid air pressed down on our already damp bodies as we outsiders attempted to daintily walk down the path without getting our shoes too dirty, while they walked comfortably and seemed to stay the most clean. The warm mist blurred the green landscape, and the outstanding sound of earth sucked our thoughts into the mist, thoughts of mud and the desire for comfort and cleanliness, the anxiety of the unknown.

Our group had arrived in the small, unmapped village of Rey Balentun in the Petén department of Guatemala. We had traveled from San Salvador to Suchitoto to Chalatenango in El Salvador, and after a twelve hour bus drive, we arrived in San Andres, Guatemala. Each step of the way, our North American comforts were stripped away. From the city of San Andres, the fourteen of us, with our oversized backpacks, fancy cameras, and water bottles filled with safe drinking water, piled in the back of two Toyota trucks embarking on the hour crusade into the unmapped countryside.

On rocky roads, our drivers dauntlessly charged through mud puddles the size of swimming pools. As each new swimming pool of muddy water appeared I thought, "there is no way we're going to make it through". Each time we did. With white knuckles, I would grasp the door and hold my breath. At each sharply inclined hill, I would hold my breath. I had a flashback to the Indiana Jones ride at Disneyland. It was

difficult to pay attention to the fact that each conquered swimming pool and hill plunged us deeper into the breathtakingly green landscape.

Having reached our destination, we were greeted by faces that looked almost as unsure and hesitant as ours. To say that two worlds were colliding would be an understatement. To say that they owned some animals would be an understatement. Chickens, roosters, pigs, dogs, cats, and small children roamed about as we sat down to eat soup the women had prepared for us, including thick, fresh tortillas. The separation between us and them was still present as our group clung to each other while they finished their meal after us. Soon our North American fellowship would be disconnected as we separated into families throughout the village.

Following lunch, our trip leader, Pablo, loaded us back into the Indiana Jones' trucks and took us to meet our host families. Digging deeper into the country side, we traveled onward. We dropped off Yolanda and Lauren at their family's house. We dropped Patrick and Hernan off at their family's house's gate, and pretty soon, Louisa, Damien, and I were the only ones left. In my head, I had already thought of possible questions to ask or how to interact with the family. My confidence had gone from grape to raisin on this trip, and I needed to reassure myself that I could connect with these people. I would just have to discover how. We drove another quarter of a mile and arrived at the house of Acturo's family.

The truck pulled off at the bottom of a small hill, and we grabbed our backpacks and walked up toward a small house. We stepped into the dark, smokey kitchen with the thatched roof, and introduced ourselves. We smiled big bright smiles, awkwardly

proclaiming "hola!" and "me llamo Anita". I knew that it was common to have large families, but new faces kept popping up each time I turned around. Looking back, I was semi-satisfied that my clichéd perception that huge families lived in small houses had been accurate.

The house was built on a smooth, leveled concrete foundation with two rooms that opened onto a concrete porch. We tracked mud across the porch as we were led to one of the two rooms. Each room had three beds pushed up against wood walls. Regrettably, I noticed that the family would remove their shoes before walking on the porch, as to not track mud onto it. I chastised myself as one of the girls grabbed the broom wrapped in a wet t-shirt to mop off the mud I had just tracked onto it. The tin awning above the porch was lined with a drain pipe that filtered rain water into a huge water basin.

The father of our familia, Acturo, walked us around what would be their front "yard" and showed us the fruit trees. Pointing out to each one, I could tell that he was trying to share his life with us, piece by piece. I am embarrassed to say that I was initially intimidated by men in the village. Here, the male and female roles were still distinctly separated. Men worked hard in the fields all day, and the women worked and cooked in the home. With this gender separation, my prejudices of a machismo man as the head of the household made me cautious. However, Acturo welcomed us with a genuine spirit and trust. He never appeared embarrassed of their living conditions (which I had anticipated), and he wasn't intimidated by us either. He had already leveled the ground, and we were considered equals.

Acturo pulled out some plastic chairs, inviting us to sit and relax. Neither Louisa nor I spoke strong Spanish, so we mostly communicated through our bilingual friend Damien. I cannot even remember the questions we asked, but I do remember feeling incredibly uncomfortable. I was hesitant as to how to integrate myself into their daily life, but Acturo just smiled a quiet smile and talked to us. He told us that it was his son's birthday and that there would be many people over later.

I love birthdays and wondered how they celebrated. Low and behold, Doris, his wife, was making pastel, a cake! They mainly celebrated a birthday by inviting people over, much like a party. Soon enough, many young men and women began arriving. Doris served dinner, and we ate and asked more questions. I gave many of the young ones paper and crayons to draw me a picture with their name so I could learn. I could only say 'gracias! Mui bonita!" and smile my hopefully welcoming smile. Soon after, it started to rain. Pour. Torrential downpour is an understatement. All the friends, all the family crowded under the porch, but the magic was that no one really talked. We all just sat and watched and listened.

It rained for about an hour, and by the time it was finished, the sun had almost set. With no electricity, they brought out handmade candles, and we asked more questions. At this point, I had finally figured out that there were two families staying here, Acturo's brother's family were inbetween houses and had traveled this way for the birthday. This explained the explosion of faces that kept popping up. The night continued on, and the children squished themselves into shared beds. We sat out on the porch, and the candlelight began to lull me into a sleepy dream state. The parents shared with us

legends and ghost stories. Listening to the rumbles and trills of Spanish sounded like music, continuing to lull me to sleep. I felt calm and in a neutral state.

We all shared a domino yawn and decided that it was time to head to bed. Just as I was about to enter one of the rooms, my flashlight flashed on a huge spider (I embarrassingly profess my fear of them), and I tried to mention it gently to Acturo. He gave me a questioning look, and then slaped it dead with his hand. Having already been paranoid of bug bites, my anxiety heightened as Louisa and I prepared for bed. I turned my sleeping sheet into cocoon so nothing could get in. After a long day, the seventeen of us snoozed away in the seven beds.

Part of the excitement of falling asleep in a house of seventeen people is waking up to the sound of the six little kids squealing in the morning. I woke up needing to use the restroom. I put on my sandals caked in mud, and tromped over the latrine. Having never used a latrine before, I had my doubts. This just did not seem very sanitary, and it did not smell like bleach or Lysol. Once again, my comfort boundary was lowered.

For breakfast, we had some leftover cake and coffee sitting quietly as we reentered the purgatory of awkward interactions. Again, the Toyota trucks came to pick us up (including four more family members) to take us back to the main meeting area. We picked up Patrick and Hernan, Yolanda and Lauren, and the group of fourteen piled into the one truck. We resumed the climb up steep hills and charge through muddy swimming puddles. Our group, having been reunited, spoke excitedly of our night. We shared quick stories as we all were called to listen to the "president" of the village introduce one of their health promoters, the closest person these families had to a doctor.

The health promoter of the community began to tell us the story of the cucheraras, the spoonmakers. Many of the families in Rey Balentun had taught themselves to whittle spoons. They start with huge blocks of native hard wood and literally carve them with a machete down to a spoon. They have very few tools, but they sand these spoons down to a fine, soft piece of art. They showed us ornamented ladles, salad tongs, chopsticks, measuring spoons, regular spoons, etc. These spoons were made with such precision and looked as if they could be sold at a Williams and Sonoma at the mall.

They explained to us how many of their families had not originally lived in this community, that many of them had been uprooted from their land and forced to relocate. Big farming companies had come into the countryside, bought all the plots surrounding their land, and threatened them to sell. If they chose not to sell, the families were threatened with death. So, many of them had landed in Rey Balentum, with small plots of land that are not big enough to produce a profit. These families, including Acturo's family, farm the land all day to feed themselves, but their spoons are their only source of extra income.

We sat and listened to their stories. My heart dropped when Acturo spoke up to emphasize that making and selling these spoons is the only way his family can afford basic things. He said that if any great tragedy were to happen, if one of his kids were to become sick, they would not have enough money for basic medicine. He said that if this spoon business does well, they might get simple electricity soon, and a long shot at clean drinking water. As I listened to him talk, even though I did not understand, the manner in which he spoke was not to emit a sense of guilt or to ask for help, but merely a sharing of

knowledge, a telling of how it is. He spoke with genuine bluntness, and in my head, all I could think about was how I had spent at least 75$ on preventative medicine just for this trip.

After listening to their story, we watched them craft some spoons. From beginning to end, we saw them machete the wood down to form, and we watched them sand it smooth. It took about 3 hours to make one (haphazardly made) example spoon. Usually it takes them about 12 hours. After a long morning of spoon making, we shared a meal together. The community wives and daughters had been cooking all morning, and we sat at a long table, enjoying the savory, fresh meat.

Back to schedule, we loaded back into the trucks to spend the last afternoon and night with our families. I was starting to feel comfortable. My personal comforts and worries were put on the backburner as I now projected my thoughts onto this family that I was beginning to feel a strong connection with.

That afternoon, we walked to the neighbor's house, looked at their lagoon, their actual swimming pool. We played some field soccer, and then tromped back home in the mud after yet another torrential downpour. That evening, I sat up and talked with the two girls (Jocelyn and Araceli) and son (Samuel Louise). They exchanged words in Spanish for words in English, and this trading continued late into the night. We ate dinner by candlelight, and spoke to the parents, asking questions about their dreams for their children, about the education systems, and about their land.

What made me so comfortable with them was how they laughed at us. The girls would laugh at my horrible accent, and the adults would laugh at their children's

laughter. Something new, something exciting had evolved that day. We formed a simple, human connection that made the separation of how we lived our lives almost impossible to understand. I will never forget the look on Samuel Louise's face when he asked me how much my camera cost me, and I told him 100$. I will never forget the smell of the smoky, dirt-floor kitchen with no ventilation and an open fire stove. I will never forget walking through layers upon layers of mud, amongst a luscious green landscape, a view where the earth finally seemed just a little more rich than the people that lived on it.

It was in these moments that I finally felt called to do something about this chasm between my world and theirs. These reflections morphed into a combination of determination and hopelessness as I knew that the help or actions I wished to give may never be enough. My desire for them to have water, electricity, and more concrete to cover the mud is warped into a structural problem that I do not have the training nor skills to attack. Furthermore, I wondered how long these feelings, these connections would travel back with me to the comfort of my carpeted floor and tiled bathroom. The separation of worlds, of perspectives, left me wanting to do something.

So we bought their spoons. We bought their spoons and their ladles and their tongs, and then we bought some more. Beyond the inherent beauty of the spoon was the knowledge that this may be the only thing we could ever directly do to help this community of families that had made a place in our hearts in only 2 days.

Now, back at Regis, writing this reflection in my own room with my own bathroom within non-muddy walking distance, I return to the buzzword of my thesis,

empathy. Empathy modulates our natural ability to share, understand, and respond to the state of another (Davies, 2012). This ability moderates our social interactions, and many theories, including evolutionary and behavioral perspectives, consider it to be essential in prosocial behaviors. Philosophers such as Hume and Smith considered empathy to be the basis for morality (Trout, 2009). Having literally walked a mile in the shoes and daily life of this community, my human connection and perspective taking inevitably calls me to action.

However, to understand what this abstract emotion of empathy facilitates, whether that is prosocial behavior or emotional avoidance, a more concrete understanding of empathy itself must be hammered down. Too often does empathy get mixed with sympathy, even compassion. Particularly, in my field of neuroscience, the operational definition of empathy varies from researcher to researcher, making the study of it even more challenging.

In this thesis, I first will do a review of the scientific literature of empathy in an attempt to sharpen blurred lines of definitions and understandings. This will set the stage for delving deeper into the question that has traveled back with me from Rey Balentun in Guatemala. If the purpose of empathy is to elicit prosocial or helping behavior, does walking a mile in another's shoes increase empathetic concern and thus increase prosocial actions?

Chapter 2: Sifting through Empathy Vocabulary

The biggest impediment to understanding empathy, particularly in social and cognitive neuroscience, began with the hammering out of an operational definition that researchers could agree on. Theodor Lipps first introduced the German word *einfühlung*, meaning "feeling into oneself", into psychology, adapting it from its use as a way to appreciate art described by Robert Vischer (de Waal, 2012; Zahavi & Overgaard, 2012; Montag, Gallinat, & Heinz, 2008; Jahoda, 2005). Vischer's neologism described a way to project oneself into or to be a part of an object of beauty to understand it more fully, and Lipps integrated the idea into a question explored by many philosophers; that being, how do humans understand and know the thoughts and ideas of others to understand them more fully (Jahoda, 2005). Eventually, Einfühlung and Lipps went on to influence the father of psychoanalytic theory, Sigmund Freud (Jahodo, 2005).

During this time in the 18th century, e*infühlung's* best translation was sympathy, and perhaps only by misinterpretation of the German translation by American psychologist, Edward Titchner (1867-1927), did the concept of empathy get mixed into the definition (Jahodo, 2005). Schools of psychological thought now separate sympathy and empathy as two quite significantly different ideas, but even in the interpretations of *einfühlung*, the lines are blurred.

Adam Smith may have been the first philosopher to describe sympathy, stating that our human nature includes the ability to experience "fellow-feeling". This "fellow-feeling" comes from emotion felt from the powerful emotional state of another (Davis, 1994). One of the most common examples of a sympathetic reaction is the one of sympathetic crying. A newborn baby is more likely to cry if it is in a room with another crying baby (Davis, 1994; Simner, 1971). The same is true of sympathetic fear. If a stimulus creates a fear reaction in one member of a species, the same stimulus will elicit the same reaction in another member of the species to the same stimuli. From an evolutionary perspective, this may have developed as a means to communicate and coordinate behavior. Other examples include contagious yawing, where when one subject yawns, others will have a similar yawning reaction (Campbell & de Waal, 2011).

McDougall (1908) in *Introduction to Social Psychology* suggested that sympathetic reactions did not result from "imaging ourselves into" an experience of another. He also did not think that the emotional reactions were a product of learning based on repeated experience, but rather McDougall believed that the sympathy was hard-wired into our perceptual networks (Davis, 1994). However, though sympathy involves the sharing and perception of other's emotional states, the sharing of affect, sympathy is described as having a "passive flavor" (Davis 1994). This is where the distinction between empathy and sympathy becomes pertinent to this conversation. Empathy, its counterpart, is a more active way of thinking toward another, of empathetic emotional sharing. I imagine it as a metaphorical hand emmerging from your brain

reaching out to grasp another. This active grasping hand is what empathy theorists call perspective taking.

Sympathy differs from empathy in that it does not require perspective taking. Sympathetic emotions are more focused on one's self. When John sees a homeless man on the corner of the street, he feels anxiety or perhaps fear. Empathy however involves an elaborate perspective taking, such that instead of John feeling anxiety or fear for the man on the corner, John would feel *with* the man. Perspective taking requires an active, thoughtful attempt to get "inside" the other (Davis, 1994), and this was a step up from the passive sympathy reactions. This perspective taking is why many psychologists, philosophers, and cognitive neuroscientists believe that empathy provokes prosocial, moral behaviors (Trout, 2009; Batson, 2009; Zahavi & Overgaard, 2012). Empathy is other focused, but the self and other are tied together by a similar affective state or emotion.

The definition of empathy has and will continue to change over time, but currently empathy is defined as "the natural capacity to share, understand, and respond with care to the affective states of others" (Decety, 2012). In cognitive neuroscience it is understood as "the affective reaction to the affective state of another" (Singer and Lamm, 2009). It can be thought of as the cliché of "walking a mile in another's shoes" or even the perspective of "that could have been me" (Trout, 2009).

These definitions serve the general understanding of this feeling, but the study and research of empathy requires more concrete delineations. As science skates forward into concrete analyses of empathy, unsurprisingly empathy does not seem to fall into one

designated pathway in the brain, nor does it perpetuate consistent behaviors in experiments. The disagreements of neural pathways and mechanisms of empathy have diverged to encompass two categories or domains of empathy. In cognitive neuroscience, empathy has been separated into two distinct categories, both using a variety of neural processes. The first and most common understanding is cognitive empathy and the other is affective empathy.

Cognitive empathy is mostly what humankind attributes to their understanding of empathy. It involves the ability to know or interpret the state of another without experiencing the same affective state. We are able to do this due to our higher cognitive abilities. As far as we believe, we are the only mammals or even species able to conceptualize and imagine the state of another. Though my mom has never died, I can conceptualize and imagine how that might feel, and therefore empathize with a friend whose mother has just recently passed away.

Cognitive empathy is closely tied with what neuroscience is calling *theory of mind* theory. *Theory of mind* refers to the ability to understand the mental states of others (beliefs, intentions, dreams, emotions). It does not require a sharing of mental states, but rather a personal interpretation of the other. This subtype of empathy is a thought to be a top-down process. Higher cortical areas (such as the tempo-parietal junction, precuneous, and medial prefrontal cortex) formulate hypotheses or inferences from clues from the environment which then activate subcortical networks for emotional regulation and action (Walter 2012; Panksepp 2011).

During emotional regulation, cognitive empathy can induce a subtype reaction of personal distress, where the negative affective state that is elicited by the affective state of another reverts back to a self-oriented reaction. Walter (2012) explains this as when you see other people suffering, the reaction within yourself becomes negative, thus motivating you to turn away in order to reduce the feeling of personal distress. Perhaps this evolved as a way to avoid being tricked or betrayed.

Affective empathy, however, comes from a completely opposite direction in the brain. Affective empathy evolves from a bottom-up processing network and is closely tied to a *perception-action* model. The perception of the other's state will automatically activate the observer's similar representations of that state, generating an automatic and somatic response (Walter, 2012; Preston & de Waal, 2002). Another name for this ability to understand mental states was termed *simulation theory*, the expression of an emotion or mental state of another internally stimulated the same psychological state in ourselves (Walter, 2012, Goldman, 2006). This is very similar to sympathy. Sympathy usually only described feelings of compassion for the other, and as the general term of empathy was used increasingly in social psychology (Davis, 1994), the term sympathy was replaced with affective empathy. It seems as though affective empathy and sympathy embrace similar meanings, and often get muddled together.

Biologically, the perception-action model and simulation theory are closely tied with the discovery of new specialized neurons, called mirror neurons. Mirror neurons, found in the ventral premotor cortex, anterior and posterior interparietal area, inferior frontal gyrus and somatosensory areas, work within a system of neurons that will fire

when one executes an action as well as when on perceives another executing the same action. fMRI studies have concluded that beyond motor action, the mirror neuron system includes emotions as well, including pain and disgust (Walter, 2012, Wicker et al., 2003). Because this system of mirror neurons involves emotional mimicry and emotional contagion, it best fits the affective empathy of bottom-up processing (Walter, 2012).

So why is the distinction between cognitive and affective empathy important? The distinction becomes critical when formulating research questions regarding the process or outcome of empathy. Described later, the research of empathy within nonhuman species looks at a generally affective view of empathy, whereas most human studies integrate the cognitive theory of empathy. Neither is more correct than the other, but the direction of processing will be critical to the real-world applications of empathy research, especially if that involves animal testing.

We grasp so longingly for an understanding of empathy because, as was stated above, this emotion appears to call and instigate some sort of reaction. The evolution of this emotion may be the anchor to the formulation of social connectedness, and further, social morality. There is no doubt that humans behave based on both types of empathy, but is it possible that one is better than the other in promoting better, more decent, more just reactions?

So, we have both this low road to empathy and high road to empathy. The low road entails certain basic applications of affective states, such as facial expressions, bodily movements, hunger, etc (Walter, 2012). The low road implies an automatic empathetic response compared to the high road which involves inferences and thoughts

based on contextual and situational information. Though the high road leads to empathetic motivation as well, it is missing the component of isomorphy, of a similar experience or feeling. Without this, I suggest that an important connection is missing. The high road, the cognitive path to empathetic response, is like going from my individual thoughts, calculations, and interpretations of situation. The low road implies a sort of togetherness, a form of camaraderie.

Chapter 3: The "Generation of Affect"

"Our knowledge has made us cynical; our cleverness, hard and unkind. We think too much and feel too little." –*The Great Dictator*

We are a species of thinkers. "We think too much and feel too little," in the words of the Jewish Barber from Charlie Chaplin's movie, *The Great Dictator*. Is it possible that this highly evolutionary trait of abstract thought now inhibits societal morality? In the world of academia, we never really identify "thoughts" to be negative toward our experience. While thinking is a very general term, perhaps more specifically our emotional rationality may be inhibitory, overregulating our behaviors and stunting our actions. We have come to rely on our ability to trust our mind's rationality, when really it may be entirely faulty and selfish. On an empathetic level, relying primarily on executive thought often fails to encourage prosocial helping behavior.

If we look at the state of our interactions and social stratifications from one-on-one encounters to world responsibility, our rationality may be what has separated us in the first place. If empathy is integral to the process of social interaction, even social morality, we must pay attention to when it fails. Both cognitive and affective empathetic pathways co-occur, but cognitive empathy has downfalls of which we are consciously unaware.

Cognitive empathy implies a complex form of inference into the state of another, involving observation, memory, knowledge, and reasoning (Decety & Jackson, 2012).

This mentalizing ability has served us well in identifying basic emotions, but is less reliable when identifying complex emotions, which are tied to a very personal representation of the world. Complex emotions are ingrained with thoughts of desire and beliefs, and these complicate the process of conceptualizing the state of another merely by the fact that we are inclined to afford priority our own personal desires and beliefs. Humans are not reliable in formulating a similar perspective merely by conceptualization. This is a faulty system.

Conceptualization, or cognitive perspective-taking, fails because of the bias to personal knowledge. Adult humans tend to infer that others have the same knowledge as themselves even when aware of the other's different point of view (Keysar, Lin, & Barr, 2003). When reasoning about others, we default to and are biased by our own perspectives of a situation. We project how we would feel or interpret another's situation, and that may be entirely different from how the other actual feels. Surprise! Humans are egocentric. To go beyond our own perspective to anticipate what others are thinking is a challenge (Decety & Jackson, 2012; Royzman, Cassidy, & Baron, 2003). Humans overestimate what they know. People's predictions of others' feelings that are in certain arousal states such as hunger or thirst will be based on how they would feel in that particular situation (Decety & Jackson, 2012). We think we understand others more than we actually do.

Additionally, knowledge of a situation gained from alternative avenues fails to strengthen cognitive perspective as well. Reading a newspaper article or watching news broadcasts do not provide the adequate amount of intricate detail to formulate the details

and emotions associated with a situation. Humans are less likely to be affected by facts than feelings. In a study conducted by Bollinger & Kreuter (2012), information about breast cancer presented to African women via a personal narrative from a woman produced stronger, more positive emotions (such as inspired, proudness, less upset) than information presented by an informational video. The information provided gives an inaccurate representation in that the information is just that, information.

Empathy requires a sense of mental flexibility. Any type of empathy, affective or cognitive, requires a form of perspective taking; most researchers agree on that. Cognitive empathic success increases its sensitivity and relies on how balanced we are at "imagining ourselves into" the other. The sensitivity manifests in a fine line between too much external perspective and too little. Our egocentric bias is an example of the latter. Humans may not quite let go of personal emotional states enough to fully understand the emotional state of another (think of the teenage girl, "Oh I know exactly how you're feeling, I was sad once too!").

However, the other extreme of too much perspective can be just as detrimental to empathetic concern as well. Excessive perspective taking into another can manifest as *personal distress,* a subcategory of cognitive empathy. Personal distress occurs when a negative affective state is perpetuated in the subject due to the negative affective state of the other. In simpler terms, the pain of another is causing too much pain in oneself, thereby initiating a reversion back to a self-orientation. Walter (2012) explains this as when you see other people suffering, the reaction within yourself becomes negative, thus motivating you to turn away in order to reduce the feeling of personal distress. I could

have easily traveled to El Salvador and Guatemala and become too overwhelmed by the negative emotions of anxiety, stress, and hopelessness and reverted back to my tunnel vision of my own perspective, but the purpose or outcome of empathy is not a complete merging of the self and the other (Batson, 1987). Dysfunction of the self-other distinction becomes overwhelming especially with negative emotion, causing personal distress. By this token, human's self-identity still needs to be distinguished without being diminished all together.

In summary, cognition can become too strong, overwhelming the individual with possible negative feelings motivating action to alleviate the negative state in the self rather than the other. And while this high road, cognitively regulated path allows the subject to act upon their representation of the state of another, this rationality is complexly tied to the individuals own beliefs, opinions, attitudes, and feelings. This bias can cause inappropriate reactions or no action at all. Cognitive empathy is sensitive to the intricacy of mental perspective taking, and thus the understanding of the other person becomes racked with holes, and picture of the other's perspective is incomplete. Even beyond the self-bias, knowledge collected from outside information cannot fill in the holes in perspective either.

Because of inaccurate perspective taking within the domain of cognitive empathy, I argue that the other domain of affective empathy produces more accurate representations of empathetic concern. The alternative for a more comprehensive understanding of another individual than that given by a cognitive perspective involves experiencing, with them, an affective mental state. What better way of understanding the

state of another than to experience the same state? By doing so, the possibility of being subject to the sensitivities of top-down processing diminishes, and feelings of personal distress return to an other-oriented, team action. Affective empathy, the bottom-up process fills in the gaps that cognitive thought and outside information could not. Affective empathy facilitates direct perspective taking by shifting the focus from the cognitive component of imagination and conceptualization of the states of another to a concrete understanding through experience. It is a switch from the cognitive processing to the affective processing based on 'emotional knowledge'. Pedwell (2012) suggests that emotional knowledge is more legitimate and truer than other ways of knowing, perhaps because it is instinctual, genuine affective emotions can only be experienced by "feeling that type of truth (Pedwell, 2012)."

Chapter 4: Instinct

The beauty of affective empathy is that it came first. It did begin as instinctual, and neuroscientists can track its development in children as well as primates, perhaps even rats. Our capacity for emotions, in particular, emotions that are shared between one individual and another, is innate to our human condition, even our mammalian condition. The development of affective empathy is theorized to be the path of evolutionary socialization, which lends to affective empathy's success in superior prosocial outcomes.

The development of affective empathy began with motor mimicry, which involves 'state-matching' (Panksepp, 2011). From an evolutionary standpoint, de Waal (2012) proposes that bodily synchronization is essential to coordinating movements between social animals. This creates a behavioral responsiveness between species within a flock, pack, pod, etc. For example, in schools of fish, if one fish darts one way, the whole school follows. Being attuned to the behavioral states of another is an evolutionary adaption to danger, and may have been the beginnings of socialization. Forms of motor mimicry include contagious yawning in primates (Anderson et al., 2004), as well as other behaviors such as feeding facilitation, contagious self-scratching, and neonatal imitation (de Waal, 2012). These represent that foundation of empathy in affective responses in mammals.

Eventually, motor mimicry developed to emotional contagion. Animal research in the last 40 years has begun to intricately observe animal's emotional responses to others

as a basis for understanding socialization and empathy. However, this is not a recent development, and scientists have been aware of other species ability to respond to the emotional states of other animals for quite some time now. Even Darwin wrote that, "many animals certainly sympathize with each other's distress or danger (de Waal 2012)". Being attuned to the state of another instigated the development of socialization via the activation of the same neural representations in the subject as the object, described above as the perception-action theory. Current research now believes that motor mimicry, emotional contagion, and development of socialization created the foundation for affective empathy within the development of the perception-action theory.

Because the perception of the other's state will automatically activate the observer's similar representations of that state, identification with the other is a precondition for imitation and empathy (de Waal, 2012), and allows for this neural mimicry to occur. First this developed as body mapping, identifying similar movements are shared, and then understanding that certain pains can be shared, and eventually emotional sharing.

Because affective empathy developed from bottom-up processes, specific criteria of empathy can be evaluated in the lab. By understanding affective empathy's evolutionary mechanisms, neuroscientists can study affective empathy in its development and maturation by organized techniques and manipulations. Understanding the evolution, development, and formation of the empathetic neural mechanisms can provide information involving disorders such as psychopathy and autism, and treatments and solutions may be more readily identified. Cognitive empathy relies heavily on self-report

in human studies. In the field of neuroscience, animal models allow for behavior, pharmaceutical, and environmental manipulations for more in depth explorations.

This past semester I explored affective isomorphy as a criterion of affective empathy in a rat model. The project grew from a study conducted by Bartal, Decety & Mason (2011) which concluded that rats exhibit prosocial empathetic behavior. The project design was adjusted to test isomorphy's effect on empathetic action. Just as the conceptualization of empathy within a human context is racked with intricacies, so is the exploration of empathy in other mammals.

During the experiment, rat pairs were housed together for two weeks prior to testing. Empathetic responsiveness is altered if subjects have lived with, share kinship, or have greater familiarity with their partner, the object of empathic concern (Panksepp, 2011; Davis, 1994). There is obviously a clear difference between the empathy I feel toward someone within my own family, school, country or city, to the empathy felt for individuals from a different country. Humans, and even other mammals, show emotional preference to family, bonds of kinship, anybody they identify with. Trout (2009) in *The Empathy Gap* wrote that "our best motivations don't result from elaborate logical architecture of first principles or abstract theories of justice, but from a natural sense of our common humanity (9)." The use of logic and rationality does not encourage prime social behavior, but rather a common connection throughout our human condition.

Empathetic connections are more difficult to make through a television or book. However, social organizations use common denominators such as children or even

images depicting extreme hunger to encourage charity or help, because in reality, the common denominator of humanity is not enough to evoke prosocial behavior or empathetic concern across cultures. Our affective state matching is most reliable when a connection is made by strong identifications, and the best identification we can make is by pure affective state matching.

The solution is what Henrik Walter (2012) has termed affective isomorphy. Affective isomorphy is the basis for "walking a mile in another's shoes". While it has been made a defining criterion of affective empathy, even Walter speculates to its necessity in the affective definition. In real life situations, humans may perceive someone being racially attacked, but instead of fear or despair, one might feel pity. Perhaps leaving out affective isomorphism is more consistent to our real life cases of empathy (Walter, 2012), but perhaps it is the lack of accurate isomorphism that causes prosocial and helping behaviors to be stilted. Beyond a one-on-one scale, the separation of cultures and even countries has created boundaries of recognition and identification between individuals of one state or way of life different from their own. My research in the lab explored affective isomorphy and concluded with no definite answer. It is still unknown whether isomorphy increases empathetic concern. However, further research may shed light on the capacity for other-oriented actions.

The conclusions of research will take time to integrate into daily life, so how do we bridge the separations between the distant "other" outside of the lab? The advances in technology have increased our knowledge and awareness of the 'other', and relief work and funds have increased. Could it be better? I would venture to say yes. The results of

an actual network of international politics are distinctly different from a shared network of minds created by affective experience. Now technology and computers allow us to work internationally from a distance, but how do we know that the help being given is what is needed? Again, personal biases create unfiltered influence and there remains a lack of understanding. Affective isomorphic experience creates a more holistic understanding where prosocial action is more effective.

This is a not grandiose new idea that I brilliantly constructed. Using this low-road of empathy via affective isomorphic experience has been established in many international organizations (Pedwell, 2012) and even at our own university. In lay terms, isomorphic experiences are called service projects, immersion trips, service learning, urban plunges, and many more. International development officials have integrated immersion trips with their international office employees and "they suggest is that through putting themselves 'in the shoes' of poor families, development staff can come to really understand the specific hardships faced by those they are meant to serve and may be able to feel for them and with them in a way they did not before (Pedwell, 2012)." I have already spoken of the effect of my immersion trip on my perspective of the individuals in Rey Balentun.

It would be interesting to take a poll to see how many people currently involved in social relief, peace corp, Jesuit Volunteer Corps, etc, experienced an immersion trip or participated in some service project, to see if those undertakings affected their willingness and desire to help others. I would venture to say that many individuals doing social work, whether that be by physically serving with those or teaching about it and

sharing their experiences, have gained perspective of another person through isomorphic experiences.

Rationality undoubtedly has an important place in our human culture. It is a part of our human condition. However, I caution reliance on our cognitive domains for decision-making regarding the wellbeing of others. Our cognitive domain is unreliable. In terms of science, we can make definitive lines and separations between domains and definitions of empathy. In a real-world situation, they are ingrained with each other. Neither process, affective or cognitive, will out rule the other. Just as we exercise our abilities to understand our social counterparts using previous knowledge, our own beliefs and interpretations, our own imaginings, we also need to exercise our ability to take true, emotional perspectives of the other rather than the ones we formulate in our head.

Spending even just a weekend with Acturo's family, my rationality, everything that I had known to be true, was stripped away by each muddy bump in the road, and I was left with an emotional vulnerability. Part of why this emotional knowledge is so effective is that it is shared. The process of deducing the state of another and understanding them is no longer singular, but the process becomes pluralized. Top-down processing, cognitive empathy begins with the self and can (but not always) lead to the action for another. Instead, because of the shared emotional state, the identification of the other and situation, affective empathy with its bottom-up processing encourages a social action by collaboration and solidarity.

References

Batson, C., Turk, C. L., Shaw, L.L., & Klein, T. R. (1995). Information function of empathic emotin: Learning that we value other's welfare. *Journal of Personality and Social psychology, 68*(2), 300-313. Doi: 10.1037/0022-3514.68.2.300

Batson, C. (1985, 2009). These things called empathy: Eight related but distinct phenomena. In J. Decety, W. Ickes (Eds.), *The social neuroscience of empathy* (pp. 3-15). Cambridge, MA US: MIT Press.

Bollinger, S., & Kreuter, M. W. (2012). Real-time moment-to-moment emotional responses to narrative and informational breast cancer videos in African American women. *Health Education Research*, *27*(3), 537-543. doi:10.1093/her/cys047

Campbell, M. W., & de Waal, F. M. (2011). Ingroup-outgroup bias in contagious yawning by chimpanzees supports link to empathy. *Plos ONE*, *6*(4), doi:10.1371/journal.pone.0018283

Davis, M. H. (1994). *Empathy: A social psychological approach*. Dubuque, IA: Brown & Benchmark: Social Psychology Series.

Decety, J. (2012). Empathy: From bench to bedside (social neuroscience). Cambridge, Massachusetts: The MIT Press.

Decety, J., & Jackson, P. L. (2004). The Functional Architecture of Human Empathy. *Behavioral And Cognitive Neuroscience Reviews*, *3*(2), 406-412. doi:10.1177/1534582304267187

de Waal, F. M. (2012). A bottom-up view of empathy. in F.M. de Waal, P. Ferrari (Eds.), The primate mind: Built to connect with other minds (pp. 121-138). Cambridge, MA US: Harvard University Press. doi: 10:4159/harvard.9780674062917.c8

Goldman, A (2006). Simulating minds: The philosophy, psychology, and neuroscience of mindreading. Oxford, UK: Oxford University Press.

Jahoda, G. (2005). Theodor Lipps and the Shift from 'Sympathy' to 'Empathy'. *Journal Of The History Of The Behavioral Sciences*, *41*(2), 151-163. doi:10.1002/jhbs.20080

Keysar, B., Lin, S., & Barr, D.J. (2003). Limits on theory of mind in adults. *Cognition*, *89,* 25-41.

McDougall, W. (1908). *An introduction to social psychology.* London: Methuen.

Mikels, J. A., Löckenhoff, C. E., Maglio, S. J., Carstensen, L. L., Goldstein, M. K., & Garber, A. (2010). Following your heart or your head: Focusing on emotions versus information differentially influences the decisions of younger and older adults. *Journal Of Experimental Psychology: Applied*, *16*(1), 87-95. doi:10.1037/a0018500

Panksepp, J. B., & Lahvis, G. P. (2011). Rodent empathy and affective neuroscience. *Neuroscience And Biobehavioral Reviews*, 35(9), 1864-1875. doi:10.1016/j.neubiorev.2011.05.013

Pedwell, C. (2012). Affective (self-) transformations: Empathy, neoliberalism and international development. *Feminist Theory, 13*(2), 163-179. doi:10.1177/1464700112442644

Preston, S., & de Waal, F. (2002). Empathy: Its ultimate and proximate bases. *The Behavioral And Brain Sciences, 25*(1), 1-20.

Royzman, E.B., Cassidy, K.W., & Baron, J. (2003). I know you: Epistemic egocentrism in children and adults. *Review of General Psychology, 7,* 38-65.

Simner, M. L. (1971). Newborn's response to the cry of another infant. *Developmental Psychology*, *5*(1), 136-150. doi:10.1037/h0031066

Trout, J. D. (2009). *The empathy gap: Building bridges to the good life and the good society*. New York, NY: Penguin Group.

Walter, H. (2012). Social cognitive neuroscience of empathy: Concepts, circuits, and genes. Emotion Review, 4(10), 9-17. doi: 10.1177/1754073911421379

Wicker, B., Keysers, C., Plailly, J., Royet, J.-P, Gallese, V., & Rizzolatti, G. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron, 40*, 655-664.