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University of Nevada, Reno

An Analysis of Altruism Between Evolutionary Biology and Social Psychology.

A thesis submitted in partial fulfillment
of the requirements for the degree of

Bachelor of Arts in Psychology, and the Honors Program

by

Martin E. McMahon III

Matthew Locey, PhD., Thesis Advisor

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Matthew Locey, Ph.D., Thesis Advisor

Tamara Valentine, Ph. D., Director, **Honors Program**

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Abstract

Altruism is an important topic to both social psychologists, and evolutionary biologists, though both disciplines will define altruism differently. For social psychology, altruism is an interaction between individuals, where individuals exhibit self-sacrifice for other individuals (MacDonald & She, 2015). Evolutionary biology defines altruism with respect to the individual's interaction with its environment, where each individual will exhibit self-sacrifice for the sake of the community's collective fitness as a whole (Earnshaw, 2014). Noting these two different definitions for altruism, this paper intends to critically analyze both the differences, and similarities of altruism through a variety of studied observing altruism between groups and individuals, and between human beings and other animals of the animal kingdom. Two studies cited in this paper, "Altruism Among Relatives And Non-Relatives" by Dr. Howard Rachlin, and Dr. Bryan Jones, and "Group selection and contextual analysis" by Dr. Eugene Earnshaw, use altruism differently for the sake of their tested hypothesis. For this paper, these two articles will be analyzed for their point of view with respect to altruism both for the individual, and for the community the individual would belong to. Utilizing other articles, testing a variety of hypothesis which all utilize altruism to some degree, this paper analyzes the physiological basis of altruism as well as how altruism acts as a positive density dependent trait to persist in a community. Altruism is also analyzed with respect to the individual interaction one would find between two individuals in a community, looking at the benefits one might acquire from exhibiting altruistic behavior. Finally, both definitions are brought together to note both the definitions and similarities between the two disciplines, ideally to eliminate any discrepancies that might exist between the two disciplines to promote collaboration.

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Introduction

Altruism is a pattern of behavior observed in human society, and in animal behavior studied in both social psychology and evolutionary biology. Both disciplines define the term “altruism” differently, shown in the studies and reports submitted for both disciplines where the difference in definitions show in how altruism is analyzed for either study. In social psychology, “altruism” is defined in how each individual exhibits self-sacrifice for other individuals (MacDonald & She, 2015). Here, importance is placed on person to person interaction with respect to altruistic behavior. In evolutionary biology, altruism is analyzed with respect to how each individual sacrifices their own individual fitness for the sake of benefitting the group as a whole (Earnshaw, 2014). As opposed to each individual interacting with other individuals within a community, evolutionary biology looks at how each individual will exhibit altruistic behavior for the improvement of the community as a whole.

For this paper, two studies were analyzed for how each uses altruism to research their respective hypotheses. These two studies “Altruism among Relatives and Non-Relatives” by Dr. Howard Rachlin and Dr. Bryan Jones, and “Group Selection and Contextual Analysis” by Dr. Eugene Earnshaw, utilize altruism in both contexts. “Altruism among Relatives and Non-Relatives”, analyzing the effect of kinship and social distance on monetary donation, looks at how willing participants are to make various monetary donations to other individuals based on how related they are to the individual as well as the social distance each participant would feel towards each individual, where decreased social distance equated to a closer social connection (Rachlin & Jones, 2008). This study looks at altruism in a case-by-case basis where each individual is performing an altruistic act in partaking in financial charity for another individual. “Group Selection and Contextual Analysis” is a study which looks at overall group fitness, with

altruism being another factor determining the overall fitness of a group of individuals. In this study, altruism is analyzed in tandem with other interactive behaviors, such as mutualism and spite, but with respect to how altruism influences the group as a whole (Earnshaw, 2014).

This paper intends to analyze how altruism is used in both social psychology and evolutionary biology to note differences, and commonalities between the two to potentially inspire a more cohesive environment between social psychology and evolutionary biology. To do this, both points of view will be analyzed through “Altruism among Relatives and Non-Relatives” by Dr. Howard Rachlin and Dr. Bryan Jones, and “Group Selection and Contextual Analysis” by Dr. Eugene Earnshaw to see where the two differ and where the two remain the same, utilizing other studies to draw further connection between the two viewpoints on altruism.

Literature Review

Altruism starts with cooperative behavior within a community. Here, community is defined as any group of individuals sharing the same major niche (Agarwal, Goyal & Qureshi, 2015). “Cooperative behavior” is then defined as behavior which benefits all members of a community. The article which details the definition for cooperative behavior further explains that this production of common goods for a community will often come at a cost to the producer (Houchmandzadeh, 2015). Cooperative behavior breeds social cohesion -- a tendency for individuals to help each other – which in turn allows the collective to be more adaptive than a group of individual organisms (Silva & Mace, 2014). This study builds a connection between cooperative behavior and social cohesion, noting a tendency for cooperative behavior to breed further cooperative behavior in the future.

The initial definition of “cooperative behavior” is found in another study looking at relative group size, and a tendency for individuals within each group to exhibit either selfish, or cooperative behavior. What this study finds is that larger groups will tend towards cooperative behavior whereas smaller groups will tend to exhibit more selfish behavior, displaying “inclusive fitness”, defined as the relative fitness of a community of individuals as a whole (Houchmandzadeh, 2015). This further connects cooperative behavior and inclusive fitness, noting a positive relationship between cooperative behavior, social cohesion, and inclusive fitness. Here, altruism is analyzed with respect to how an individual can work towards this increase in the group’s inclusive fitness through altruistic acts.

Other cooperative behaviors include commensalism and mutualism, with spite being present on the other end of the spectrum for possible interactions between organisms.

“Commensalism” is defined as any relationship between two organisms in which the individual performing the act acquires some benefit while the secondary individual accrues neither benefit, nor harm. The same source which defines “commensalism” also defines “mutualism” as any relationship between organisms in which both individuals acquire some benefit (Ames, Helms & Stoeckel, 2015). “Spite” is then defined in another source as any relationship between two organisms where both individuals will accrue some cost. This source then notes that this is typically found in vengeful behavior, or in punishments enacted on a secondary individual where the first individual will perform an act which harms the second, and the second will harm the first individual in response (Marlowe, Berbesque, Barrett, Bolyanatz, Gurven & Tracer, 2010). These definitions, however, look at each relationship with respect to individuals acting on individuals as opposed to individuals having some influence on a community.

On an individual level, altruism is analyzed with respect to reputation and reciprocity. One article, looking at reputation and a tendency to exhibit altruistic behavior, found a positive connection between the two, suggesting a positive correlation between the standing an individual would have in a community, and that individual’s willingness to exhibit altruism. The article further defines reputation to include influence, status, and social interaction as key factors, and potential benefits to exhibiting altruistic behavior as better reputation will equate to more of this influence, status, and social interaction (Raihani, 2014). Reciprocity is then defined as this tendency between individuals to share and exchange resources and services (Silk, Brosnan, Henrich, Lambeth & Shapiro, 2013). Reputation leads to reciprocity, which leads to social cohesion and further cooperative behavior.

Further benefits of altruistic behavior are analyzed in another study, finding a connection between biological familiarity and a likelihood to exhibit altruistic behavior (Dede & Ayranci,

2014). Others have found that kinship, the biological relationship one would find between two blood relatives, predicts altruistic tendencies (Kurvers, Adamczyk, Kraus, Hoffman, Van Wieren, Van der Jeugd, Amos, Prins & Jonker, 2013). “Relatedness”, a synonym for “kinship”, is defined as the genetic similarity between two individuals (Ciarmiello, Piccirillo, Carillo, De Luca & Woodrow, 2015). This connection between kinship and cooperative behavior was further supported by a study on Chimpanzees which found a positive correlation between cooperative behavior and relatedness (Silk, Brosnan, Henrich, Lambeth & Shapiro, 2013).

Another benefit of altruistic behavior is found in mutual cooperation, where only mutually cooperative behavior will yield a benefit for both individuals. In the context of The Prisoner’s Dilemma, individuals exhibited these cooperative behaviors even for complete strangers (Zhang, Gao, Wang & Liu, 2014). Albert Tucker developed The Prisoner’s Dilemma as a social thought experiment utilized for analysis of cooperative behavior (Tucker, 1950). Albert Tucker described the thought experiment as a dilemma noting the possibility for cooperative and selfish behavior between two individuals. In this dilemma, named after the hypothetical situation of two prisoners being interrogated for the same crime, each individual can either give the other up, which exhibits selfish behavior, or remain quiet, which then exhibits cooperative behavior. Another study, looking more at mutualistic behavior, forms a connection between social learning and cooperative behavior, where participants tend to exhibit more cooperative behavior as they’re able to learn which of the decks utilized within the study will maximize a reward for both themselves and a charity. The connection this study then makes to altruism is that each individual was tested for their willingness to exhibit altruistic behavior in a survey involving hypothetical situations with altruistic, mutualistic, and selfish choices for a response. In the study it was observed that individuals who were more likely to make deck

choices benefitting local charities over themselves were more likely to engage in pro-social behavior, as noted in self report, though overall reward learning did not have a predictive relationship with individual pro-social behaviors. The final conclusion of this study was that individual altruistic tendencies were associated with this bias towards social rewards (Kwak, Pearson & Huettel, 2014).

With respect to biology, altruism is often analyzed with respect to fitness, whether it's individual, or inclusive. "Individual fitness", defined as a single organism's ability to survive in a certain environment to reproductive success, differs from "inclusive fitness", as defined above, in the former's focus on the individual as opposed to the later's focus on the group (Li, Lu, Yang, Kong & Deng, 2015). Altruistic behavior, by definition, decreases an organism's individual fitness. By itself, altruism would then be considered a maladaptive trait, a trait which hinders an organism's likelihood to survive to reproductive success in a particular environment (Ma, Pannebakker, Beukeboom, Schwander & Van de Zande, 2014). This would explain evolution biologists analyzing altruism with respect to inclusive fitness, as well as the benefits that would be gained in exhibiting such a maladaptive trait. With these benefits, altruism could be an adaptive trait, a trait which enhances an organism's likelihood to survive to reproductive success in a particular environment (Li, Lu, Yang, Kong & Deng, 2015). And as noted above, Houchmandzadeh (2015) found a positive correlation between cooperative behavior and inclusive fitness.

With altruism being present in community interaction, as opposed to just between two individuals, altruism can be analyzed as a trait which follows all of the basic rules of population genetics. In population genetics, density dependence is the tendency for the success of a particular trait to be based on the abundance of that trait within a community. Positive density

dependence is a tendency for the relevant trait to succeed the more the trait is present within the community. Negative density dependence has the opposite relationship: the trait tends to flourish when there are only a few individuals exhibiting that trait within the community (Mugabo, Perret, Decencière, Meylan & Le Galliard, 2015). The finding of a positive correlation between population size and cooperative behavior (Houchmandzadeh, 2015) suggests that altruism is a positive density dependent trait. The mechanism for this positive density dependence might be social control: individuals within the community could react to other individuals based on observing altruism and other variations of cooperative and selfish behavior. One study, analyzing the differences between altruistic and selfish behavior within communities, found a third behavioral type reacting to the altruistic, and selfish individuals observed in the study. This third behavioral type was distinguished as discriminatory behavior, where some individuals within the population would be able to recognize the altruistic members of their community, and predominantly help those members of their community over the more selfish individuals (Silby & Curnow, 2012). This tendency for selection, whether on an individual or group level, is also noted in another study, analyzing a method of testing for individual, or group selection, with respect to altruistic behavior (Earnshaw, 2014). In this study, the “Price approach” is analyzed for its effectiveness of differentiating between individual selection, and group selection. The final conclusion of this study was that altruism is a trait influenced by selective control, though specific layers between the individual and the community are difficult to distinguish, at least utilizing the approach noted above. In this study, altruism is less the primary concern of analysis, and more an established example of a trait subject to multiple levels of selection, which were the primary concern of analysis.

The next question is whether altruism is due to a trait that can be found in an individual's biology as opposed to being based purely in an individual's psychology. One study, analyzing neural patterns and altruistic behavior did find a connection between extreme altruistic behavior and common neural activity, where individuals willing to exhibit extreme altruistic behaviors will show similar neural patterns (Marsh, Stoycos, Brethel-Haurwitz, Robinson, VanMeter & Cardinale, 2014). The difference between an individual's physiology, and behavioral patterns then introduces nature vs. nurture. "Nature" exhibits an individual being driving by internal mechanism and structure, which in biological terms would be the individual's genetics and physiology. "Nurture", defined by the same source, is then an observable trait or behavior that's based on the individual interacting with the environment during the course of their life (Gruber, 2013). Though nature and nurture are defined in two different ways, the truth is that the two influence each other as opposed to nature and nurture being two distinct origins for a trait. In truth, the way an individual reacts to its environment will influence that individual's physiology, to include their neural structure, which means the correlation found between extreme altruistic behavior, and similar neural patterns doesn't prove that altruism is a trait based purely on an individual's physiology. What this study does conclude, however, is simply that altruism can be found in an organism's physiology, and neural patterns (Marsh, Stoycos, Brethel-Haurwitz, Robinson, VanMeter & Cardinale, 2014).

This connection between social psychology and evolutionary biology is supported by Dr. Rachlin, and Dr. Jones' work in "Altruism among Relatives and Non-Relatives". In this study, participants were asked for their willingness to participate in financial charity based on social distance and biological relatedness. What was observed was that these individuals would tend to give more financial charity to individuals who displayed favorable social distance, where the

closer the individual was, socially, to the participant of the study, the more the participant would be willing to partake on the financial charity. Furthermore, biological relatedness had a positive correlation with charity as the participants would also be more willing to partake in the charity if the individual in question was related to them. What was found was that even if two of the individuals were of the same social distance, more financial charity would be given to the individual with more biological relation (Rachlin & Jones, 2008). The important factor of this study was that altruism was presumed to act as a trait found in evolutionary biology, where altruism is a trait founded in the biological, or social benefits one might gain from exhibiting such behaviors, though the behavior itself was analyzed on an individual basis, similar to how social psychologists will analyze altruism. Though the two disciplines will define, and analyze altruism differently, there are key similarities that could give common ground for future collaboration and research.

Altruism: Evolutionary Biology

In evolutionary biology, altruism is viewed by the self-sacrifice an individual within a community can make for the sake of the community as a whole. This definition of altruism is provided by Dr. Eugene Earnshaw (2014) in “Group Selection and Contextual Analysis.” In this article, Dr. Earnshaw looks at Multilevel-Selection 1 (MLS 1) and Multilevel-Selection 2 (MLS 2). MLS 1 holds that selection occurs on each individual within the community separately, where the inclusive fitness is an average of the collective fitness’ of each individual. In MLS 2, however, the community has its own fitness level, measured in the group’s collective ability to survive and reproduce from generation to generation. In MLS 1, individual fitness has importance as each individual within the community has their own fitness level, which translates into an independent success rate of survival and reproduction while MLS 2 puts importance on inclusive fitness, where the fitness of each individual is actually determined by this collective fitness determining inclusive fitness.

Altruism would then fit in both MLS 1 and MLS 2 since each individual is sacrificing their own individual fitness for the sake of increasing the inclusive fitness of the group. The specific observation in Dr. Earnshaw’s article is that, often, statistical analysis of independent causal events between MLS 1 and MLS 2 is impossible (Earnshaw, 2014). What this observation means for altruism is that it’s a more fluid relationship between the individual and the community than it is a divisible relationship between each individual with each other, which then translates into inclusive fitness. Unfortunately, this could mean either that current methods of analysis are ineffective in dividing this relationship between individuals, or that such a division is impossible. Though Dr. Earnshaw’s final conclusion is that such a division is impossible, this is where this paper would intend to draw a connection between altruism as

defined by evolutionary biology, and altruism as defined by social psychology, as social psychology will analyze altruism with respect to that individual relationship concluded to be impossible.

Dr. Earnshaw does discuss altruism with respect to individual interacting with individual, clarifying the terminology to be on the same spectrum as mutualism and spite, though this discussion is more to note that altruism is an interaction between individuals, which then equates to an effect on the community as a whole. Here, altruism isn't merely analyzed with respect to individuals acting on individuals, altruism is analyzed with respect to what these individual relationships mean for the group. Individuals are altruistic, however, a group is one made up of altruists, which is the more important distinction when analyzing relative fitness. This distinction of altruism, however, as a relationship between individuals is still equated to the effect on the community as a whole. This relationship between altruism and the community as a whole, in fact, is concluded to be a fluid connection between altruism and the community, as it's concluded in the article that the overall evolutionary change of the group cannot be measured as additive forces of individual fitness forming an equation to yield the inclusive fitness of the group (Earnshaw, 2014). With respect to MLS 1 and MLS 2, altruism would then be seen with respect to the fitness suggested by each model. MLS 1 would have altruism defined in terms of individual fitness whereas MLS 2 would have altruism as a trait of the group as a whole. In MLS 2, altruism would then range between weak, and strong, where the group exhibits stronger collective altruism with more individuals in the group exhibiting altruistic behavior. On a group level, altruism would then be seen as an adaptive trait, as each individual isn't sacrificing their own individual fitness, but adding to the inclusive fitness of the group, which then equates to their own success through group selection.

The view evolutionary biology has on altruism, expressed in Dr. Earnshaw's article, is perhaps due, then, to the maladaptive nature of individual altruism, where an individual is sacrificing their own individual fitness for the sake of increasing the individual fitness of another individual. Altruism acting as a positive density-dependent trait would then make sense, since altruism would then be studied with respect to the effect on a community as a whole as opposed to being a trait studied between individuals. The conclusion Dr. Earnshaw made in his article, where it's impossible to differentiate between MLS 1 and MLS 2, at least statistically, would also make sense since MLS 1 would analyze altruism on an individual basis, where altruism is being analyzed in an environment where altruism wouldn't be expected to flourish, in an environment where only a few individuals exhibit altruistic behavior (Earnshaw, 2014). According to MLS 1, altruism would remain a maladaptive trait to be selected against, even within a community. MLS 2 would then analyze altruism in an environment where it would flourish as a positive density dependent trait, since MLS 2 would analyze altruism with respect to the other altruistic individuals within the community. Here, altruism would be analyzed as an adaptive trait. This difference between the adaptive, and maladaptive nature of altruism could also explain the requirement for altruism to be analyzed with respect to the effect altruism would have on a community as a whole as opposed to the specific interactions each individual would have with other individuals within that community.

Altruism: Social Psychology

In social psychology, altruism is studied with respect to each individual's self-sacrifice for the sake of another individual, as shown in a number of research studies within the field of social psychology. As defined, altruism is then the self-sacrifice an individual will make for the sake of others (MacDonald & She, 2015). In Dr. Rachlin and Dr. Jones' article entitled "Altruism among Relatives and Non-Relatives", altruism is studied with respect to how willing individuals are to participate in financial charity, depending both on genetic relatedness, and social distance. Each participant in the study was asked about participating in financial charity, specifically with respect to how much money each participant would be willing to forego, depending on the individual who would be receiving the charity. This fits the definition given for altruism in social psychology as each participant is asked to exhibit altruistic behavior for another individual, as opposed to participating in charity for the sake of a group, or community.

In this study, participants are asked to participate in self-sacrifice, in foregoing financial gain, for the sake of providing financial gain for another individual. The observed variables in this study were social distance, and biological relatedness, based off of a key principle in biology where traits and genes cannot flourish within a population while proving to be maladaptive (Rachlin & Jones, 2008). When observed on an individual basis, altruism is a maladaptive trait, discussed in the previous section on evolutionary biology, which suggests that altruism, as a trait, shouldn't be able to flourish within a population. Dr. Rachlin and Dr. Jones, therefore, came up with the hypothesis that altruism is then a trait which came about to aid in social connection, and biological fitness (Rachlin & Jones, 2008).

As noted in the hypothesis in the study, the cost that would be suffered in participating in altruistic behavior would then be overwritten by the benefits that would be acquired in the nature

of the individual the altruistic act was done for. If the individual in question is a social acquaintance, with close social distance, then the sacrifice would be outweighed by the benefit of reciprocity in social connection helping each other out, whether consciously, or subconsciously (Rachlin & Jones, 2008). The principle of reciprocity between friends would then be the difference between being willing to spend time and effort in helping a friend who may have already helped you as opposed to someone you've barely just met, or even a complete stranger. With respect to biological relatedness, the other half of the hypothesis notes that helping a relative will outweigh the sacrifice of altruistic behavior if doing so will ensure that your genetic relatives are able to survive to reproduction, passing on your genetic material. The article also predicted that as genetic relatedness increased, so would the willingness to participate in altruistic behavior, as it would then be more beneficial to aid an individual who would pass on more of your genetic material than someone who would only pass on a small fraction of that genetic material (Rachlin & Jones, 2008).

Though Dr. Rachlin and Dr. Jones analyze altruism with respect to individuals acting on individuals, the article analyzes altruism with respect to biology as well. The relation to social psychology is in the fact that altruism is observed between individuals as well as observed between social acquaintances on a scale of social distance, ranging between close friends to total strangers. Here, altruism is assumed to have maladaptive qualities when observed between individuals, giving rise to the hypothesis of altruism increasing with increased social connection, or biological relatedness, however, the individual interactions are still quantified to note correlation. The conclusions drawn from this article, based on the empirical data observed in the study, were that there was a positive correlation between financial charity given to the individual, and how socially connected the participant felt towards the individual in question. With respect

to biological relatedness, this positive correlation between financial charity and biological relatedness was also observed, noting the genetic differences one would find between siblings and cousins. Furthermore, comparing the two variables of social distance and biological relation, it was also observed that participants would be more willing to exhibit altruistic behavior for relatives over individuals who only had some social distance with the participant (Rachlin & Jones, 2008).

In contrast to how altruism was analyzed in Dr. Earnshaw's paper on inclusive fitness and individual fitness, Dr. Rachlin and Dr. Jones analyzed altruism on an individual basis, looking at individuals interacting with other individuals. In the analysis of altruism, Dr. Rachlin and Dr. Jones then equate altruism to self-control as opposed to a universal trait held by an individual. Instead of altruism being a general personality trait exhibited by everyone, altruism is then a measure of risk vs. reward on par with choosing how to ration one's time, where self-sacrifice is the resource in question. Participants are then more willing to ration their ability for self-sacrifice for individuals who might either reciprocate the favor in the future, or equate to increased biological fitness in the individual having a biological relation to the participant, where the individual then has a better chance of indirectly passing on the participant's genetic material (Rachlin & Jones, 2008). As opposed to individuals sacrificing for the sake of the group, as analyzed in evolutionary biology, individuals are then sacrificing for the sake of an increased, or equivalent return, relating to individual fitness.

The implication for altruism would then be less that altruism is a strictly maladaptive trait, even in individuals interacting with other individuals, but an inherently adaptive trait based on the other individual in question. Though the individual act itself would still be considered maladaptive, in the fact that the participant is sacrificing themselves, the effect that would be

observed later on would be the force that renders the original altruistic act as adaptive. Since an effect isn't guaranteed, however, there would have to be a judgment of risk vs. reward determining the final decision to act. In evolutionary biology, the risk vs. reward of giving to your community is more guaranteed to come out positive than the risk vs. reward for sacrificing yourself for another individual, meaning it's more beneficial to sacrifice yourself for the sake of the group as opposed to sacrificing yourself for the sake of another individual, which might explain the tendency to view altruism as that sacrifice made for the collective. In social psychology, the risk vs. reward of sacrificing one's self for another individual is based on reality, as altruism is observed between individuals as well as between an individual and a group.

Similarities

In this paper, two articles were analyzed for their analysis of altruism based on the definition that would be given by their respective disciplines. In social psychology, altruism is defined as self-sacrifice for the sake of others (MacDonald & She, 2015). For this definition of altruism, the article “Altruism among Relatives and Non-Relatives” by Dr. Rachlin and Dr. Jones was analyzed for the use of altruism as an act done between two individuals, specifically in participants giving financial charity to other individuals based on social distance and biological relation (Rachlin & Jones, 2008). Evolutionary biology defines altruism as the self-sacrifice an individual makes for the good of the community the individual belongs to (Earnshaw, 2014). Dr. Earnshaw’s article entitled “Group Selection and Contextual Analysis” was analyzed for this definition of altruism, as the article goes over the differences between individual, and inclusive fitness with respect to selection, using altruism as the primary example of a trait influencing both inclusive, and individual fitness (Earnshaw, 2014).

Both “Altruism among Relatives and Non-Relatives” and “Group Selection and Contextual Analysis” analyze altruism as a biological trait that follows the same basic principles exhibited by other traits. This biological basis of altruism is supported by a study analyzing neural patterns, discussed in the literature review, noting a positive correlation between a willingness to exhibit altruism, and a similarity in brain wave patterns, suggesting a physiological bases for the behavior. This biological basis supports a comparison between social psychology and evolutionary biology as the study was conducted using examples of altruistic behavior as defined by social psychology even though a biological basis for altruistic behavior was what was found (Marsh, Stoycos, Brethel-Haurwitz, Robinson, VanMeter & Cardinale, 2014).

Furthermore, both studies also recognize the maladaptive nature of altruism when analyzed between individuals. Dr. Earnshaw uses this maladaptive nature to note that altruism influences inclusive fitness as a whole rather than differentiating instances of individual fitness, which then add up to the inclusive fitness of the group (Earnshaw, 2014). Dr. Rachlin and Dr. Jones, however, used this maladaptive nature of individual altruism to note a potential connection between the social connection and biological relationship of the individual in question and each participant's willingness to exhibit altruistic behavior. The final conclusion of this study was that an observable, positive correlation could be found between a willingness to exhibit altruistic behavior, and both the social distance, and biological relation of the individual in question, with a third relationship being found that noted an increased willingness to exhibit altruistic behavior for family members over individuals who simply had some social distance to the participant (Rachlin & Jones, 2008).

These two studies, "Altruism among Relatives and Non-Relatives" and "Group Selection and Contextual Analysis", analyze altruism under different definitions, though both also note important implications for altruism which could lead to an increased understanding to how altruism works. Dr. Rachlin and Dr. Jones' work on individual altruism found an insightful relationship between biological relatedness and social distance, and a willingness to exhibit altruistic behavior on an individual basis (Rachlin & Jones, 2008). Dr. Earnshaw noted a relationship between altruism, and inclusive fitness, where it's difficult, concluded impossible, to differentiate selection on an individual level, and equate these individual events influencing individual fitness to the inclusive fitness of the population as a whole (Earnshaw, 2014).

When analyzing these two studies together, some insight can be seen on how altruism works between the individual, and the community the individual belongs to. Dr. Rachlin and Dr.

Jones found a connection between social distance and biological relation, and altruistic behavior, which might translate into how other animals exhibit altruistic behavior as well (Rachlin & Jones, 2008). If this relationship can prove to be a constant between all forms of life, “altruism”, as defined in evolutionary biology, could then incorporate this relationship when analyzing individual fitness in exhibiting altruistic behavior. If further studies could then be done analyzing altruism on an individual, and a population-wide scale, altruism could be analyzed in human behavior with respect to inclusive fitness, giving insight to the discipline of social psychology. If altruism can be seen as a behavioral trait that can be analyzed, and studied, under the same principles and definitions between evolutionary biology and social psychology, further insight can be found in both human psychology and ecology.

Conclusion

In this paper, altruism was analyzed with respect to how the term is defined in both social psychology, and evolutionary biology. Specifically, social psychology defines altruism as self-sacrifice made for the sake of another individual (MacDonald & She, 2015). Evolutionary biology then defines altruism as the self-sacrifice one makes to the aid of their group as a whole (Earnshaw, 2014). This difference between the individual, and the group, called attention to the difference between individual, and inclusive fitness, and the implications altruism would have on either. Though both disciplines view altruism differently, if a connection can be found in analyzing altruistic behavior, particularly linking altruism to both the group, and the individual, it's possible for both disciplines to be able to utilize, and study altruism in the same way.

Dr. Earnshaw, with his article entitled "Group Selection and Contextual Analysis", analyzed the differences between inclusive, and individual fitness, using altruism the trait in question for an individual interacting with either another individual, or the group as a whole. In this article, Dr. Earnshaw goes over the statistical analysis of individual fitness, calling attention to the idea that individual altruism is a maladaptive trait when individuals only interact with other individuals. In the article, it's concluded that the individual events which influence individual fitness are impossible to quantify as additive forces equating to the inclusive fitness of a group, which means the inclusive fitness of a group is a more fluid process than just the additive nature of individual fitness, which then suggests that altruism works on the group level as well as the individual level within a community (Earnshaw, 2014).

Dr. Rachlin and Dr. Jones, with their article entitled "Altruism among Relatives and Non-Relatives", analyze altruism on an individual basis, with participants engaging in altruistic behavior with other individuals, utilizing the definition for altruism given in social psychology.

Here, the connection is made between social distance, biological relation, and altruism, in the positive correlation observed between both an ideal social distance and increased biological relation, and a willingness to exhibit more altruistic behavior, found in giving more financial charity during the study. Furthermore, the positive correlation was observed between both variables, where participants were willing to give more to biological relatives than individuals with no biological relation, yet the same social distance (Rachlin & Jones, 2008). Here, the connection is found between social connection and biological relationship, despite the altruistic behavior being exhibited between individuals. If this positive correlation between social distance, biological relation, and altruism can be strengthened, evolutionary biologists can conduct further studies utilizing this relationship to be able to analyze altruism with respect to individual and inclusive fitness.

Though altruism is defined differently between the two disciplines, I feel it's more than possible for the field of social psychology and evolutionary biology to be able to find similarity in how altruism can be studied, and analyzed. As shown in both "Altruism among Relatives and Non-Relatives" and "Group Selection and Contextual Analysis", altruism is a biologically implicit trait which follows numerous principles in population genetics and evolutionary biology, even when studied with respect to individual fitness as opposed to inclusive fitness. Given the physiological basis of altruistic behavior, the correlation between individual altruism, social distance, and biological relationship, and the potential connection between altruism and inclusive and individual fitness, further research might be able to bring the two definitions of altruism closer together in meaning. If altruism can be viewed, and analyzed the same between both evolutionary biology and social psychology, both disciplines could then provide insight to further understanding of human psychology and evolutionary biology.

Appendix A: Glossary

Adaptive trait-	A trait which allows an organism to survive to reproductive success in a particular environment (Li, Lu, Yang, Kong & Deng, 2015).
Altruism (evolutionary biology)-	An act in which an individual sacrifices their own fitness for the benefit of the group as a whole (Earnshaw, 2014).
Altruism (social psychology)-	Self-sacrifice for the sake of others (MacDonald & She, 2015).
Commensalism-	A relationship between two organisms whereas the individual performing the act acquires some benefit while the secondary individual accrues neither benefit nor harm (+/0) (Ames, Helms & Stoeckel, 2015).
Community-	A group of individuals who share the same major niche time (Agarwal, Goyal & Qureshi, 2015).
Cooperative Behavior-	Behavior which benefits all members of the community (Houchmandzadeh, 2015).
Density Dependence-	When the success of a trait depends on its relative abundance in a community, either positive or negative (Mugabo, Perret, Decencière, Meylan & Le Galliard, 2015).

Density Dependence (Negative)-	When a trait is able to flourish within a community only when there are a few individuals exhibiting the trait within the community (Mugabo, Perret, Decencière, Meylan & Le Galliard, 2015).
Density Dependence (Positive)-	When a trait is able to flourish within a community the more it's present within that community (Mugabo, Perret, Decencière, Meylan & Le Galliard, 2015).
Discriminatory Behavior-	When an altruist is able to recognize, and primarily help their altruistic relatives within a community (Silby & Curnow, 2012).
Inclusive Fitness-	The relative fitness of a community as a whole (Houchmandzadeh, 2015).
Individual Fitness-	A single organism's ability to survive to reproductive success in a certain environment (Li, Lu, Yang, Kong & Deng, 2015).
Kinship-	The genetic relationship between two individuals (Kurvers, Adamczyk, Kraus, Hoffman, Van Wieren, Van der Jeugd, Amos, Prins & Jonker, 2013).
Maladaptive trait-	A trait which hinders an organism's likelihood to survive to reproductive success in a particular environment (Ma, Pannebakker, Beukeboom, Schwander & Van de Zande, 2014).

Mutualism-	A relationship between two organisms where both organisms benefit from the association (+/+) (Ames, Helms & Stoeckel, 2015).
Nature-	When an individual is guided by internal mechanism and structure [physiology] (Gruber, 2013).
Nurture-	When an observable trait, or behavior comes from an individual's experience in interacting with the environment (Gruber, 2013).
Reciprocity-	A tendency for individuals to exchange resources and services (Silk, Brosnan, Henrich, Lambeth & Shapiro, 2013).
Relatedness-	How genetically similar two individual organisms are to each other (Ciarmiello, Piccirillo, Carillo, De Luca & Woodrow, 2015).
Reputation-	The standing an individual has within a community that determines the individual's influence, status, and the likelihood for interaction with other members of the community (Raihani, 2014).
Social Cohesion-	A tendency for individuals to help each other in a community (Silva & Mace, 2014).

- Social Distance- How close an individual feels towards another individual in the same community (Rachlin & Jones, 2008).
- Spite- A relationship between two organisms where both organisms accrue some cost to the association, typically found in the presence of punishment, and retaliation for a wrongdoing having been committed on either individual (Marlowe, Berbesque, Barrett, Bolyanatz, Gurven & Tracer, 2010).
- The Prisoner's Dilemma- A dilemma formulated which describes a possibility for two individuals to either exhibit cooperative, or selfish behavior towards each other with the effects that might come about from whichever behavior the individuals choose, grounded in the example of two prisoners being interrogated for the same crime, where either can either give the other up, exhibiting selfish behavior, or stay quiet, exhibiting cooperative behavior (Tucker, 1950).

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