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Inclusive Fitness, Reciprocal Altruism and Emotion: Testing a Social-Functional Model of Anger and Gratitude Across Kin and Non-Kin Relationships

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A thesis submitted in partial fulfillment of the requirements for the Doctor of Philosophy degree in Psychology

INCLUSIVE FITNESS, RECIPROCAL ALTRUISM AND EMOTION: TESTING A SOCIAL-FUNCTIONAL MODEL OF ANGER AND GRATITUDE ACROSS KIN AND NON-KIN RELATIONSHIPS

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Abstract

Guided by the theories of inclusive fitness (Hamilton, 1964) and reciprocal altruism (Trivers, 1971), two studies tested hypotheses related to the notion that emotions are part of an evolved psychological system that functions, in part, to regulate social exchange. Emotional experience and exchange behaviors were predicted to vary based on both the structure of the situation and the type of relationship one has with a partner. Due to an absence of inclusive fitness effects, interaction with non-kin (compared with kin) exchange partners was expected to trigger more intense emotional responses. Study 1 found that, as expected, unfair offers led to feelings of anger, but more so for non-kin partners compared to kin partners. Similarly, fair offers led to feelings of gratitude, but more so for non-kin partners. Study 2 used a 3 (emotion induction: anger, gratitude, control) by 4 (relationship partner: stranger, friend, cousin, sibling) by 2 (social dilemma task: take-some, give-some) experimental design and found evidence in support of the prediction that emotions are more likely to influence exchange behaviors with non-kin partners compared with kin partners. This research extends the social-functional approach to emotions into the context of evolutionary social psychological theory.

Keywords: Evolutionary psychology, Emotion, Inclusive fitness, Reciprocal altruism

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Inclusive Fitness, Reciprocal Altruism and Emotion: Testing a Social-Functional Model of Anger and Gratitude Across Kin and Non-Kin Relationships

Close relationships are defined by the causal interconnections between thoughts, feelings, and behaviors between individuals across time (Kelley, et al., 1983; Kelley & Thibaut, 1978). This interdependence leads to subjective experiences within relationship contexts that are based on a complex set of factors that include self-, partner-, and relationship-based influences. One way to organize and model interdependence processes is to examine the structure and function of social emotions. At a dyadic level of analysis, emotional expressions help to inform relationship partners of situation-relevant beliefs and intentions, which in turn leads to rapid coordination of social interaction. This coordination is often facilitated by the evocation of complementary and reciprocal emotions in others (Keltner & Haidt, 1999). As such, emotions act as powerful proximal motivators in social situations. When viewed from a social functional perspective, emotions provide insight into the means by which social bonds are forged, regulated, and maintained (Keltner & Haidt, 1999; Keltner, Haidt, & Shiota, 2006). Within this framework, emotions like anger and gratitude are understood as part of information-processing programs that potentiate thoughts and behaviors that helped solve adaptive problems faced by our hunter-gatherer ancestors (Nesse, 1991; Tooby & Cosmides, 1990; Tooby & Cosmides, 2008).

Guided by evolutionary theory, the current research tested the general notion that emotional experience varies based on both the structure of the situation and the type of relationship one has with a partner. Specifically, interaction with non-kin is predicted to be associated with a pattern of more intense emotional response compared to interaction

with kin in the presence of situational cues related to breaches of equity and reciprocity. Once triggered, these emotions are predicted to be more likely to influence exchange behaviors with non-kin partners compared to with kin partners. These predictions follow from the proposition that emotions are part of an evolved psychological system that regulates reciprocal altruism--a system that is not necessarily required to police exchange between kin (Hamilton, 1964; Trivers, 1971).

Evolution and Social Psychology

Charles Darwinôs (1859) theory of evolution by natural selection is foundational for biologists, and is now beginning to guide the study of human behavior within the field of psychology. The goal of evolutionary psychology is to map a universal human nature by integrating psychology with principles from other fields such as biology, cognitive science, anthropology, and neuroscience (Tooby & Cosmides, 2005). This process of consilience is a movement that has promise for bridging the gap between social science and the natural sciences by exploring the ultimate causes of human behavior using evolutionary theory.

There are three main components to the theory of natural selection: variation, inheritance, and selection (Darwin, 1859; Maynard Smith ,1958; Williams, 1966). Variation refers to differences in the attributes of individuals within a species (e.g., height, eye color, immune response, etc). Only the variable traits that are inherited (i.e., passed on reliably from parents to their offspring via genes) are subject to the evolutionary process. Selection refers to the differential reproductive success achieved by individuals because of the heritable variant traits that help with tasks associated with survival or reproduction. Over time, the traits of reproductively successful individuals

will occur with greater frequency in the population. The measure of an individual's direct reproductive success in passing on genes to offspring is referred to as *classical fitness*.

Although powerful and elegant, Darwinôs original theory was unable to account for some observed phenomena such as altruistic behavior among humans. How could natural selection have favored behavior that reduces personal fitness (i.e., survival and reproduction of offspring)? William Hamilton (1964) provided a theoretical contribution that was able to solve this putative paradox. Hamiltonôs *inclusive fitness theory* takes a ñgeneôs eye viewò in that it conceptualizes fitness as the sum of an individualôs personal reproductive success (i.e., fitness in the classic Darwinian sense) plus the effects the individualôs actions have on the reproductive success of his or her genetic relatives. Using this enhanced evolutionary framework, Hamilton reasoned that altruism could have evolved if the fitness-related costs (*c*) to the altruist were smaller than the benefits (*b*) realized by the recipient, discounted by the degree of genetic relatedness between the two parties (*r*). He formalized this relationship into an inequality commonly referred to as Hamiltonôs Rule: $c < rb$. Armed with this new idea, scientists were now able to include altruistic behavior under the umbrella of evolutionary theory.

Inclusive fitness theory has received considerable empirical support in non-human samples (Trivers, 1985), and has also more recently shown promise for explaining human social behaviors. The majority of this work has been guided by a set of theories derived from inclusive fitness theory by Robert Trivers: the theory of reciprocal altruism (1971), the theory of parental investment (1972), and the theory of parent-offspring conflict (1974). These theories share the common element of outlining zones of cooperation and conflict between individuals based on the variables from Hamilton's rule.

The *r* from Hamilton's rule refers to the probability that two individuals share a particular allele based on common ancestry (Krebs, 1987; Mealey, 1985). An allele is one of two or more forms of a gene at a specific locus in a DNA sequence. The degree of relatedness is probabilistic and may vary between any two individuals, but has a reliable pattern within a population. Specifically, classes of kin have the following relatedness coefficients: siblings .50, parents with children .50, grandparents with grandchildren, .25, aunts/uncles with nieces/nephews .25, half siblings .25, first cousins .125, and second cousins .0625 (Buss, 2004).

Inclusive Fitness and Human Behavior

Evidence from studies using a wide variety of samples and methods points to human behavior conforming to expectations derived from inclusive fitness theory. In one of the earliest of these studies, Essock-Vitale and McGuire (1985) examined helping behaviors using a sample of 300 white, middle class adult women aged 35 to 45 living in Los Angeles. Their structured interviews showed that major help was significantly more likely to come from kin than non-kin, and the help that came from kin was more likely to come from close kin (i.e., individuals with higher *r*). They also found that help was more likely to flow from individuals who are older and have more resources than in the opposite direction. These findings illustrate how the costs and benefits to individuals involved in helping behaviors vary in a manner consistent with the tenets of inclusive fitness theory.

Smith, Kish, and Crawford (1987) analyzed archival records of wills in British Columbia to test the hypothesis that people will give more of their wealth to close kin relative to distant kin. As predicted, this study found declining disbursement with

decreasing levels of genetic relatedness, with 46% of estates bequeathed to relatives sharing 50% of their genes, 8% bequeathed to relatives sharing 25% of their genes, and less than 1% bequeathed to relatives sharing 12.5% or less of their genes. A similar pattern of results have been found in a laboratory studying examining dispersal of imagined lottery winnings (Webster, 2003).

Burnstein, Crandall, and Kitayama (1994) conducted a series of studies using hypothetical scenarios that examined the extent to which decision rules for altruism conform to inclusive fitness theory. Participants were asked to report how likely they would be to help family members with various attributes (e.g., age, sex, health) after considering hypothetical scenarios of need (e.g., everyday helping, life-or-death situations). As expected, the authors found that participants were generally more likely to help kin as genetic relatedness increased. Interestingly, this result proved especially strong when comparing scenarios requiring help in a life-or-death situation versus help required in an everyday situationð but only for younger and healthier kin. Helping in the everyday scenario was not affected by age or health. This finding makes sense when viewed from an inclusive fitness theory perspective. In situations where a family memberôs life is in danger, psychological mechanisms involved in the distribution of altruistic behavior should consider cues that approximate higher reproductive value because this is important information related to increasing inclusive fitness.

Inclusive fitness theory is not a psychological theory per se, but given the fact that it does help explain patterns of helping behaviors, there are likely to be a set of proximal psychological mechanisms through which inclusive fitness effects operate. At this point, there has unfortunately been very little research designed to examine the mediators of

genetic relatedness on helping decisions. One construct that has been investigated is emotional closeness (i.e., feelings of concern and caring). Korchmaros and Kenny (2001) asked participants to make hypothetical high risk life-or-death helping decisions for five or more family members and found that the relation between genetic relatedness and willingness to help decreased by 33% when emotional closeness was included in the model. A follow up study by Korchmaros and Kenny (2006) built on this finding and showed that the link between genetic relatedness and emotional closeness is mediated by propinquity (Festinger, Schachter, & Back, 1950), perceived similarity (Byrne, 1961), and exposure and interaction (Saegert, Swap, & Zajonc, 1973).

Kruger (2003) integrated the proximal constructs of empathic concern (Batson, Sager, Garst, Kang, Rubchinsky, & Dawson, 1997) and self-other overlap (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997) into a model of kin helping. Similar to Korchmaros and Kenny (2001), Kruger (2003) found indirect effects of these constructs on the link between genetic relatedness and intentions to help in hypothetical life-or-death situations. The majority of the unique variance accounted for by genetic relatedness, however, was not accounted for by these proximal mechanisms. In other words, there remain unspecified mediators operating on this relation.

These findings, and several others (for reviews see Burnstein, 2005; Kurland & Gaulin, 2005), represent a body of empirical evidence supporting the notion that altruistic behavior among kin is predictable from the tenets of inclusive fitness theory. But what about altruism when the *r* is removed from Hamiltonôs rule ($c < rb$)? Outside of kin relationships, cooperative behavior results in a cost to the altruist and a gain to the

recipient that is not offset by the degree of shared genetic material. Thus, we are once again faced with the paradox of altruism.

Cooperation Beyond Kin

Various evidence of altruistic behavior directed to non-kin exists for humans (Brown, & Brown, 2006; Caporael, Dawes, Orbell, & van de Kragt, 1989), and for other species as well (Trivers, 1985; Wilkinson, 1988). In the first of his seminal contributions to evolutionary theory, Robert Trivers (1971) laid the foundation for a theoretical framework that could explain this altruistic behavior outside of the direct operability of Hamiltonôs Rule, but still within the boundaries of evolutionary theory. His theory of reciprocal altruism simply states that altruistic behavior among non-kin can evolve so long as these acts were reciprocated at some future date and that the benefit to the recipient was greater than the cost to the altruist. Assuming that human ancestors in the environment of evolutionary adaptedness (EEA; Tooby & Cosmides, 1990) lived in close, interdependent groups with low dispersal rates, the stage would be set for reciprocal exchanges of resources that benefited both parties (Trivers, 1971). That is, when shared food, tools, knowledge, etc. is repaid (not necessarily in kind) by the recipient, both parties experience a net increase in fitness (Burnstein, 2005).

Computer simulations of the prisonerôs dilemma have provided support for the theory of reciprocal altruism. If this game is only played once, the logical strategy is to defect (i.e., not cooperate). Axelrod and Hamilton (1981) showed that the key to shifting playerôs decisions toward cooperating is to repeat the game several times, with neither player knowing when it will endð as is often the case in real life. Within this context, the dominant strategy is called tit for tat: start by cooperating and continue to do so as long as

the other person cooperates; if the other person defects, then defect. Interestingly, this very basic strategy encompasses many of the issues discussed by Trivers (1971), most notably cheating.

Acting in a cooperative manner leaves one vulnerable to being cheated. The recipient of an altruistic act has the opportunity to not reciprocate at all, resulting in the altruist incurring the cost without any compensating benefits (gross cheating). The recipient also has the opportunity to reciprocate, but by less than what he/she was given (subtle cheating). Given the vast amount of cooperation exhibited by humans despite this vulnerability, it is perhaps not surprising that Tooby and Cosmides (1992) were able to uncover a system of psychological mechanisms that they claim represent evolved adaptations to detect cheaters within the context of social exchange. A clever set of studies illustrated that logic puzzles that people are typically unable to solve (e.g., The Wason Selection Task; Wason, 1966) become obvious when they are framed as a social contract. In the Wason selection task, participants are presented with four cards. Each card has a letter on one side and a number on the other. Participants can only see one side of the card and are asked to test rules like "if a card has an even number on one side, then it has a vowel on the other". The majority of participants are unable to select the correct cards to flip to test the rule. If a situation with the same logical structure is presented as a social contract, however, participants fare much better. For example, imagine a situation where a bouncer is working at a bar and he must ensure no one under eighteen years old is drinking. The rule to test is "if a person is drinking, s/he must be eighteen or older". Participants are more likely to select the correct answer of the beer drinker and the sixteen-year old if they must select who to check out of: someone drinking a beer,

someone drinking a pop, a twenty-five year old, or a sixteen-year old (Buss, 2004). This finding has been replicated several times, including using cross-cultural samples (for a review, see Cosmides & Tooby, 2005), and provides further evidence that individuals appear able to intuitively parse situations into costs and benefits. For example, if someone under eighteen is drinking at the bar, they are receiving a benefit without meeting the requirement (i.e., the cost) of being of legal age to drink. These cheater detection mechanisms are also of interest for potentially drawing distinctions between the psychological processes involved in kin versus non-kin altruism.

Kin Versus Non-Kin Altruism

The adaptive value of mechanisms for cheater detection in social exchange does not necessarily follow from inclusive fitness theory, but can be seen as necessary for reciprocal altruism. This is due to inclusive fitness effects mitigating the need for reciprocity. More specifically, social exchange among kin does not require reciprocity to the same degree as exchange with non-kin because any benefit realized by kin also benefits the altruist due to the overlap in genetic material. Thus, discriminating against non-reciprocating individuals cannot be easily explained by kin selection (Trivers, 1971). This is in contrast to social exchange outside of kin relationships, which Trivers felt was subject to reciprocal altruism selection. To have evolved, non-kin altruism would have required equity in exchange. As such, mechanisms to monitor and enforce this equity would have been selected for due to their adaptive value in these situations during the EEA.

Maintaining exchange equity in non-kin relationships may involve separate psychological mechanisms from those used for kin altruism. Burnstein (2005) succinctly

notes the key theoretical point that ñsocial bargains demand policing; kin altruism does notò (Burnstein, 2005, p. 547). To operate efficiently, this system of social exchange mechanisms would need to be functionally organized.

Regulation of the Reciprocal Altruism System

The theories of inclusive fitness and reciprocal altruism parsimoniously specify conditions under which tendencies for altruistic behavior could have evolved. Largely missing from the work of Hamilton, Trivers, and those who have come after them, however, is a thorough discussion and empirical testing of proximate mechanisms that give rise to these altruistic behaviors. A systematic exploration of emotion-states resulting from the detection of domain-specific environmental cues may help provide insight into the psychological mechanisms underlying altruistic behavior in kin and non-kin relationships. This process involves taking a social functional perspective on emotion.

Based on his interactions with several geographically dispersed tribes during his voyage on the Beagle, Darwin (1872) was one of the first to make the observation that emotional displays (e.g., furrowed brows, eyebrow flashes) serve a communicative function and may represent a universal human trait--a claim that was later empirically bolstered (Ekman, 1972; Izard, 1977). Rather than viewing emotions as debased or disruptive to more rational cognitive processing, a functional approach attempts to define emotions in terms of how they enable individuals to effectively respond to situational challenges and opportunities (Fischer & Manstead, 2008; Keltner & Haidt, 1999; Keltner, et al., 2006; Levenson, 1999).

Tooby and Cosmides (1990; 2005; 2008) posit that emotions can be seen as super-ordinate programs that organize and coordinate psychological mechanisms based

on context. They claim that emotions evolved due to repeated encounters with similar situations that required guided information processing and behavior. Each emotion-state is associated with the activation and deactivation of psychological mechanisms in a manner that guides cognition and behavior adaptively. From this functional perspective, emotions can be seen as domain-specific algorithms that take specific environmental cues as input, and lead to thoughts and behaviors (i.e., output) that would have been adaptive during the EEA.

Challenges and opportunities faced by humans include finding and retaining a mate, rearing and protecting offspring, and maintaining social order and group organization. These fundamental social tasks are accomplished in part with the help of specific emotional responses that arise from situational cues unique to these domains. For example, the identification of a suitable and valued mate is linked with feelings of desire and love (Buss, 1994; Gonzaga, Keltner, Londahl, & Smith, 2001), and to hormonal responses that facilitate sexual behavior (Diamond, 2003). Rivals who are perceived to be threatening to a romantic bond are linked with feelings of jealousy (Buss & Schmidt, 1993). The attachment system contains a complex set of emotions that guide both rearing and protecting young (Bowlby, 1969; 1973; 1979; 1980) and maintaining romantic bonds (Hazan & Shaver, 1987).

Although this conceptualization of emotion was not available to Trivers (1971), the psychological system he claimed was selected for to regulate the altruism system is compatible with the more refined ideas of Tooby and Cosmides (1990; 2005; 2008). He proposed that liking or disliking exchange partners, moralistic aggression, gratitude, guilt, trust, and some forms of dishonesty and hypocrisy all represent adaptations to regulate

the altruism system. Importantly, Trivers (1971) felt that this suite of adaptations operated in exchange situations both between kin and between non-kin. Based on the nature of inclusive fitness effects, however, he claimed that the psychological system he posited to regulate reciprocal altruism was the result of reciprocal altruistic selection. If this is true, differences may exist in the operation of this system during kin and non-kin exchange situations. Testing the proximal activation and behavioral outcomes of exchange-related emotions across these situations represents one way to potentially investigate these differences, yet up to this point no research has set out to do so.

Present Research

By examining the interrelations between social emotions, situational cues associated with equity of exchange, and kinship, the current studies attempted to more clearly specify how emotions function to regulate social exchange. Based on the logic of inclusive fitness (Hamilton, 1964) and reciprocal altruism (Trivers, 1971), it was expected that non-kin exchange will involve more intense emotional responses when compared to exchange with kin. In addition, because social emotions are proposed to function to police equity in social exchange, emotion-states were predicted to lead to differences in altruistic decision making toward non-kin compared to kin exchange partners. The current research was primarily focused on one negative emotion (anger) and one positive emotion (gratitude).

Anger is associated with appraisals of offense or injury and a sense of confidence and certainty that what has happened was caused by someone else (as opposed to by the situation or the self) (Lazarus, 1991; Wiener, 1980; 1986); appraisals that can lead to aggressive behavior (Berkowitz, 1990). Being angry is linked to physiological changes

that might prepare one to fight, such as blood flow to the hands (Ekman, Levenson, & Friesen, 1983), and activation in the left frontal hemisphere of the brain, a pattern characteristic of approach motivation (Harmon-Jones & Sigelman, 2001). In the context of social exchange, when an exchange partner does not reciprocate after an altruistic act, a state of anger serves to communicate the altruistôs displeasure with this situation. As an agitated and potentially aggressive state of arousal, anger holds the threat of physical confrontation as well as the potential for the discontinuation of the exchange relationship (Nesse, 1990; Trivers, 1971). In the current research, anger was generally expected to be triggered by uncooperative or inequitable behaviors committed by exchange partners. This anger, however, was predicted to be more intense during interaction with non-kin compared to kin exchange partners because the costs of uncooperative behavior by kin are partially mitigated by shared benefits from a genetic perspective. Once triggered, a state of anger was expected to motivate less cooperative, more punitive behaviors toward exchange partners. These behaviors, however, were predicted to be more prevalent during interaction with non-kin compared to with kin exchange partners based on the notion that anger functions to police social exchange and that exchange in the absence of inclusive fitness demands more careful consideration of relative costs and benefits.

Gratitude is a positive emotion linked to appraisals that the self has received a positive outcome that was caused by the actions of someone else (McCollough, Kilpatrick, Emmons, & Larson, 2001; Weiner, 1985). The experience of gratitude is a relatively understudied construct. It has, however, been shown to foster prosocial behavior in both beneficiaries and benefactors (McCollough, et al., 2001). From a functional perspective, feelings of gratitude after being the recipient of an altruistic act

serve as a motivator to alter weightings in decision rules related to future exchange interaction with the altruist (Tooby & Cosmides, 2005). In Triversô(1971) model, gratitude is proposed to regulate responses to altruistic acts in a manner that considers the cost/benefit ratios of such acts. This proposition has received some preliminary empirical support, with larger (compared to smaller) benefits received from exchange partners leading to more felt gratitude and altruistic future behaviors in a laboratory setting (Tsang, 2007). The experience of gratitude thus appears to be triggered partly based on an assessment of the subjective value of a benefit from an altruistic act. As such, in the current research, more cooperative and altruistic behaviors from exchange partners in general were expected to trigger feelings of gratitude. Benefits received as a result of altruistic behavior from kin, however, were expected to evoke less gratitude than the same benefits received from non-kin altruism. Again, this prediction stemmed from the assumed operation of Hamilton's rule, with the relative costs and benefits of exchange varying based on the presence or absence of inclusive fitness effects. In line with this reasoning, a state of gratitude was expected to motivate more cooperative and altruistic behavior toward exchange partners in general, but more so for non-kin compared to kin partners.

The current research was comprised of two studies and is the first to examine emotions as a proximal process associated with decision making related to exchange situations across kin and non-kin relationships. Despite the fact that humans spend so much time interacting with family members, empirical research on kin relations remains understudied by social psychologists (Daly, Salmon, & Wilson, 1997; Salmon & Shackelford, 2011). The current research aimed to help address this gap in the literature

by utilizing structured exchange situations to test evolutionary psychological hypotheses related to how individuals think, feel, and behave during interaction with kin and non-kin. The primary expectation of this research was that these exchange situations will detect differences in emotional response (Study 1) and function (Study 2) for interaction with kin compared to with non-kin based on the inclusive fitness effects present during kin exchange.

Study 1

Guided by both inclusive fitness theory (Hamilton, 1964) and reciprocal altruism theory (Trivers, 1971), Study 1 was designed to test the notion that emotional responses to exchange situations vary depending on relationship type. From a genetic perspective, costs incurred during exchange with a genetic relative are partly offset by shared benefits (i.e., inclusive fitness effects; Hamilton, 1964). In contrast, there is no discounting mechanism operating on the costs and benefits during exchange with non-kin. As such, reciprocal altruism theory posits that non-kin social exchange must be more strictly policed and that this is partly achieved by social emotions such as gratitude and anger (Trivers, 1971). Based on this theoretical rationale, the goal of Study 1 was to test the prediction that individuals would report more intense emotional responses after interacting with unrelated relationship partners compared to with genetic relatives.

The subjective costs and benefits during interaction between dyads is a key element to modeling social behavior using interdependence theory (Kelley, Holmes, Kerr, Reis, Rusbult, & Van Lange, 2003; Kelley & Thibaut, 1978). Varying the cost/benefit structure of situations has also been fruitfully utilized by experimental economists and game theorists to study human decision making (Camerer, 2003), and has

more recently begun to emerge as a tool for evolutionary social psychologists. For example, the prisoner's dilemma is one of game theory's simplest and most widely known frameworks for studying strategic behavior (Van Vugt & Van Lange, 2006). If the game is played only once, the dilemma arises because the payoff structure favors each player defecting despite the fact that this results in a lower benefit compared to what the players would each receive if they had cooperated. But what if the players were siblings? If Hamilton's *r* is incorporated into the payoff structure, the cost of being defected against by a sibling is mitigated by a mutual shared benefit. In this case, each payoff to a sibling is worth its face value, as well as half the other sibling's payoff (from an inclusive fitness perspective). Adding Hamilton's Rule and kinship to the prisoner's dilemma leads to cooperating becoming the dominant strategy (Kenrick, Sundie, & Kurzban, 2008). Of course, this is an abstract and purely theoretical thought exercise, but it does illustrate the potential for combining game theory and evolutionary social psychology.

Study 1 utilized a structured situation taken from experimental economics called the ultimatum game. This game is an experimental tool first developed by economists for studying cooperation between individuals (Camerer, 2003). In the ultimatum game, two individuals must make decisions related to the allocation of some valued good (typically money). Players are designated into roles, with one individual acting as the Proposer and the other as the Responder. The Proposer acts first and makes an offer to the Responder for how to split some amount (e.g., $10). The Responder can then either take the Proposer's offer, or reject it, in which case both individuals receive nothing. Based on this situation, a rational response from the Responder is to accept any offer greater than zero. Experimental economic research using the ultimatum game has shown that, contrary a

normative rational response, offers below 20% of the endowment are usually rejected (Camerer, 2003). This divergence from strictly rational choices points to the ultimatum game triggering social processes associated with assessments of fairness and punishment behavior.

Evolutionary psychological research using the ultimatum game has found that tendencies toward making cooperative offers vary according to factors such as anonymity and reputational concerns (Lamba & Mace, 2010), and the fluctuating asymmetries of the Proposer (Zaatari & Trivers, 2007). There has also been some general psychological research that has examined the role of emotions on offers and responses during the ultimatum game. For example, Responders who communicate anger during the ultimatum game receive larger offers from Proposers than Responders who communicate happiness, but this effect is attenuated by situational factors such as the Proposer's ability to deceive and when the consequences of an offer being rejected are low (Van Dijk, Van Kleef, Steinel, & Van Beest, 2008). Another study used coded video of facial expressions from individuals in both roles of the ultimatum game and found that cooperative individuals were more likely to express both positive and negative emotions, a finding that illustrates the importance of the role emotion plays in guiding altruistic decision making (Schug, Matsumoto, Horita, Yamagishi, & Bonnet, 2010).

To test the idea that emotional responses during social exchange are more intense when interacting with non-kin than with kin, an experiment was designed using a hypothetical iterated version of the ultimatum game and four classes of relationships: strangers, friends, cousins, and siblings. Specifically, participants were asked to imagine playing the role of Responder in an ultimatum game and reported their emotional

responses to receiving generous, reciprocal, and unfair offers from each of the relationship partners. An iterated, as opposed to a one-shot, version of the ultimatum game was chosen to more closely simulate the ongoing interaction involved in an actual social relationship (Axelrod & Hamilton, 1981; Camerer, 2003).

This design, which is presented in greater detail below, allowed Study 1 to test two main hypotheses. First, that emotional responses will differ based on offer sizes, with generous and fair offers leading to more gratitude and less anger than unfair offers, and unfair offers leading to more anger and less gratitude (hypothesis 1a; a main effect of offer size). More importantly, an offer size by relationship type interaction was expected such that, for each offer size, participants will report more intense emotions for offers from genetically unrelated individuals compared with cousins and siblings (hypothesis 1b: an interaction between offer size and relationship type). More specifically, the intensity of emotional response was expected to vary according to the degree of relatedness, with stranger's offers leading to the highest emotional response, followed by friends, then cousins, then siblings.

Method

Participants

A sample of 52 undergraduate psychology students from a university in Southwestern Ontario participated in exchange for partial course credit. The average age of the sample was 19.51 years old (*SD* = 6.4 years; range of 17 to 53). Of the 52 participants, 20 were male and 32 were female. In order to participate, all subjects met the selection criterion of having a same-sex sibling, cousin, and friend. Four additional

individuals participated in the experiment but their data were excluded because they reported that their sibling was either a step-sibling or a half-sibling.

Procedure

Participants reported to a laboratory and completed all measures using a personal computer outfitted with MediaLab questionnaire software. After reading and signing informed consent forms, participants were asked to enter the names of three same-sex relationship partners: a friend, a cousin, and a sibling. A computer program inserted these names into items and stimuli where appropriate for the remainder of the study. A same-sex individual named Paul for men and Mary for women was also included in subsequent conditions as a 'stranger'. Participants were then given a detailed description of the ultimatum game. After receiving this description of the game, each participant then rated how they would feel after receiving three different offers for how to split $100 from each of the four relationship partners. These combinations resulted in a 3 (offer size: $20/$80, $50/$50, $80/$20) by 4 (relationship type: stranger, friend, cousin, sibling) repeated measures design. The various combinations of offers and relationship partners were presented in one of two orders: either cycling through the same offer across the relationship partners, or cycling through the 3 offers for each relationship partner. Finally, participants were thanked and debriefed.

Materials

Demographic and relationship partner information. Participants were first asked to complete the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) to measure their current emotional state. Next, participants were asked for their age and sex. In addition, for each friend, cousin, and sibling, participants

completed items that measured the partner's age, emotional closeness felt toward the partner, inclusion of other in self, and felt similarity toward the partner. Specifically, emotional closeness was measured using the single item "How emotionally close do you feel toward (name inserted by questionnaire software)"? with a 7-point Likert-type scale (1 = *not at all*; 7 = *very much so*). Felt similarity was also measured with a single Likert-type item "How similar to do you feel to (name inserted by questionnaire software)" (1 = not at all; 7 = very much so). Inclusion of other in self (IOS) was measured using a set of seven pairs of circles that vary in the degree to which they overlap, with 1 = circles hardly overlapping and 7 = circles that almost completely overlap (Aron, Aron & Smollan, 1992). These items were included for use as covariates during discriminant analyses.

Ultimatum game instructions. Participants received a detailed description of the rules of the ultimatum game. This was done using a series of slides within the questionnaire software that included both text and a visual depiction of the ultimatum game. Specifically, participants were shown an iterated version of the ultimatum game using a series of examples in which the Proposer and Responder take turns making decisions for how to split $100. Finally, they were told that they would next be asked to imagine playing the game with the relationship partners they had previously identified.

Exchange stimuli. Participants were asked to imagine themselves as having just acted as the Proposer and making a $50/$50 offer to one of their relationship partners and that the partner accepted the offer. They were then asked to imagine that in the next round of the game, they will act as the Responder and their partner will be the Proposer. The Proposer offers were an $80/$20 split, a $50/$50 split, or a $20/$80 split. All three

offers were presented for each of the relationship partners, setting up a 3 (offer) by 4 (relationship type) repeated measures design.

Dependent measures. After each of the 12 conditions (3 offer sizes by 4 relationship partners), participants were asked to rate the degree to which they would experience a series of emotions. Specifically, participants were asked the degree to which they would feel gratitude and anger. In addition to these two main outcomes, participants also rated how disappointed and uneasy they would feel. They also rated how likely they felt each partner would be to make each offer. All of these dependent measures were measured using a 7-point Likert-type scale (1= *not at all*, 7 = *very much so*). Finally, participants were asked how much of the $100 they would offer to each partner as the Proposer in the next round of the game. These additional outcome variables were included for exploratory purposes.

Results

To provide a sense of the interrelation between the dependent variables, partial correlations are presented in Table 1. These correlations are presented with the effect of the experimental conditions statistically removed. The negative valenced responses of anger, disappointment, and uneasy were positively correlated with each other and negatively correlated with gratitude.

Table 1.
Study 1 - Partial correlations between dependent measures controlling for experimental conditions of offer and relationship type

Variable	1	2	3	4	5	6
1. Anger	-					
2. Disappointment	.75*	-				
3. Uneasy	.47***	.55***	-			
4. Gratitude	-.31***	-.32***	-.16***	-		
5. Likelihood	-.31***	-.34***	-.38***	.19***	-	
6. Next Offer	-.19***	-.17***	.02	.05	.02	-

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Main Analysis

To test Study 1's main hypotheses, a mixed model ANOVA was conducted for each of the dependent measures (i.e., six models in total). These models were estimated using the MIXED procedure in SPSS and included random intercepts for relationship type and offer. Including these random intercepts allowed the analyses to model variation in how individuals generally differ in their emotional responses across relationship type and offer size. This method of analysis provides results similar to a repeated-measures ANOVA, but allows for greater flexibility for modeling within individual variance on dependent measures. The models were specified such that the three offer sizes and the four relationship types were treated as repeated factors.

The results of the tests for main effects and interactions from these models are presented in Table 2. There was a significant main effect of offer size for each of the dependent measures. This finding fits with Study 1's general expectation of emotional reactions varying based on the size of an exchange partner's offer (i.e., hypothesis 1a). Significant main effects of relationship type were found for all of the dependent measures except for uneasy and expected. The main effects were qualified by significant

relationship type by offer size interactions for all of the dependent measures. The significant interactions justified post hoc analyses. All post hoc tests of mean differences used the Bonferroni adjustment to control for family-wise error rate.

Table 2
Study 1 - F-Ratios for Main Effects and Offer by Relationship Type Interactions

	Relationship Type	Offer	Rel. Type x Offer
Gratitude	20.20***	173.62***	5.99***
Anger	8.71***	146.42***	5.06***
Disappointed	2.98*	250.23***	2.87**
Uneasy	0.83	78.43***	3.01**
Likelihood	1.28	151.62***	6.46***
Next Offer	10.64***	86.12***	2.93**

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

All cell means and standard deviations from this analysis are presented in Table 3. The pattern of means will be discussed for each outcome measure in turn. Means for gratitude have been plotted graphically in Figure 1. Participants generally reported feeling more gratitude for larger offers. Examining how gratitude varied across both relationship types and offer sizes shows that, as predicted in hypothesis 1b, participants reported more gratitude for offers made by genetically unrelated individuals. There were

Table 3
Study 1 - Means and Standard Deviations for Offer by Relationship Type Conditions

	Gratitude	Anger	Disappointed	Uneasy	Likelihood	Next Offer
$20/$80						
Stranger	3.35 (1.75)	4.81 (1.85)	5.58 (1.64)	3.98 (2.23)	4.10 (1.59)	28.81 (17.38)
Friend	2.56 (1.75)	4.02 (1.99)	4.65 (2.27)	3.58 (2.24)	2.83 (1.88)	34.23 (17.36)
Cousin	2.42 (1.65)	3.98 (2.25)	4.54 (2.30)	3.13 (2.05)	3.00 (2.08)	36.35 (17.85)
Sibling	1.92 (1.04)	3.12 (1.73)	4.52 (1.91)	3.42 (2.19)	3.12 (2.08)	40.48 (18.74)
$50/$50						
Stranger	5.77 (1.28)	1.27 (0.77)	1.75 (1.17)	1.81 (1.60)	5.31 (1.89)	46.21 (11.19)
Friend	5.13 (1.62)	1.21 (0.82)	1.44 (1.09)	1.42 (0.94)	6.04 (1.41)	50.67 (5.24)
Cousin	4.88 (1.72)	1.25 (0.79)	1.38 (0.87)	1.25 (0.62)	5.38 (1.73)	48.75 (7.60)
Sibling	4.35 (1.92)	1.10 (0.41)	1.44 (1.09)	1.37 (1.14)	4.56 (2.08)	49.42 (10.23)
$80/$20						
Stranger	6.42 (1.13)	1.42 (1.05)	1.75 (1.28)	4.06 (1.99)	2.21 (1.33)	50.29 (21.25)
Friend	6.46 (1.09)	1.35 (0.97)	1.94 (1.61)	4.46 (2.00)	2.54 (1.46)	61.92 (19.63)
Cousin	6.35 (1.34)	1.42 (1.23)	2.31 (1.79)	4.71 (1.88)	2.73 (1.57)	52.69 (16.31)
Sibling	6.25 (1.36)	1.38 (0.97)	1.83 (1.45)	4.65 (2.08)	2.79 (1.96)	64.81 (20.27)

no significant differences for the $80/$20 offer, probably due to ceiling effects. There were, however, significant mean differences across relationship type for the $50/$50 offer, with gratitude felt toward strangers being higher than toward friends ($p < .01$), cousins ($p < .001$), and siblings ($p < .001$). Gratitude felt toward siblings was significantly less than was felt toward friends ($p < .001$), and cousins ($p < .05$). For the $20/$80 offer, a similar pattern emerged, with participants reporting significantly more gratitude toward strangers compared to friends ($p < .01$), cousins ($p < .001$), and siblings ($p < .001$). The pattern of reported gratitude for the $20/$80 offer is interesting, especially within the stranger condition. As would be expected for the lowest offer size, gratitude was lowest after the $20/$80 split, but this small offer from strangers triggered more gratitude compared the other relationship partners. Overall, an explanation for this pattern is unclear, although it could be because participants expected a smaller offer from

a stranger and were relatively more satisfied with this offer size from a stranger compared to the other relationship partners.

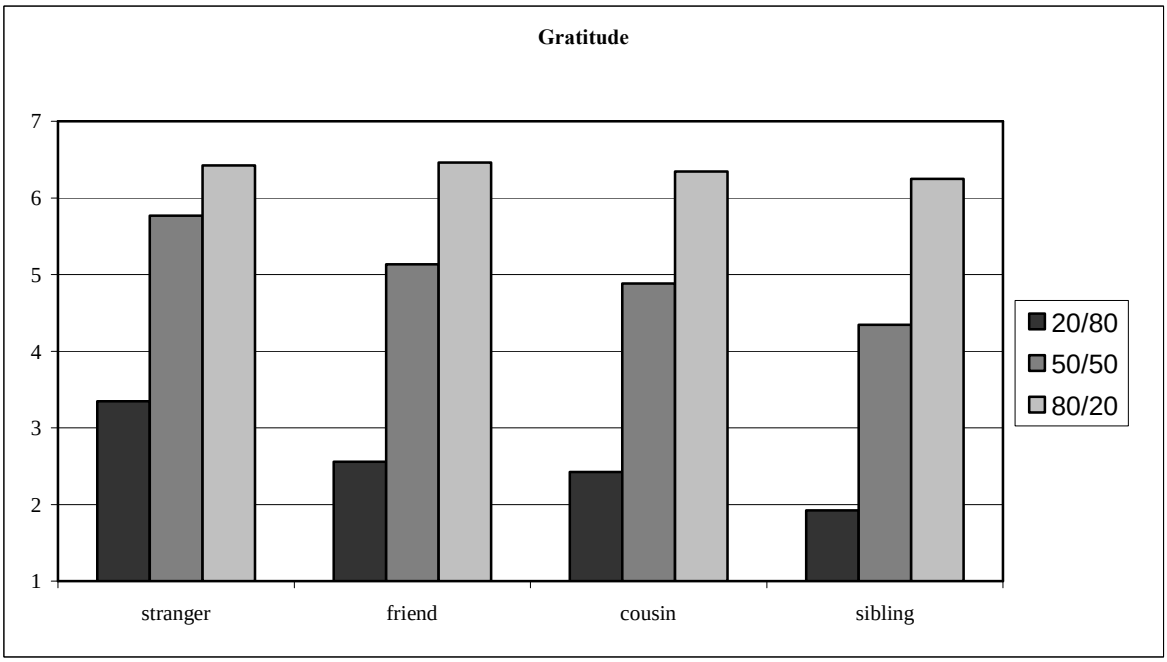

Figure 1 - Study 1 Means for Gratitude Across Offer Size and Relationship Type

Means for anger have been plotted in Figure 2. Participants reported higher levels of anger when offered a $20/$80 split and very little anger after the other two offers. Focusing on variation in reported anger across the relationship type for the $20/$80 offer once again found support for hypothesis 1b, with higher levels of reported emotion for offers made by genetically unrelated individuals. Specifically, participants reported more anger after receiving a $20/$80 offer from a stranger when compared to friends ($p < .07$), cousins ($p < .05$), and siblings ($p < .001$). Receiving this offer from a sibling resulted in significantly less anger when compared to friends ($p < .05$), and cousins ($p < .05$).

A similar pattern to anger was found for disappointment. There was little disappointment reported after the $50/$50 and $80/$20 offers. Participants did, however,

feel disappointed after receiving a $20/$80 offer, but more so from a stranger when compared to friends ($p < .05$), cousins ($p < .01$), and siblings ($p < .01$).

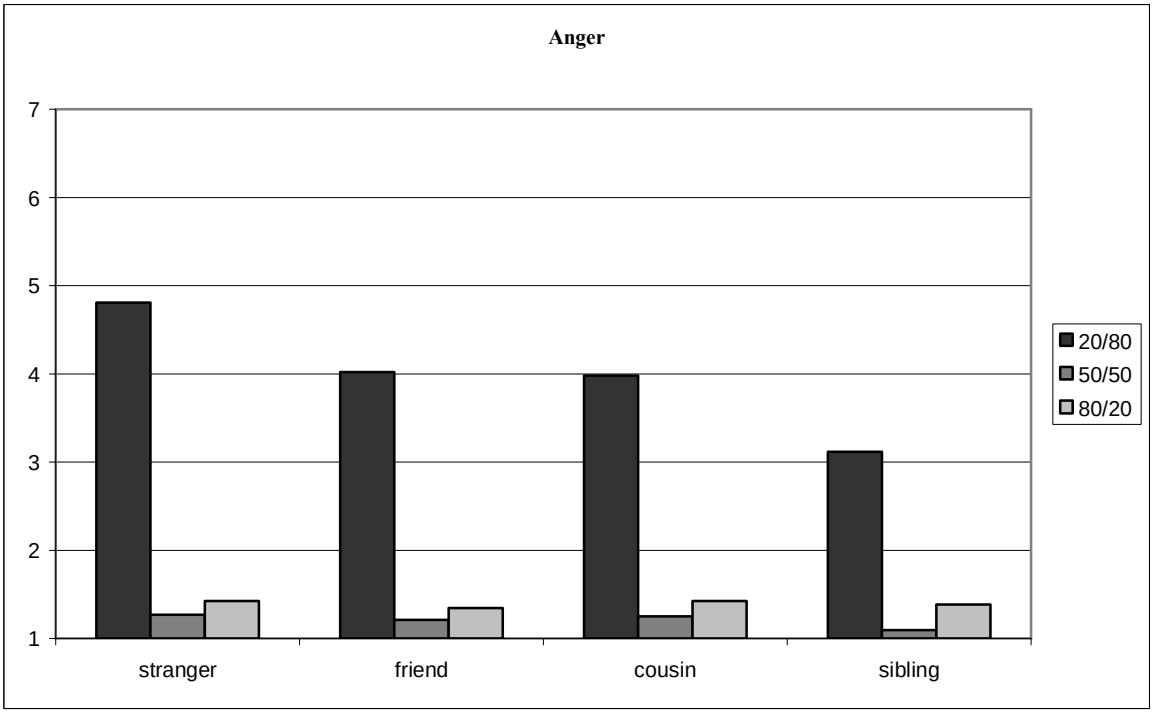

Figure 2 - Study 1 Means for Anger Across Offer Size and Relationship Type

A different pattern emerged for the uneasy outcome variable. Means for uneasy are presented in Figure 3. Participants generally reported feeling less uneasy after receiving a $50/$50 offer compared to after a $20/$80 or $80/$20 offer. Examining the mean differences in uneasy across relationship types revealed no significant differences for the $80/$20 offer, and a difference between strangers and cousins for both the $20/$80 offer ($p < .05$) and the $50/$50 offer ($p < .01$). The difference in uneasiness between strangers and siblings for the $50/$50 offer was marginally different ($p < .06$).

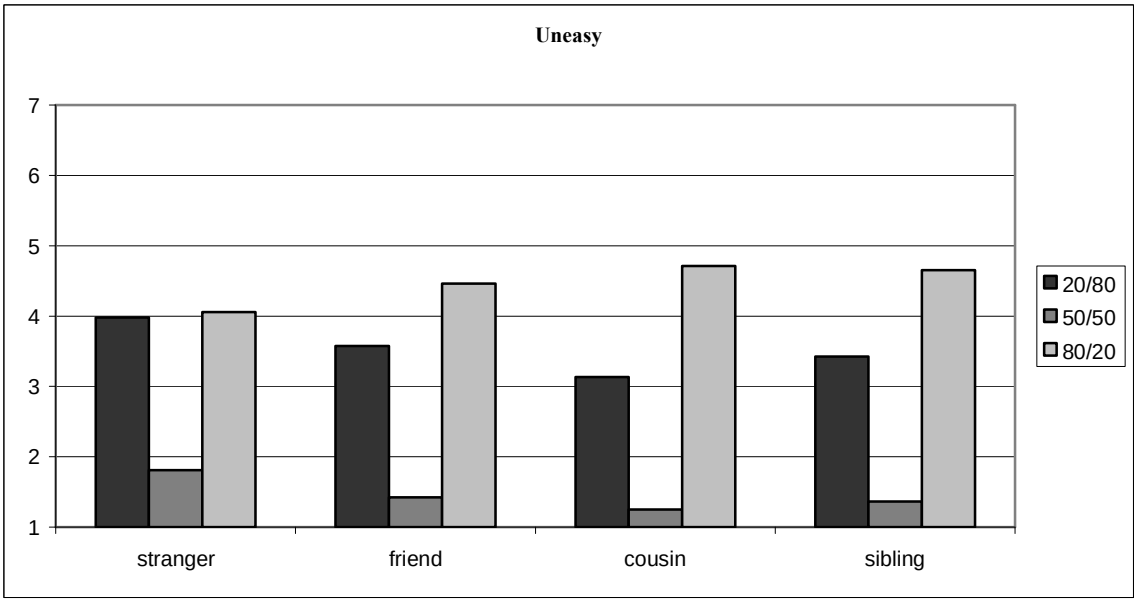

Figure 3 - Study 1 Means for Uneasy Across Offer Size and Relationship Type

Participants were more likely to expect their exchange partners to make a $50/$50 offer relative to the other offer sizes (see Figure 4). Within the $50/$50 condition, friends were rated as more likely to make this offer size compared to siblings ($p < .001$). Strangers were rated more likely to make a $20/$80 offer more so than friends ($p < .001$), cousins ($p < .01$), and siblings ($p < .05$).

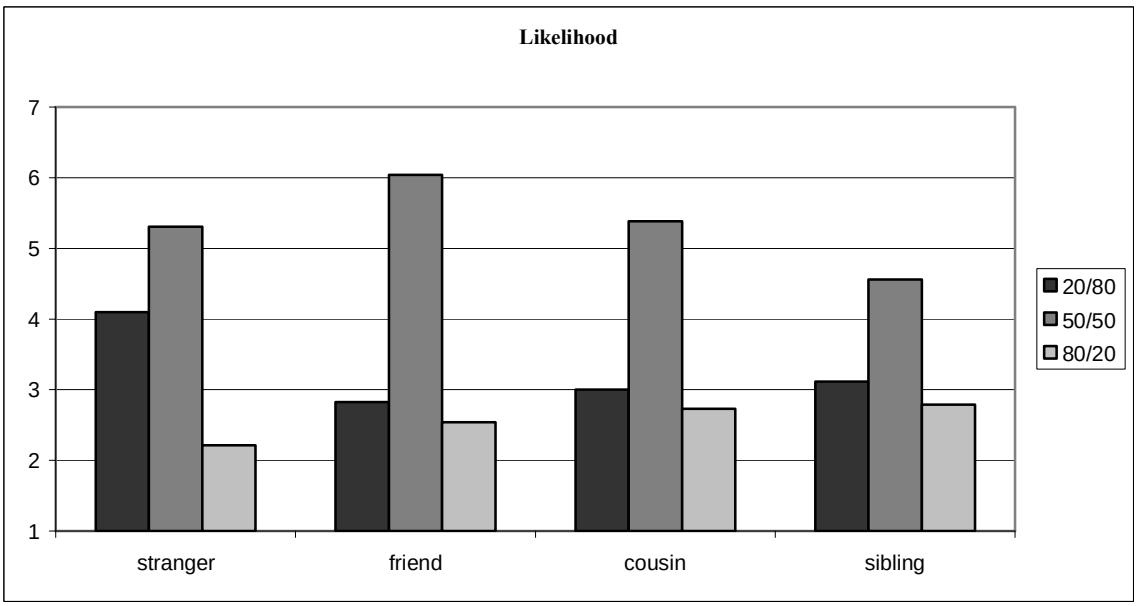

Figure 4 - Study 1 Means for Likelihood of Offer Across Offer Size and Relationship Type

Finally, after being instructed to imagine switching roles and playing a new round, participants generally made similar offers to the one they had just received. There were, however, differences within previous offer sizes across relationship types. After receiving a $20/$80 offer, participants stated that they would subsequently make significantly smaller offers to strangers compared to cousins ($p < .01$) and siblings ($p < .001$). After receiving a $50/$50 offer, participants reported that they would make larger subsequent offers to their friends compared to strangers in the next round ($p < .01$). After a $80/$20 offer, larger offers were made to friends compared with strangers ($p < .001$) and cousins ($p < .01$). Siblings were given larger offers than strangers ($p < .001$) and cousins ($p < .001$).

Discriminant Analyses

Another set of analyses were conducted to rule out of the possibility that the differences in emotional response across relationship type were due to variables shown to be important by previous related research. For example, Korchmaros and Kenny (2001) found that emotional closeness mediated the relation between genetic relatedness and willingness to act altruistically toward a relationship partner. Re-running the current analyses with emotional closeness as a covariate did not alter the results for any of the emotion outcomes. In other words, the emotional responses to the various offer sizes across relationship types did not vary based on how emotionally close subjects felt toward their relationship partners. There were main effects of emotional closeness on the likelihood and next offer variables, but including this covariate did not affect the significance or pattern of the relationship type by offer interactions. It should be noted that these discriminant analyses were conducted without data from the stranger condition

because the covariates were not applicable. Means and standard deviations for the variables used in the discriminant analyses are presented in Table 4.

Table 4
Study 1 - Mean and Standard Deviations for Relationship Partner Measures

	Age	Emotional Closeness	IOS	Felt Similarity
Friend	20.96 (11.87)	5.15 (1.48)	4.90 (1.62)	4.67 (1.37)
Cousin	22.28 (12.59)	3.44 (1.92)	3.25 (1.70)	3.37 (1.73)
Sibling	19.11 (7.86)	5.77 (1.43)	5.50 (1.44)	4.79 (1.45)

A relationship partner's age is another factor related to altruistic behaviors toward kin, a finding attributed to the relation between age and reproductive fitness (Burnstein, et al., 1994; Smith, Kish, & Crawford, 1987). Including partner age as a covariate did not alter the results for any of the outcome variables except for disappointment. There was a main effect of a partner's age on the disappointment variable and the interaction between relationship type and offer size was no longer statistically significant. It should be noted, however, that the age difference required to significantly influence altruistic decision making is likely much larger than the relatively small variance in partner age found in the current sample.

Similar patterns of results were found for the discriminant analyses using the inclusion of other in self (IOS) and similarity variables. Neither of these variables impacted the results for any of the emotion outcomes. There were main effects of IOS and similarity for the likelihood and next offer outcomes, but including these variables as a covariate did not alter the pattern of significance of the relationship type by offer size interactions.

Another set of analyses were run to test if there were sex differences for emotional response across levels of relationship type. Although no a priori hypotheses related to sex differences were made for Study 1, when compared to men, females have been previously shown to treat non-kin more like kin in contexts such as nepotism and incest avoidance (Ackerman, Kenrick, & Schaller, 2007). There were no significant main effects or interactions when participant sex was added to the models. As such, it appears that men and women do not differ in their emotional response to offer sizes across levels of relationship type.

Finally, re-running the main analyses controlling for baseline mood (measured with the PANAS) and including the order in which participants were presented with the offers as a factor did not alter any of the results.

Discussion

Study 1 was generally supportive of hypotheses 1a and 1b. Participants reported emotional responses that varied based on offer size, with smaller offers leading to more anger and disappointment and larger offers leading to more gratitude (hypothesis 1a). Importantly, probing the interaction between offers size and relationship type using pairwise comparisons found that these emotional responses differed in a manner consistent with the evolutionary theories of inclusive fitness and reciprocal altruism (hypothesis 1b).

As predicted by hypothesis 1b, offer size and relationship type interacted to predict gratitude in a manner that generally conformed more intense emotional response for non-kin, with offers from the least related individuals (i.e., strangers) leading to the most intense gratitude and offers from kin (i.e., cousins and siblings) leading to the least

intense gratitude. This step pattern was also found for anger after an unfair offer, with the most intense anger being reported for strangers and the least for siblings.

The exploratory outcome variables also led to some instructive findings. The results from reported uneasiness across offer sizes points to a preference for $50/$50 offers. This finding fits with the notion of reciprocal responses (i.e., tit-for-tat) being a normative strategy during exchange situations. Also of interest was the pattern of means for the likelihood variable. Strangers were rated most likely to make unfair offers, a finding that may be related to why participants reported feeling more gratitude when strangers acted cooperatively. The fact that friends were rated as most likely to make a reciprocal $50/$50 offer further fits with the rationale that underpins reciprocal altruism theory. More specifically, in the absence of inclusive fitness effects, altruism among non-kin partners requires equity in exchange over time. Finally, the likelihood variable led to an interesting finding when considered in combination with the result from the emotion outcome variables for strangers. Participants reported higher levels of anger and gratitude after a stranger's unfair offer despite also reporting that they felt that strangers were most likely to make this small offer. This finding does not follow from more general theories of emotion in which affect is triggered by expectancy violations (e.g., Bercheid, 1983; Carver & Sheier, 1990; Mandler, 1975) and thus may represent evidence for a process unique to non-kin exchange situations.

How and when an emotion is triggered is only part of piecing together a social-functional explanation of emotions (Keltner & Haidt, 1999; Keltner, Haidt, & Shiota, 2006). From an evolutionary perspective, active emotion states are posited to serve as logic executors that lead to patterns of cognitive and behavioral response that would have

been adaptive in the EEA (Tooby & Cosmides, 1990; Tooby & Cosmides, 2008). As such, feelings of gratitude and anger may be associated with a predictable pattern of outcomes that vary based on evolutionary important situational cues like kinship.

Study 2

Do active emotion-states lead to differences in decision making across relationship types? Study 1 provided evidence showing that emotional responses during exchange situations are stronger for non-kin exchange partners. To extend this finding and further test a social-functional model of emotions within the context of the theories of inclusive fitness and reciprocal altruism, Study 2 was designed to search for differences in exchange behaviors based on emotional experience and kinship.

Making inferences about the social function of an emotion requires first discovering the contextual inputs that trigger the emotional response, and then delineating its subsequent cognitive and behavioral outputs. In other words, one first needs to know what an emotion *does* before speculating about what an emotion is *for*. Study 2 's primary goal was to build on Study 1's results by investigating the cognitive and behavioral outcomes of anger and gratitude in the context of social exchange. If it is true that, as proposed by Trivers (1971), anger and gratitude function to regulate reciprocal altruism between non-kin, then in addition to being more likely to be triggered during non-kin exchange, these emotions should also be linked to outcomes during non-kin exchange that predictably differ from their outcomes during kin exchange. More specifically, feeling angry should lead to more punitive, less altruistic behaviors during exchange with non-related partners compared to with kin. Similarly, feelings of gratitude should lead to

more generous and cooperative behaviors during exchange with non-kin compared to with kin.

Previous research has shown that affective states (i.e., moods and emotions) are linked to the way individuals make judgments and decisions (for a review, see Forgas & George, 2001). Most of this work has focused on positive and negative moods and found that mood valence influences judgments through factors such as selective retrieval of congruent information from memory (Bower, 1981), subjective mood interpretation (Martin, Ward, Achee, & Wyer, 1993), selecting actions to maintain or repair the current mood state (Isen, Nygren, & Ashby, 1988), and misattributing moods to judgments (Schwarz & Clore, 1988). Valance of mood alone, however, cannot completely explain the link between affect and making judgments. For example, sadness and anger both have negative valence, but have different impacts on judgments stemming from appraisals of certainty and control (DeSteno, Petty, Wegener, & Rucker, 2000; Keltner, Ellsworth, & Edwards, 1993). Similarly, fear and anger both have negative valence, but lead to different assessments of risk (Lerner & Keltner, 2001).

Experimental research on the effects of affect on social judgments and decision making has intentionally ignored contextual factors such as the nature of the relationship between individuals in order to focus on basic processes. Rather than acting as noise that obscures the operation of these basic processes, situational factors such as kinship may lead to theoretically important interactions between affect, and cognitive and behavioral outcomes. Study 2 introduced relationship type as a factor in order to test whether the effects of anger and gratitude impact altruistic decision making differently across the same four relationship types used in Study 1. Testing this idea involved a 3 (emotion

induction: anger, gratitude, control) by 4 (relationship partner: stranger, friend, cousin, sibling) by 2 (social dilemma task: take-some, give-some) experimental design.

The take-some and give-some dilemmas each present individuals with a situation in which they may act selfishly or altruistically toward a partner (Hamburger, 1974). In both of these situations, each partner is endowed with some tokens (typically chips or coins; e.g., Van Lange & Liebrand, 1991; Van Lange & Kuhlman, 1994). Importantly, these tokens have twice the monetary value for one partner compared to the other. In the give-some dilemma, for example, each individual is endowed with tokens that are worth $X each if kept, or $2X each if given to the partner. Individuals have an opportunity to act selfishly and keep all their tokens for maximum profit, or give some coins to their partner, to whom they are worth twice as much. In the take-some dilemma, a partner's tokens are worth $2X each to the partner, and $X to the self. The decision in the take-some dilemma is how many tokens to take from the partner. An individual may act cooperatively and not take any of the partner's more valuable tokens, or more selfishly and take some tokens for the self.

The take-some and give-some situations are structurally equivalent in the sense that tokens have the same relative value to the self and partner in each case. In other words, a typical token allocation in the take-some situation should just be in inverse of the give-some situation (Van Lange & Kuhlman, 1994). Psychological differences may exist, however, between these two dilemmas based on the distinction between giving and taking (Hamburger, 1974). Giving tokens involves incurring a personal cost for the benefit of a partner, whereas taking tokens involves getting a personal benefit at the cost of a partner. Drawing this psychological distinction gives the take-some dilemma

situational cues linked with the potential for punitive behaviors, and the give-some dilemma the potential for benevolent behaviors. These motives are linked to anger and gratitude respectively, and thus make the take-some and give-some situations well-suited for testing the current hypotheses. Moreover, including both situations maps onto the ongoing, interactional nature of an actual relationship, with both giving and taking occurring among partners across time.

Study 2's design allowed for a test of the three-way interaction between emotion induction, relationship type, and social dilemma (hypothesis 2a). Within the take-some dilemma participants were expected to take more tokens from strangers and friends compared to from cousins and siblings (hypothesis 2b). Importantly, the amounts allocated to strangers and friends were expected to interact with the emotion induction such that more tokens would be taken in the anger condition and less in the gratitude condition. The amounts taken from cousins and siblings were not expected to differ across the emotion induction conditions (hypothesis 2c). That is, the activation of anger and gratitude were expected to impact exchange behaviors and decision-making differently for kin compared to non-kin. This hypothesis is based on the notion that anger and gratitude are part of a psychological system that regulates reciprocal altruism, and that kin-based exchange is less likely to be influenced by this system (Trivers, 1971).

Within the give-some dilemma, a similar pattern was expected to emerge. Participants were expected to give more to siblings and cousins compared to strangers and friends (hypothesis 2d). As in the take-some condition, these differences were expected to fluctuate based on the emotion induction, but only for non-kin (i.e., strangers and friends). More specifically, the amounts given the strangers and friends were

expected to interact with the emotion induction such that more money would be given in the gratitude condition and less in the anger condition. The amount given to cousins and siblings was not expected to significantly differ across the emotion induction conditions (hypothesis 2e).

Method

Participants

A sample of 96 individuals participated in exchange for a $5 honorarium (either a Starbucks gift card or an electronic money transfer). Participants were recruited using advertisements posted around the campus of a university in Southwestern Ontario. The average age of the sample was 24.71 years old (*SD* = 7.33 years; range of 18 to 57). Of the 96 participants, 35 were male and 61 were female. In order to participate, all subjects met the selection criterion of having a same-sex sibling, cousin, and friend. Nine additional participants filled in the questionnaire, but their data were discarded because they did not complete the emotion induction task.

Procedure

Data for Study 2 were collected online using questionnaire software. After reading informed consent information and verifying that they meet the selection criteria, participants provided demographic information (e.g., age, sex) and the names of a same-sex friend, cousin, and sibling. An email address for each relationship partner was also requested. This information was not retained for ethical reasons. Rather, participants were asked to provide this information so that they could be given a cover story within the demographic questionnaire that told them their relationship partners would be sent the

results of their token allocation and that one of the relationship partners would be selected to actually receive the monetary equivalent of the tokens they were allocated during the social dilemma.

Each participant was then randomly assigned to an emotion induction (anger, gratitude, or control) and a social dilemma (take-some or give-some) condition. After reading a detailed set of instructions for how to play either the take-some or give-some game, participants completed the appropriate emotion induction exercise for their condition. Immediately after the emotion induction, participants were asked how they would behave in the social dilemma with each of the four relationship partners. For the stranger condition, participants were told that they have been matched with a same-sex individual who had previously completed the study named Taylor Anderson. After finishing the experiment, participants were told that their relationship partners would not be contacted and that the contact information they provided would be destroyed. Finally, participants were debriefed and asked for an email address to send their $5 compensation.

Materials

Demographic and relationship partner information. Participants were first asked for their age and sex. Next, for each friend, cousin, and sibling, participants completed items that measure the partner's first name, age, emotional closeness felt toward the partner, inclusion of the other in self, and felt similarity toward the partner. This information was collected using the same 7-point Likert-type items that were used in Study 1. As in Study 1, this information was collected for use as covariates during discriminant analyses.

Participants were also asked for an email address for each of their relationship partners. This contact information was ostensibly used to inform relationship partners what decisions were made by the participant in the social dilemmas and as a means of contacting the partners in the event that they were randomly selected to actually receive the monetary equivalent of their token allocation.

Emotion induction. Participants completed a directed writing task first developed by Strack, Schwarz, and Gschneidinger (1985) and validated in several studies (e.g., Dunn & Schweitzer, 2005; Lerner & Keltner, 2001; Tiedens & Linton, 2001). One version of the task induced gratitude, and the other version induced anger. This exercise involves first asking participants to "briefly describe three to five things that make you feel [gratitude/angry]." Next, participants were asked to "describe in detail the one situation that made you feel the most [gratitude/anger] you have felt in your life, and describe it such that a person reading the description would feel [gratitude/anger] just from hearing the situation." Participants in the control condition were asked to name three to five things in the cereal aisle at their grocery store and then to describe the cereal aisle it in such detail that someone could picture it perfectly.

Manipulation check. A separate sample of 66 individuals was recruited using the Amazon Mechanical Turk service. Originally developed to allow computer software developers to use human intelligence to test their code, Mechanical Turk can also be used to run short surveys. The three manipulation check conditions each took approximately 5 minutes to complete and were therefore well-suited for collection on Mechanical Turk. Twenty-two individuals were assigned to each of the three conditions. After completing either the gratitude, anger, or control directed writing task, participants rated the degree to

which they felt anger, gratitude, fear, shame, guilt, and pride using a 7-point Likert-type scale (1= *not at all*, 7 = *very much so*).

Social dilemma. In the take-some condition, participants were told that each of their relationship partners was endowed with 20 tokens that are worth 50 cents each to the partner, and 25 cents each to the participant. Participants were then asked to report how many of the tokens he/she wished to take from each of the four partners. Taking all of the partner's tokens would result in a maximum payoff for the participant of $5, and taking none of the partner's tokens would result in a maximum payoff for the partner of $10. After deciding how many tokens they wished to take from each partner, participants were presented with three follow-up items related to their allocation. Specifically, participants were asked to report how much anger and gratitude they would expect each partner to feel after learning how many of their tokens were taken. In addition, participants were asked to report how fair they think each partner would consider their token allocation. These follow-up items were assessed using a 7-point Likert-type scale. For example, the anger item asked: "Based on the number of tokens you decided to take from [Friend's name], how much anger do you think [Friend's name] will feel after finding out how you decided to allocate the tokens?" (1 = *very little*, 7 = *very much*). The follow-up items were included primarily for exploratory purposes, but also provide a link between Study 1 and Study 2 in that they measure emotional response.

In the give-some condition, participants were told that, for each of the four relationship partners, s/he was endowed with 20 tokens worth 25 cents each to the participant and 50 cents each to the partners. Participants then reported how many of their tokens they wished to give to each partner. Leaving all 20 tokens to a partner would

result in a maximum payoff to the partner of $10, and leaving no tokens would result in a maximum payoff to the participant of $5. As in the take-some condition, participants were presented with three follow-up items after their token allocation decisions using 7-point Likert-type scales. Specifically, for each relationship partner, participants rated how much anger and gratitude they expected their partners would feel after learning about how many tokens they were given, as well as how fair they think each partner would consider their allocation.

In an attempt to increase the psychological realism of the situation, participants in both the take-some and give-some conditions were told that all of their relationship partners (and the previous participant used for the stranger condition) would be sent an email informing them of the results of the token allocation they decided upon. In addition, participants were told that one of their relationship partners would be randomly selected, and for that partner, the cash equivalent of their token allocation would be split between the participant and the partner. There were no emails sent, and no cash payments were made beyond the $5 compensation for participating in the study.

Results

Manipulation Check

Before the main analyses, data from the manipulation check sub-sample were analyzed. Of the 66 participants, 7 had to be dropped because they did not complete the emotion induction task. Of the remaining participants, 30 were male and 29 were female. Participants were 29.93 years old on average (SD = 9.04, range: 18-65).

A series of 1-way ANOVAs were run with the three level emotion induction task as the independent variable and the 6 emotions as the outcome variables. As expected,

there was a main effect of emotion induction on both gratitude (F (2, 56) = 32.02, p < .001) and anger (F (2, 56) = 63.60, p < .001). The emotion induction condition had no effect on the other 4 emotion items.

A series of post hoc comparisons were conducted on the means of felt gratitude and anger across levels of the emotion induction condition. These comparisons used the Bonferroni adjustment. Reported felt gratitude was significantly higher (p < .001) after the gratitude induction (M = 6.57, SD = 0.79) compared to after both the anger induction (M = 3.39, SD = 2.25) and control task (M = 3.15, SD = 1.72). Reported felt anger was significantly higher (p < .001) after the anger induction (M = 5.94, SD = 1.55) compared to after the gratitude induction (M = 1.57, SD = 1.23) and control task (M = 2.03, SD = 1.19). The emotion induction manipulation, therefore, appears to have had its desired effect.

Main Analyses

To test Study 2's main hypotheses, a series of 3-factor mixed model ANOVAs were conducted with two between-subjects variables (emotion induction and game type) and one within-subjects variable (relationship partner). These models were estimated using the MIXED procedure in SPSS and included a random intercept estimate for each dependent variable. The sample was randomly assigned across the between-subjects conditions such that each of the six cells had 16 participants. All post hoc comparisons of mean differences used the Bonferroni adjustment to control for family-wise error rate.

As predicted in hypothesis 2a, there was a significant 3-way interaction between game type, emotion induction, and relationship type on token allocation (F (6, 270) = 3.29, p < .01). This highest-order interaction justified decomposing the model to examine

the emotion induction by relationship type interactions on token allocation within each of the two game types. Analyzing the pattern of means within the take-some and give-some game types allowed for a test of the remaining hypotheses related to how emotion influences exchange behaviors across relationship types.

Take-Some Condition Results

The results of the tests for main effects and interactions for token allocation within the take-some condition are presented in Table 5. There was a significant main effect for both emotion induction (F (1, 45) = 3.66, $p < .05$) and relationship type (F (2, 135) = 16.60, $p < .001$). The main effect of relationship type fits with the expectation that participants would take tokens differently across relationship partners. Contrary to expectations, there was not a significant interaction between the two independent variables on tokens taken.

Table 5
Study 2 - F-Ratios for Main Effects and Interactions across Emotion Induction by Relationship Type Conditions within Take-Some Game Type

		Tokens Taken
Emotion Induction	F (1, 45)	3.66*
Relationship Type	F (2, 135)	16.60***
Emotion Induction x Relationship Type	F (6, 135)	1.73

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

To test the notion that participants would take more tokens from non-kin compared to kin (i.e., hypothesis 2b), a planned comparison was conducted on the combined tokens taken from strangers and friends (i.e., non-kin partners) compared to cousins and siblings (i.e., kin partners). This comparison was significant ($p < .001$), with the more tokens taken from non-kin (M = 11.57, SD = 6.91) than from kin (M = 8.20, SD

= 5.46). It should be noted that this difference appears to be primarily due to the higher number of tokens take from strangers (M = 13.38, SD = 6.31). The means for the other levels of relationship type were: friends (M = 9.31, SD = 6.80), cousins (M = 9.08, SD = 5.23), and siblings (M = 7.31, SD = 5.59).

A comparison of tokens taken across levels of emotion induction was conducted based on the significant main effect of emotion induction. Participants took significantly more tokens ($p < .05$) in the anger condition (M = 11.31, SD = 6.02) compared to participants in the gratitude condition (M = 7.64, SD = 6.74). There were no differences between tokens taken in the control condition (M = 10.69, SD = 6.00) with either the anger or gratitude condition. The cell means and standard deviations of token allocation across levels of emotion induction and relationship type within the take-some condition are presented in Table 6.

Table 6
Study 2 - Cell Means and Standard Deviations for Take-Some Token Allocation across Emotion Induction and Relationship Type Conditions

	Anger	Gratitude	Control
Stranger	16.93 (3.57)	11.25 (7.42)	13.31 (6.27)
Friend	12.00 (7.92)	6.57 (5.76)	9.38 (5.75)
Cousin	9.56 (2.28)	6.88 (6.57)	10.81 (5.36)
Sibling	6.81 (3.49)	5.88 (6.35)	9.25 (6.23)

Despite the lack of an interaction, planned comparisons of mean tokens taken across levels of emotion induction within levels of relationship partners were conducted. The pattern of means for token allocation within the take-some condition is presented graphically in Figure 5.

Although not in the expected manner, the emotion induction task did impact the token allocation decisions of strangers and friends, but not cousins and siblings. Specifically, participants took more tokens from the stranger after completing the anger induction compared to when they completed the gratitude induction ($p < .05$). The same pattern emerged for friends, with participants taking more from friends after the anger induction compared to after the gratitude induction ($p < .05$). There were no significant differences across levels of emotion induction within the cousin or sibling conditions. In order to provide better evidence for hypothesis 2c, ideally the number of tokens taken after the anger and gratitude induction for non-kin partners would have each significantly differed from the control condition rather than from each other. Nevertheless, the general pattern fits with the expectation that anger and gratitude impact exchange decisions differently across non-kin versus kin relationship partners, and thus provides partial support for hypothesis 2c.

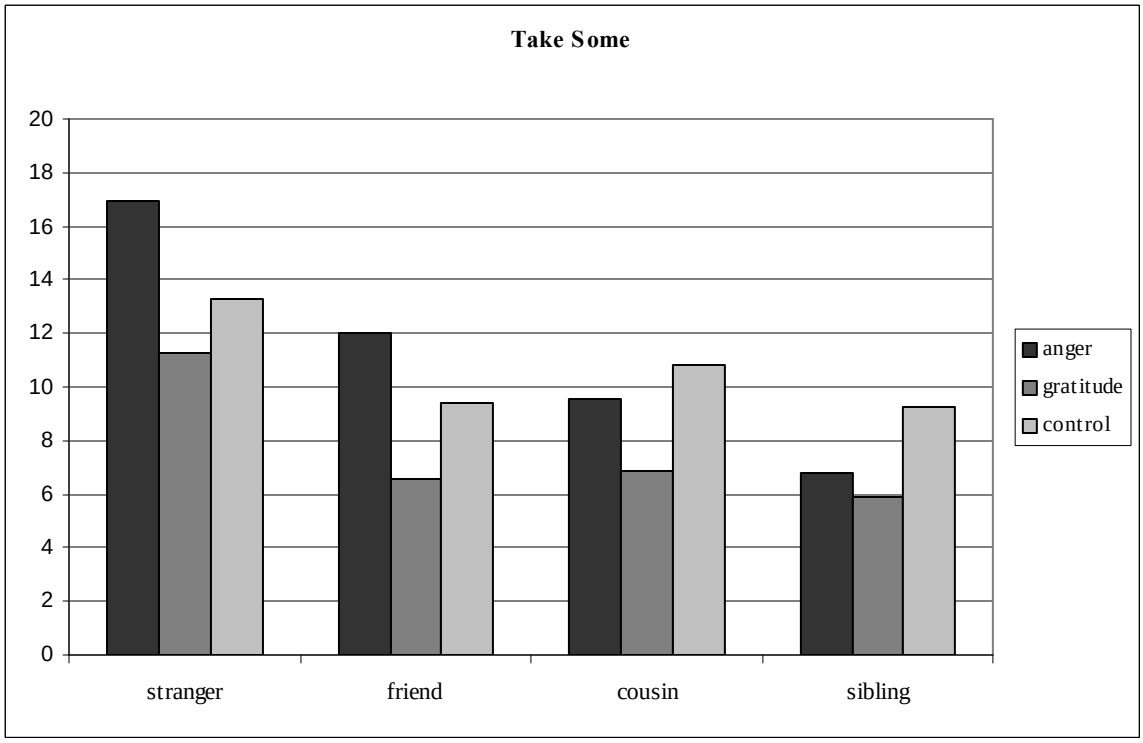

Figure 5 - Study 2 Means for Tokens Taken in the Take-Some Condition Across Emotion Induction and Relationship Type

Expected Partner Reaction Results

To provide a sense of the interrelation between the main dependent variable (tokens taken) and the follow-up items, partial correlations are presented in Table 7. These correlations are presented with the effects of the emotion induction and relationship type removed. The number of tokens taken was positively associated with the level of anger expected from a relationship partner and negatively associated with level of expected partner gratitude. How fair the token allocation was expected to be assessed by the partner was negatively correlated with the number of tokens taken.

Table 7.
Study 2 - Partial correlations among tokens and follow-up measures controlling for the experimental conditions of emotion induction and relationship type

Variable	1	2	3	4
1. Tokens Taken	-			
2. Expected Anger	.54***	-		
3. Expected Gratitude	-.52***	-.46***	-	
4. Fairness of Offer	-.56***	-.63***	.60***	-

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

A separate set of mixed-model ANOVAs were run for the three exploratory follow-up items. Results from these models are presented in Table 8. Of the three items, only expected anger had a significant interaction (F (6, 135) = 3.16, $p < .01$).

Table 8
Study 2 - F-Ratios for Main Effects and Interactions across Emotion Induction by Relationship Type Conditions within Take-Some Game Type

		Expected Anger	Expected Gratitude	Fair Offer
Emotion Induction	F (1, 45)	9.78***	6.02**	1.69
Relationship Type	F (2, 135)	11.03***	16.01***	11.61***
Emotion Induction x Relationship Type	F (6, 135)	3.16**	1.86	1.13

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

The pattern of means across experimental conditions for these follow-up items are presented in Table 9. Given the correlations between these follow-up items and the number of tokens taken, it is not surprising that the means across experimental conditions generally conform to the pattern found in the main analysis. This is especially the case for expected anger.

Table 9
Study 2 - Means for Follow-up items across Emotion Induction by Relationship Type Conditions within Take-Some Game Type

	Expected Anger	Expected Gratitude	Fair Offer
Stranger			
Anger	5.56 (1.67)	2.13 (1.20)	3.06 (1.61)
Gratitude	2.12 (1.78)	2.75 (2.32)	3.75 (1.91)
Control	3.43 (2.50)	2.75 (1.69)	3.63 (2.75)
Friend			
Anger	3.81 (2.43)	3.50 (1.83)	4.50 (1.97)
Gratitude	1.31 (0.79)	5.44 (1.31)	5.44 (1.15)
Control	2.56 (1.96)	3.44 (2.16)	4.38 (2.42)
Cousin			
Anger	3.44 (1.46)	3.25 (1.44)	4.06 (1.29)
Gratitude	2.00 (1.71)	4.81 (1.72)	5.19 (1.72)
Control	2.75 (1.91)	3.31 (1.49)	4.31 (2.18)
Sibling			
Anger	2.31 (1.30)	4.38 (2.13)	5.19 (1.11)
Gratitude	1.44 (1.03)	5.38 (1.45)	5.56 (1.15)
Control	2.56 (2.16)	3.63 (1.86)	4.25 (2.24)

The pattern of means for expected anger mirror the means for tokens taken and are presented graphically in Figure 6. Participants expected strangers to respond to their token allocation with significantly more anger compared to friends ($p < .001$), cousins ($p < .01$), and siblings ($p < .001$). Similar to the pattern of findings for the tokens taken variable, participants in the anger induction condition expected significantly more anger from strangers compared to individuals in the gratitude ($p < .001$) and control ($p < .01$) conditions; and more anger from friends compared to individuals in the gratitude

condition ($p < .001$). There were no significant differences in expected anger across emotion conditions for cousins and siblings.

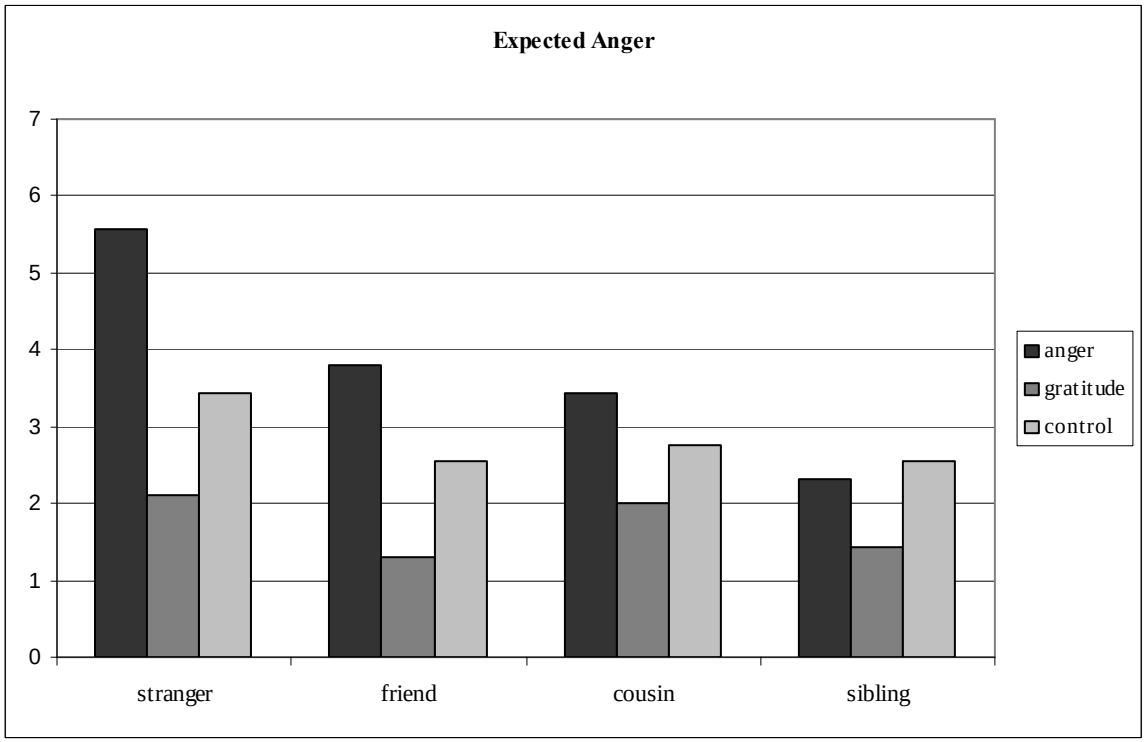

Figure 6 - Study 2 Means for Expected Anger in the Take-Some Dilemma Across Emotion Induction and Relationship Type

There was an interesting and unexpected pattern that emerged for expected partner gratitude. The means for the expected gratitude outcomes are presented graphically in Figure 7. In general, participants expected that strangers would feel less gratitude when they were told about the token allocation compared to friends ($p < .001$), cousins ($p < .001$), and siblings ($p < .001$). Participants in the gratitude induction condition reported that their friends would feel significantly more gratitude compared to individuals in the anger induction condition ($p < .01$) and the control condition ($p < .01$). This was also the case for expected gratitude from cousins, with individuals in the gratitude condition expecting more gratitude from cousins compared to individuals in the

anger condition ($p < .05$) and the control condition ($p < .05$). Finally, individuals in the gratitude induction condition reported expecting that their siblings would feel more gratitude compared to individuals in the control condition ($p < .05$). Recall that there were no differences in token allocation across emotion conditions for kin relationship partners. As such, it appears that participants projected their own felt gratitude from the emotion induction task onto the cousins and siblings without necessarily taking less tokens from them compared to participants in the anger and control conditions.

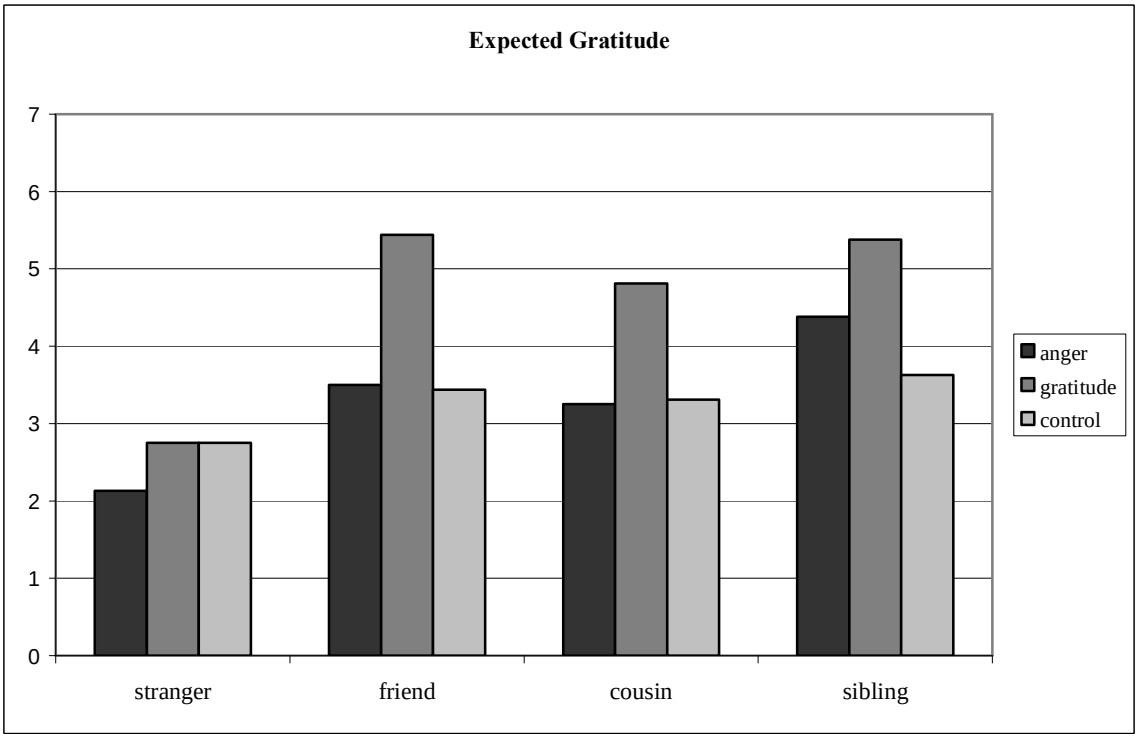

Figure 7 - Study 2 Means for Expected Gratitude in the Take-Some Dilemma Across Emotion Induction and Relationship Type

Give-Some Results

The results from the tests for main effects and interactions for token allocation within the give-some condition are presented in Table 10. There was a significant main effect for both emotion induction (F (1, 45) = 3.27, $p < .05$) and relationship type (F (2,

135) = 10.59, $p < .001$) on the number of tokens given. These main effects were qualified by a significant interaction (F (6, 135) = 2.75, $p < .05$). The significant main effect of relationship type and the significant relationship type by emotion induction interaction fit with the expectations of hypotheses 2d and 2e, and justified examining the pattern of cell means.

Table 10
Study 2 - F-Ratios for Main Effects and Interactions across Emotion Induction by Relationship Type Conditions within Give-Some Game Type

		Tokens Taken
Emotion Induction	F (1, 45)	3.27*
Relationship Type	F (2, 135)	10.59***
Emotion Induction x Relationship Type	F (6, 135)	2.75*

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

The means for tokens given across the experimental conditions are presented in Table 11. To test the prediction that participants would give more tokens to kin compared to non-kin partners (i.e., hypothesis 2d), a contrast was conducted comparing tokens allocated to cousins and siblings with tokens allocated to strangers and friends. Based on this comparison, there was not evidence to support hypothesis 2d. In other words, there was not a significant difference between the number of tokens given across these groups. Comparing the individual means across all four levels of relationship type, however, did show some significant differences. Specifically, strangers (M = 6.21, SD = 6.44) were given significantly less ($p < .001$) than both friends (M = 10.85, SD = 5.55) and siblings (M = 10.65, SD = 5.84). In addition, cousins (M = 7.39, SD = 5.56) were given less than friends ($p < .01$) and siblings ($p < .01$). Despite the main effect of emotion induction, there were no significant differences in tokens given across levels of emotion induction

(anger M = 7.73, SD = 5.05; gratitude M = 10.67, SD = 7.26; control M = 7.92, SD = 5.58).

Table 11
Study 2 - Cell Means and Standard Deviation for Give-Some Token Allocation across Emotion Induction and Relationship Type Conditions

	Anger	Gratitude	Control
Stranger	3.38 (3.85)	10.43 (8.63)	4.81 (3.37)
Friend	8.81 (3.54)	14.37 (6.22)	9.38 (5.03)
Cousin	7.88 (4.70)	7.31 (6.59)	7.00 (5.56)
Sibling	10.88 (5.07)	10.56 (6.19)	10.50 (6.54)

An interesting pattern emerges when examining token allocation across the levels of emotion induction within relationship types. The means are plotted graphically in Figure 8. As predicted in hypothesis 2e, there were differences in how the emotion induction condition impacted token allocation within relationship types. Contrary to expectations, the anger manipulation did not lead to significant differences in how many tokens were given to relationship partners, with the anger condition showing no difference from the control condition within all four levels of relationship type. In contrast, the gratitude manipulation did appear to impact token allocation, but only for non-kin partners (i.e., strangers and friends). More specifically, individuals in the gratitude induction condition gave more to strangers compared with those in both the anger condition ($p < .01$) and those in the control condition ($p < .05$). The same pattern was found for tokens given to friends, with individuals in the gratitude condition giving more tokens to friends compared to those in the anger condition ($p < .05$) and the control condition ($p < .05$). There were no significant differences across the emotion induction conditions within cousins or siblings. This pattern of results provides partial support for

hypothesis 2e, with gratitude (but not anger) leading to differences in token allocation for non-kin.

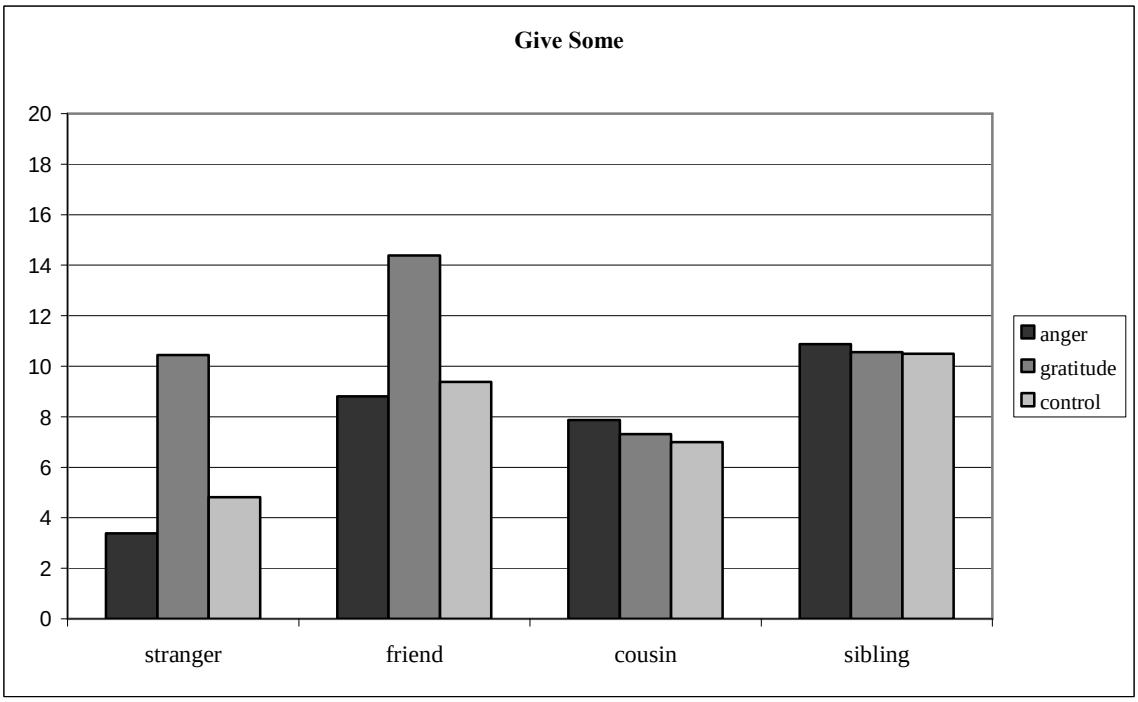

Figure 8 - Study 2 Means for Tokens Given in the Give-Some Dilemma Across Emotion Induction and Relationship Type

Expected Partner Reaction Results

To provide a sense of the interrelation between the main dependent variable (tokens given) and the follow-up items, partial correlations are presented in Table 12. These correlations are presented with the effects of the emotion induction and relationship type removed. The number of tokens given was negatively associated with the level of anger expected from a relationship partner and positively associated with level of expected partner gratitude. How fair the token allocation was expected to be assessed by the partner was positively correlated with the number of tokens given.

Table 12.
Study 2 - Partial correlations between tokens and follow-up measures controlling for experimental conditions of emotion induction and relationship type

Variable	1	2	3	4
1. Tokens Given	-			
2. Expected Anger	-.42***	-		
3. Expected Gratitude	.59***	-.42***	-	
4. Fairness of Offer	.35***	-.51***	.66***	-

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

A separate set of mixed-model ANOVAs were run for the three exploratory follow-up items. Results from these models are presented in Table 13. All three follow-up measures had significant emotion induction by relationship type interactions. These interactions justified examining the pattern of cell means across the experimental conditions.

Table 13
Study 2 - F-Ratios for Main Effects and Interactions across Emotion Induction by Relationship Type Conditions within Give-Some Game Type

		Expected Anger	Expected Gratitude	Fair Offer
Emotion Induction	F (1, 45)	1.16	0.52	0.04
Relationship Type	F (2, 135)	5.59***	10.99***	8.18***
Emotion Induction x Relationship Type	F (6, 135)	4.49***	2.18*	3.06**

Note. * $p < .05$. ** $p < .01$. *** $p < .001$

Cell means for the follow-up items across the levels of emotion induction and relationship type are presented in Table 14. Overall, the means from these follow-up items did not provide as clear a pattern as the follow-up items from the take-some condition. There were, however, a few noteworthy mean differences. For example,

participants generally expected more anger from strangers after they learned about the token allocation compared to friends ($p < .01$). Contrary to the idea that emotions play a more important role for non-kin interaction compared to kin interaction during exchange situations, participants expected less anger from friends compared to cousins ($p < .01$).

Participants in the anger induction condition reported that they expected strangers to feel more anger upon hearing about the number of tokens given compared to both individuals in the gratitude condition ($p < .01$) and the control condition ($p < .01$). Unexpectedly, there was also a significant difference between how the individuals in the anger induction condition expected their siblings to react to their token allocation, with individuals in the anger condition expecting siblings to react with significantly less anger than individuals in the gratitude condition ($p < .05$).

For the expected gratitude variable, participants expected less gratitude from strangers compared to friends ($p < .001$) and siblings ($p < .001$). Similarly to how individuals in the anger induction condition expected more anger from strangers, participants in the gratitude induction condition expected strangers to feel more gratitude upon learning of the token allocation compared to participants in the anger induction condition ($p < .05$).

Table 14
Study 2 - Means for Follow-up items across Emotion Induction by Relationship Type Conditions within Give-Some Game Type

	Expected Anger	Expected Gratitude	Fair Offer
Stranger			
Anger	3.63 (2.09)	2.69 (1.70)	3.31 (1.92)
Gratitude	2.00 (1.32)	4.38 (2.50)	4.38 (1.63)
Control	2.06 (1.29)	3.19 (1.68)	4.82 (1.38)
Friend			
Anger	1.68 (1.25)	4.88 (1.50)	5.56 (1.50)
Gratitude	1.75 (1.00)	5.44 (1.59)	5.31 (1.49)
Control	1.56 (1.03)	4.88 (1.52)	5.69 (1.25)
Cousin			
Anger	2.31 (1.74)	4.13 (1.54)	4.56 (1.86)
Gratitude	3.19 (1.94)	3.75 (1.61)	4.31 (1.30)
Control	2.06 (1.39)	4.06 (2.17)	4.63 (1.86)
Sibling			
Anger	1.38 (0.62)	5.31 (1.54)	5.81 (1.42)
Gratitude	2.69 (1.96)	4.56 (1.82)	5.06 (1.65)
Control	1.88 (1.36)	4.31 (2.06)	4.31 (1.74)

Discriminant Analyses

As in Study 1, another set of analyses were conducted to rule out the possibility that the differences in token allocation decisions were due to variables that have previously been shown to be related to kin altruism (e.g., Korchmaros & Kenny, 2001; 2006; Kruger, 2003). Means and standard deviations for relationship partner information variables used in these discriminant analyses are presented in Table 15.

Table 15
Study 2 - Means and Standard Deviations for Relationship Partner Measures (Entire Sample)

	Partner Age	Emotional Closeness	IOS	Felt Similarity
Friend	25.42 (9.38)	5.63 (1.15)	5.45 (1.33)	5.20 (1.14)
Cousin	25.21 (8.37)	4.21 (1.47)	3.75 (1.65)	3.99 (1.60)
Sibling	24.63 (8.70)	5.90 (1.26)	5.53 (1.40)	5.10 (1.55)

Two models were run for each of these relationship partner measures: one for the take-some condition and one for the give-some condition. In other words, the same models from the main analysis with token allocation as the outcome variable were re-run with a relationship partner covariate. It should be noted that these models differed from the models from the main analysis in that the stranger level of the relationship partner factor was removed. This was done because the relationship partner measures were not applicable to a stranger.

Overall, the main effects, interactions, and patterns of cell means were not altered by including any of the relationship partner measures as covariates. There were main effects of emotional closeness (for both the take-some and give-some condition) and felt similarity (for take-some only), but the including these variables in the analysis did not impact the pattern of token allocation across the emotion induction and relationship partner conditions. No main effects of were found for age of the relationship partner or the inclusion of other in self measure.

Finally, participant sex was added to the models to test for differences between men and women on token allocation. There were no significant main effects or

interactions involving participant sex on token allocation in either the take-some or give-some conditions. As was the case in Study 1, there were no sex differences in Study 2.

Discussion

Study 2 found mixed support for its main hypotheses, but when viewed in sum, did provide some evidence for the general prediction that emotional experience and relationship type impact exchange behaviors. The significant 3-way interaction between game type, emotion induction, and relationship type justified further analyzing how emotion and relationship type influenced token allocation within the two levels of game type.

Participants allocated tokens differently across levels of relationship type, but not exactly in the manner predicted by hypotheses 2b and 2d. These hypotheses predicted that there would be significant differences between how tokens were allocated between kin (i.e., cousins and siblings) and non-kin (i.e., strangers and friends). There was a significant difference in token allocation between kin and non-kin in the take-some condition, but not in the give-some condition. In general, there was a more pronounced difference between token allocation to strangers compared to the other three levels of relationship type. Participants took more from, and gave less to, strangers compared to the other relationship partners. Friends, cousins, and siblings were allocated similar amounts of tokens across the two game types.

More importantly, there was also partial support for the prediction that feelings of anger and gratitude would influence token allocation differently for kin versus non-kin relationship partners (i.e., hypotheses 2c and 2e). In the take some game, participants in the anger condition took more tokens from strangers and friends compared to individuals

in the gratitude conditions. No differences were found for how emotion influenced tokens taken for cousins and friends. The boost in tokens taken from non-kin in the anger condition fits with the notion that emotion influences non-kin social exchange differently than kin exchange. From a functional perspective, angry individuals taking more tokens can be viewed as being linked to anger's role in influencing punishment behaviors. The functional link between feelings of anger and behaving in ways that signal a desire to punish inequity or even dissolve an exchange relationship seems more relevant for non-kin exchange. As predicted, these punitive decisions were only made for non-kin relationship partners, where the absence of inclusive fitness effects requires more rigid policing of social exchange.

The structure of the give some game allows individuals to use their endowment of tokens to benefit their partner. Based on the social functional role of gratitude (e.g., fostering prosocial behavior; McCollough, et al., 2001), it stands to reason that inducing feelings of gratitude within the context of the give some dilemma may lead to more generous token allocation. This was the case, but only for non-kin relationship partners. This finding provides further evidence for Study 2's prediction that emotional experience impacts exchange behaviors differently across kin and non-kin. Placing gratitude within a functional framework means looking at the likely cognitive and behavioral outcomes associated with its activation. Thinking and acting prosocially can be seen as especially advantageous in response to altruistic behavior from novel individuals. An altruistic stranger or acquaintance is someone who is providing an opportunity to forge a mutually beneficial social bond. The link between the feelings of gratitude engendered from this

situation and the higher likelihood of reciprocating the altruism can be seen as functional for forming new relationships but is not necessarily as important for kin interaction.

The follow-up items measured expected partner responses and showed that participants generally expected strangers to respond with anger when they learned about their token allocation. This was especially true for participants who completed the anger induction. These individuals allocated less tokens to strangers and also expected the strangers respond to their allocation with anger. Expected gratitude exhibited a different pattern, especially in the take some game. Participants who completed the gratitude induction appeared to project their own felt gratitude onto their friends, cousins, and siblings--despite the fact that they did not take any more tokens from them compared to participants in the other emotion induction conditions.

The main goal of Study 2 was to test the idea that anger and gratitude are part of a psychological system that functions to regulate reciprocal altruism between non-kin exchange partners, but may not as strongly influence exchange among kin. The general pattern of results does lend some support to this notion, with token allocation varying across emotion induction within the stranger and friend conditions, but not within the cousin and sibling conditions. This finding builds on the results from Study 1, where evidence illustrating more intense emotional responses to inequitable exchange for non-kin was garnered. The follow-up items from Study 2 measured participant's expectations for how their relationship partners would emotionally respond to their offers and thus provides a link between these studies. Similar to how participants responded with more anger after smaller offers from non-kin in Study 1, participants in Study 2 expected

strangers and friends to respond to smaller token allocations with anger. This link shows how anger may fit into non-kin exchange from a dyadic perspective.

General Discussion

Taken together, the current studies represent a step toward an empirical mapping of a psychological system designed to regulate exchange with non-kin. This research was focused on examining the functional role of anger and gratitude in exchange situations. It was predicted that these emotions act as proximal mechanisms that guide thoughts and behaviors based on assessments of costs and benefits. Because costs and benefits in exchange situations can be understood to vary across kin and non-kin relationships based on the presence or absence of inclusive fitness effects, these emotions were expected to differ in their intensity and behavioral outcomes during interactions with non-kin compared to with kin.

Study 1 found that the intensity of emotional response to hypothetical offers in an ultimatum game situation varies according to the degree of partner relatedness, with offers from strangers generally leading to the highest levels of gratitude and anger, followed by friends, cousins, then siblings. This finding fits with predictions derived from the theories of inclusive fitness and reciprocal altruism and illustrates how relationship type can act as a situational factor that differentially influences emotional activation. Considering these results from a functional approach leads to some interesting implications. Recall that the functional approach to emotions attempts to define emotions in terms of how they enable effective responses to situational challenges and opportunities (Fischer & Manstead, 2008; Keltner & Haidt, 1999; Keltner, et al., 2006; Levenson, 1999). This approach fits well with the evolutionary perspectives like

inclusive fitness and reciprocal altruism. If it is the case that interacting with non-kin exchange partners requires a more careful consideration of equity (i.e., assessments of reciprocity/relative costs and benefits), then not only would emotions like anger and gratitude be more likely to be activated with non-kin, they may also be more likely to guide exchange behaviors in a manner that would have been adaptive in our evolutionary environment. Study 2 helped address this question by examining exchange behaviors within the contexts of emotional activation and relationship type.

Study 2 built on Study 1's findings by extending the research question to whether a given level of anger or gratitude would lead to different decisions within an exchange situation across levels of relationship type. In other words, once triggered, do anger and gratitude influence decisions differently for strangers and friends compared to with cousins and siblings? This extension gave the current research the potential to make a clearer functional case for anger and gratitude in the context of non-kin exchange.

The presence of inclusive fitness effects for kin relationship partners means that the flow of costs and benefits within the relationship may be assessed differently based on costs being mitigated by mutual shared benefit from a genetic perspective. In contrast, exchange interaction with non-kin requires more stringent policing of equity and reciprocity, at least according to the evolutionary account of reciprocal altruism theory (Trivers, 1971). Based on predictions derived from this distinction, Study 2 found that anger led individuals to more punitive behaviors toward non-kin compared to kin. Similarly, gratitude was linked to more generous exchange decisions for non-kin exchange partners, but not for kin partners. In other words, for strangers and friends there were stronger links between anger and taking more to the self, and gratitude and giving

more to the partner. This pattern fits well with a function account for anger and gratitude within Trivers' (1971) psychological system regulating non-kin exchange.

Within an evolutionary account of emotions, anger and gratitude are viewed as mechanisms that organize and coordinate thoughts and behaviors based on context (Tooby & Cosmides, 1990; 2005; 2008). In the current research the contextual factor of kinship led to more anger after unfair offers from non-kin; and more gratitude after fair and generous offers from non-kin. Importantly, once triggered, anger and gratitude led to the same sort of exchange behaviors toward non-kin partners in Study 2 as the patterns of hypothetical behaviors that led to their activation in Study 1. This link provides insight into the functional roles anger and gratitude play in regulating non-kin exchange.

In our environment of evolutionary adaptedness, inequity or a lack of reciprocal exchange with a non-related individual would have had negative consequences in terms of survival and fitness outcomes. Anger and its associated cognitive and behavioral consequences (e.g., aggression, punishment; Berkowitz, 1990) have been speculated to represent a evolved functional response to these situations (Nesse, 1990; Trivers, 1971). Similarly, acts of reciprocity and generosity from a non-kin individual would have had positive fitness outcomes in our ancestral environments. Gratitude and its associated cognitive and behavioral outcomes (e.g., altruistic, prosocial behavior; McCollough, et al., 2001) have been proposed to represent an adaptive response to these situations. The current research represents the first direct empirical tests of these notions.

Although far from definitive, the pattern of findings from the current experiments does lend preliminary empirical support for some of the tenets Trivers' (1971) reciprocal altruism theory. Specifically, at least in exchange situations, anger and gratitude appear to

operate differently to regulate decision-making related to altruistic behavior for non-kin relationships compared to kin relationships. This is an interesting and important contribution in several respects.

First, this research represents an empirical contribution to the evolutionary psychological literature in that it provides further evidence in support of both inclusive fitness theory and reciprocal altruism theory. Non-kin altruism remains a topic of debate in the animal literature, where there is ongoing discussion about the frequency, nature, and evolutionary origin of cooperative social behavior between non-kin animals. For example, population simulations with assumptions regarding internal states analogous to anger/punishment and gratitude/reciprocity have been shown to be a condition in which generalized reciprocity can evolve in animal species without complex cognitive systems (Barta, McNamara, Huszar, & Taborsky, 2011). This sort of generalized reciprocity (i.e., indiscriminant cooperation outside the context of a relationship) within a large population does not fit with some of the assumptions Trivers (1971) originally required for his theory (e.g., repeated interaction with the same individual). Other ideas that challenge Trivers' original theory relate to asymmetries in the ability for an organism to provide benefits to others (Dawkins, 2009), and the roles coercion and manipulation across dominance hierarchies may play on the costs and benefits involved in non-kin altruism (Clutton-Brock & Parker, 1995; Cant & Johnstone, 2006). One thing that animal researchers do agree on is that the vast majority of animal cooperation occurs among kin (Clutton-Brock, 2009). In contrast, non-kin cooperation is pervasive among humans, at least in modern society. The current research adds to the understanding of mechanisms involved in the human capacity for non-kin cooperation. Whereas cooperation and

altruism in general have received empirical attention (e.g., Batson, et al, 1997; Cialdini, et al., 1997), these topics in the context of kinship and evolutionary psychology require further study.

The current research also contributes to the psychology of kin relationships. Especially during the formative years of childhood, humans spend the majority of their time with kin. Moreover, the relative amount of time spent with kin during our ancestral past was likely much higher than it is currently. As such, introducing relationship type as a contextual factor that may impact psychological processes seems like an important area of research. Nevertheless, empirical research on kin relations remains understudied within social psychology (Daly, et al., 1997; Salmon & Shackelford, 2011).

The current research was interested in how emotions and kinship interact in exchange situations and found that anger and gratitude have different outcomes for non-kin versus kin relationship partners. Structured situations from economic decision-making frameworks are ideal for studying this sort of research question, but this is just one of many social contexts (Kelley, et al., 2003). Emotions are likely to have different profiles of activation and behavioral outcomes in other contexts. For example, conflicts between parents and children stem from strictly kin-based interactions and likely have interesting patterns of emotion and strategic decision-making (Trivers, 1974). In the current research, friends exhibited especially interesting patterns of results. In one sense, they were treated like kin (e.g., general token allocations similar to cousins and siblings), but like strangers were more susceptible to anger and gratitude affecting token allocations. More precisely defining the similarities and differences between friendship and kinship is another potential area for further study. Despite having distinct

evolutionary origins stemming from reciprocal altruism and kin selection respectively, social interaction with friends and kin may trigger kin-based psychological mechanisms when friends share relatively large amounts of fitness interdependence (Brown & Brown, 2006). Moreover, there is evidence that suggests that distinguishing kin and non-kin can be a fallible process, with inferences of kinship being triggered by attitude similarity and superficial facial similarity (DeBruine, 2005; Park & Schaller, 2005). Future research would be well served by attending to the heuristics humans use to identify kin and friends, as the presence of some situational cues may trigger responses designed for kin interaction during interaction with non-kin (Park, Schaller, & Van Vugt, 2008).

Limitations and Future Directions

Although the current research did lead to some interesting findings, there are several limitations to this research. These limitations relate primarily to methodological and conceptual issues. Like any single set of studies, this research represents a relatively small piece of a larger program of research that is required before making more definitive conclusions regarding the evolutionary origin and function of proximal psychological mechanisms like anger and gratitude.

One major limitation of the current research was the use of hypothetical stimuli in the structured exchange situations. Although Study 2 included the cover story regarding the token allocation results being emailed to partners in an attempt to add psychological realism, there is the possibility that findings using actual face-to-face exchange situations would diverge from the current results. There is also the possibility that how participants reported they would feel in response to the hypothetical offers in Study 1 would be different from how they would actually feel during a real exchange situation. Future

research could attempt to replicate these findings with varied samples and settings. For example, achieving the same pattern of findings by bringing dyads with different relationships types (e.g., strangers, friends, siblings, etc) into a laboratory to take part in economic games for actual money would serve to address the potential issue of a lack of psychological realism. Moreover, using actual dyads would allow for more complicated research questions to be tested, such as the communicative role of emotions during exchange, and how emotional expression affects subsequent transactions in a real-time economic game. Study 2 manipulated emotion in general without reference to the exchange partner, which had advantages from a methodological perspective (e.g., allowed relationship type to be a within-subjects variable). Future research could modify the emotion manipulation such that participants would enter a state of anger or gratitude based on the unfair or prosocial behaviors of a particular relationship partner. Based on the current results, it could be predicted that there would be differences in decision-making and behavior for individuals who are experiencing social emotions as a result of a stranger's behavior compared to with kin. Similarly, interacting with non-kin individuals who are expressing anger and gratitude may lead to different outcomes compared to emotion expressing kin. The shift from emotion states triggered by unrelated events to emotions resulting from interpersonal behaviors could lead to a stronger set of results compared to the results from Study 2. As such, future research employing this change would serve to both replicate the current findings and could also strengthen the pattern of evidence that provided partial support for Study 2's hypotheses. Finally, another potential avenue for future research would be to track the emotional experiences of dyad members

over time using daily diaries to get a sense of the frequency and intensity of emotions within different types of relationships.

Another methodological limitation from the current research relates to the ability to generalize the findings from the experimental factors beyond the levels that were selected in the designs. In other words, this research was only concerned with four relationship types: strangers, friends, cousins, and siblings. These types were sufficient for testing the current hypotheses, but there are plenty of interesting combinations that could be the topic of future research. For kin, parent-child, grandparent-grandchild, and aunt/uncle-niece/nephew relationships remain unexplored in the context of emotions and social exchange. There are also plenty of non-kin relationships that may be of interest for future research. For example, co-worker relationships have attributes that fit well with idea of reciprocal altruism and thus may be of use for future research. There are also plenty of instances of power differences in workplace relationships that may be linked with interesting patterns of emotions and exchange behavior. Finally, the current research treated relationship type as a within-subjects variable, which have several advantages from a design and statistics perspective, but also can be susceptible to contrast effects. Future research could attempt to replicate the current results by treating relationship type as a between-subjects variable to rule out the possibility that there were contrast effects in the current research.

In an attempt to reduce the impact of sex differences in altruism (e.g., Burnstein et al., 1994), the current research used only same-sex relationships. Using relationships with both men and women is also an area that requires further study in this domain. One topic that may yield particularly interesting results would be testing the role of emotions on

regulating exchange within romantic relationships. Especially for couples with children, romantic relationships can be conceptualized as a relationship type with a blend of non-kin and kin attributes. Members of romantic dyads with children are not genetically related, but do share a significant degree of fitness-related outcomes in the form of offspring. The high degree of relatedness between each parent and each child ($r = 0.5$) could be a cue that leads to thoughts and behaviors within romantic relationships that result in outcomes more closely associated with kin interaction. This may be especially true based on situational factors such as the age and health of the children (Burnstein, et al., 1994), with kinship processes among parents being more pronounced during situations in which cooperation is necessary in order to ameliorate threats to inclusive fitness. Future research could, for example, attempt to trigger various goals states in a sample of couples with children to see if there are patterns of prosocial and helping behaviors that are uniquely triggered by a motivation to facilitate the success of children compared to other domains that require cooperation (e.g., dividing household chores). Finding evidence for more cooperative behavior in the presence of cues more closely linked to inclusive fitness would help empirically bolster the idea that romantic partners with children represent a case where kin and non-kin psychological processes are both operating depending on domain.

Anger and gratitude are just two of the mechanisms proposed by Trivers (1971) as being important in regulating non-kin reciprocal altruism. As such, the current research only provides a first step toward a more thorough understanding of the psychological system operating on reciprocal altruism. Future research could target other social emotions like guilt. Guilt is commonly defined as a feeling that is experienced after

transgressing against a moral imperative (Lazarus, 1991). This concept fits well into a framework of equity regulation, and examining guilt across relationship types may provide evidence for it being another proximal mechanism with characteristic differences across contexts like kinship. In addition to emotions, future research could also examine how higher-order constructs like trust fit into the reciprocal altruism system.

Another of the current research's limitation is that it cannot, on its own, rule out all plausible alternative explanations for the findings. The present research tested hypotheses derived from evolutionary theories that predict that anger and gratitude function, as a result of reciprocal altruism selection, to regulate thoughts and behaviors in exchange situations differently for non-kin compared to kin. Although variables like partner's age, emotional closeness, and felt similarity were included as controls and did not impact the results, there are other explanations that require future research to definitively rule out. For example, rather than kinship, it could be that a general sense of familiarity with an exchange partner would better explain the results. The frequency with which one interacts with a relationship partner may also be an important factor. There has been a distinction made between so-called communal and exchange relationships based on whether or not strict tit-for-tat reciprocity is a relationship norm (Clark, Mills, & Powell, 1986). Instead of being based on kinship and inclusive fitness effects, the current results could be due to how individuals classify their relationships based on reciprocity norms. In other words, it may be that anger's and gratitude's role in non-kin exchange, rather than being adaptations with an evolutionary origin, are triggered as a result of more general learning processes.

Results from social psychological research guided by evolutionary theory require an additional layer of inference compared to research testing more immediate proximal processes that are less concerned with historical causes (Conway & Schaller, 2002). It would have been less complicated to have removed reference to evolutionary origin and selection processes from the current hypotheses and instead focused on predictions such as: "anger will be more intense after unfair offers from strangers and friends because people are more likely to have had negative dealings with these groups compared to family and have thus learned to feel anger as a protective mechanism". This type of research question is more common in social psychology research and is part of what has been called the Standard Social Science Model (SSSM; Tooby & Cosmides, 1992). The SSSM eschews the idea that humans have evolutionary adaptations in the form of domain specific psychological mechanisms and instead explains social behavior with domain general processes such as learning. This approach has some merit (e.g., parsimony), but places human social psychology outside of the broader framework of the rest of the natural sciences. Evolutionary psychology has great potential for bridging the gap between psychology and other disciplines like biology, and thus may be worth the added complexity of making assumptions about selection pressures from distant ancestral environments. Any social behavior is undoubtedly multiply determined, but systematic and multi-method programs of research do allow for researchers to better parse the causes of psychological phenomenon into proximal and distal categories (Andrews, Gangestad, & Matthews, 2002; Simpson & Campbell, 2005).

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Appendix A: Ethics Approval

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Use of Human Subjects - Ethics Approval Notice

Review Number	**11 10 16**	**Approval Date**	**11 10 21**
Principal Investigator	**Lorne Campbell/Harris Rubin**	**End Date**	**12 04 30**
Protocol Title	**Playing an economic game**		
Sponsor	**n/a**		

This is to notify you that The University of Western Ontario Department of Psychology Research Ethics Board (PREB) has granted expedited ethics approval to the above named research study on the date noted above.

The PREB is a sub-REB of The University of Western Ontario's Research Ethics Board for Non-Medical Research Involving Human Subjects (NMREB) which is organized and operates according to the Tri-Council Policy Statement and the applicable laws and regulations of Ontario. (See Office of Research Ethics web site: http://www.uwo.ca/research/ethics/)

This approval shall remain valid until end date noted above assuming timely and acceptable responses to the University's periodic requests for surveillance and monitoring information.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the PREB except when necessary to eliminate immediate hazards to the subject or when the change(s) involve only logistical or administrative aspects of the study (e.g. change of research assistant, telephone number etc). Subjects must receive a copy of the information/consent documentation.

Investigators must promptly also report to the PREB:
a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) all adverse and unexpected experiences or events that are both serious and unexpected;
c) new information that may adversely affect the safety of the subjects or the conduct of the study.

If these changes/adverse events require a change to the information/consent documentation, and/or recruitment advertisement, the newly revised information/consent documentation, and/or advertisement, must be submitted to the PREB for approval.

Members of the PREB who are named as investigators in research studies, or declare a conflict of interest, do not participate in discussion related to, nor vote on, such studies when they are presented to the PREB.

Clive Seligman Ph.D.

Chair, Psychology Expedited Research Ethics Board (PREB)

The other members of the 2011-2012 PREB are: Mike Atkinson (Introductory Psychology Coordinator), Rick Goffin, Riley Hinson Albert Katz (Department Chair), Steve Lupker, and TBA (Graduate Student Representative)

CC: UWO Office of Research Ethics

This is an official document. Please retain the original in your files

Curriculum Vitae

Harris Rubin
Department of Psychology
Western University

Education

Doctor of Philosophy (2012)
Psychology
The University of Western Ontario; Supervisor: Dr. Lorne Campbell

Master of Science (2008)
Psychology
The University of Western Ontario; Supervisor: Dr. Lorne Campbell

Bachelor of Arts, Honours, Summa Cum Laude (2006)
Psychology
York University; Supervisor: Dr. Ward Struthers

Bachelor of Commerce, Honours (2001)
Finance
Queenôs University, Kingston

Publications

Campbell, L., & Rubin, H. (2012). Modeling dyadic processes. In L. Campbell, J. La Guardia, J. Olson, & M. Zanna (Eds.), *The science of the couple: The Ontario symposium, Vol. 12* (pp 1-16). New York, NY: Taylor and Francis.

Rubin, H., & Campbell, L. (2012). Day-to-day changes in intimacy predict heightened relationship passion, sexual occurrence, and sexual satisfaction: A dyadic diary analysis. *Social Psychological and Personality Science, 3*, 224-231.

Campbell, L., Simpson, J. A., Boldry, J., & Rubin, H. (2010). Trust, variability in relationship evaluations, and relationship processes. *Journal of Personality and Social Psychology, 99*, 14-31.

Lackenbauer, S. D., Campbell, L, Rubin, H., Fletcher, G. J. O., & Troister, T. (2010). The unique and combined benefits of accuracy and positive bias in relationships. *Personal Relationships, 17*, 475-493.

Rubin, H. (2007). Dispositions, situations, and time: Comparing the Interactionism model to historically dominant personality frameworks. In M. G. Luther, P. J. Gamlin, G. Wagner, & S. Cook (Eds.), *Transforming lives: Authentic living and learning*. Concord ON: Captus Press.

Manuscripts under Review

Rubin, H., Campbell, L., Overall, N., & Lackenbauer, S. D. Inferring a partner's ideal discrepancies: Accuracy, projection, and the communicative role of interpersonal behavior. Revise and resubmit status at *Journal of Personality and Social Psychology*.

Professional Experience

Research and Teaching

- Teaching Assistant - Psychology 4850 - Honors Thesis
- Teaching Assistant - Psychology 171 - Introduction to Social Psychology (2008)
- Teaching Assistant - Psychology 171 - Introduction to Social Psychology (2007)
- Teaching Assistant and Lab Instructor ï Psychology 282 ï Research Methods and Statistical Analysis in Psychology (2006-2007)

Other

- 2003 Java Developer. IBM Canada, Markham Ontario
- 2001 Business Analyst. IBM Canada, Markham Ontario

Honours/Awards

- 2009 SSHRC Canadian Graduate Scholarship (PhD)
- 2008 SSHRC Canadian Graduate Scholarship (Masterôs)
- 2006 Summa Cum Laude, York University
- 2005 York University Continuing Student Scholarship

Primary Research Foci

- Close relationships
- Evolutionary Psychology

Professional Affiliation

Society for Personality and Social Psychology (SPSP)