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Symmetry of Reinforcement in Social Behavior

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by

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ABSTRACT OF THE DISSERTATION

Symmetry of Reinforcement in Social Behavior

by

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A great deal of experimental evidence supports the notion of symmetry with regards to rewarding and aversive outcomes having an equally opposite effect on behavior in non-humans (Schuster & Rachlin, 1968; Farley & Fantino, 1978) as well as in humans (Critchfield et al, 2003). Numerous studies have demonstrated a direct effect of punishment, and empirical data that support conclusions pointing toward a symmetrical law of effect, such that behavior follows the matching law (Herrnstein, 1961) in equally opposing manner when compared to reinforcing outcomes. On the other hand, the domain of Prospect Theory (Kahneman & Tversky, 1979) has found that loss has a disproportionately larger effect on behavior than an equivalent gain, seeming to provide evidence contrary to the symmetry argument. The current experiments were designed to test this argument of symmetry using well-established interactions (1 – the Dictator Game, 2 – the Ultimatum Game, 3 – the Prisoner's Dilemma Game), where the stimuli at stake were tokens with one of two values: a conditioned reward stimulus (time-off a boring task) or a conditioned aversive stimulus (time-in a boring task). Both allocation and cooperative behaviors were measured and correlated significantly with Prosocial, Individualist, and Competitor Social Value Orientation across approx. N=2100 participants. Amount given of reward tokens was equal to the amount kept of aversive tokens; overall both allocation and cooperation data indicate strong support for an argument for empirical symmetry between reinforcers and punishers in social interaction settings. These findings agree with previous research observing symmetry of behavior thus reinforcing the symmetrical law of effect (Thorndike, 1911). The results also indicate the reliability of the social value orientation measure in experiments involving social interaction and division of a utility.

INTRODUCTION

Evolution of sophisticated social behavior is a major factor which has been said to distinguish humans from other living creatures, leading to the emergence of numerous forms of social transactions, primarily in two opposing directions. The terms positive and negative reinforcement are descriptions of behavior change in the positive direction, however as the opposing valence indicates two motivations are present. Stimuli that have been associated with good and bad outcomes can become conditioned stimuli via Pavlovian conditioning, themselves serving to reinforce behavior (e.g. clicker training) or reduce it (e.g. a police car). Humans speak words “good” and “bad”, “right” and “wrong”, “yes” and “no”, and these are descriptors of motivational states and evidence of prior conditioning, but primarily humans utilize these words functionally as conditioned stimuli woven into the complex web of reinforcement schedules that makes up our reality.

One question which has not yet been fully understood in human interaction, is whether the “yes” and “no” (perhaps the most universal and earliest learned positive and negative reinforcers), are equally opposite in strength as well as direction. There are those which would disagree with the theory of symmetry of reinforcement and punishment for example, citing studies which demonstrate loss aversion (e.g. Kahneman & Tversky, 1979). Other reputable behavioral researchers have historically held fast to their claim of a differential effect of punishment (Mowrer, 1947; Dinsmoor, 1954). Surprisingly, even Skinner (1953) claimed the relative inefficacy of punishment when compared to positive reinforcement. Of course, a difficulty arises when trying to equate consequences such as food vs. shock, so direct comparison is scant in research. The majority of well-controlled laboratory research has found strong evidence for a direct effect of punishment, as well as demonstrating equally opposite function from positive reinforcement according to predictions made by the matching law (de Villiers, 1980; Farley & Fantino, 1978; Schuster & Rachlin, 1968). More recent attempts to test for symmetry of positive and negative reinforcement in humans in a monetary gain-loss setting have also found strong support for the symmetry (Critchfield, Palentz, MacAleese, & Newland, 2003; Magoon & Critchfield, 2008), however other studies have noted particular asymmetries especially in monetary settings (Kahneman & Tversky, 1979).

The goal of the present experiments was to provide an analysis of symmetry between reinforcers and punishers in the context of human social interaction, to determine whether behaviors are of equal and opposite strength when the utility at stake is equal in amount but opposite in valence. The issue to be addressed is: do fairness and self-interest behaviors follow the same pattern when the outcome is of positive utility (time-off a boring task) compared to negative utility (i.e. time-in a boring task)? The current studies provide a natural test of behavioral symmetry using tangible outcomes within the domain of social interaction.

Attempted behavioral control via verbal consequence is ever present in our ordinary speech (e.g. ‘yes’ and ‘no’ – see Skinner, 1957), in verbal as well as non-verbal interaction (Newman, Hemmes, Buffington, & Andreopoulos, 1994), and certainly in the world of negotiation (Camerer, 2003). Reinforcement for social cooperation and self-interest behavior is of great importance, for the manner in which one behaves in a social situation depends not only on the history of consequences of prior self-other interactions, but also on the perceived current and future benefit one can acquire from the interaction. In addition the motivation exists to avoid unwanted stimuli or states, even if it requires having others endure them. One question of interest is, are these motivations equally opposite? Social Value Orientation (SVO) (Messick & McClintock, 1968) is a measurement device designed to capture interpersonal preferences, and reflects motivations in a variety of interactions (Van Lange, 1999) where more than one person's interest is of concern. The current experiment was designed to assess whether prosocials, individualists, and competitors behave equally and opposite according to their SVO in situations where either positive or negative utility serve as the outcome stimuli.

While some recent human studies demonstrating 'loss aversion' in risky choice claim a differential mechanism by which positive and negative reinforcement operate, they utilized hypothetical consequences, assessing risk-taking behavior with probabilistic outcomes (Kahneman & Tversky, 1979; Rachlin, Logue, Gibbon, & Frankel, 1986). One argument which may be raised is whether operating on a single plane of stimulus utility ('hypothetical" money – gain/loss) does not completely capture the duality of conditioned reinforcement and aversion which is so evident in the design of nature. The fundamental question of symmetry may perhaps be better addressed by incorporating aversive stimuli (which are not harmful) and rewarding stimuli in similar contexts. Throughout the current experiments, the crucial positive/negative duality of stimulus utility was carefully preserved. The central purpose of this project was to determine whether symmetry would be observed in social interaction settings, specifically focusing on allocation and cooperative behaviors.

1. Approach and Avoidance

This fundamental approach-avoidance distinction has been described as fundamentally basic and universal, differing only in valence. Some have described it as a singular motivational phenomenon (Elliot, 1999). The duality's prevalence has echoed throughout the ages as the hedonistic promoting Greeks (Democritus, 460 BC) and even further back in time from the Zen tradition:

> A person who has realized wisdom is not driven by desire and aversion. Instead, they respond naturally to whatever happens, in order to help other sentient beings experience wisdom. – *Sheng-Yen*

In *Principles of Psychology (vol 2)*, James (1890) discussed pleasure and pain using the term 'springs of action' – pleasure being a 'tremendous reinforcer' and pain a 'tremendous inhibitor' of behavior. Classical conditioning (Pavlov, 1927) and operant conditioning (Skinner, 1938) both hold that animal and human reflexes and behavior are modified by their appetitive or aversive consequences and corresponding stimuli; Tolman's (1925) purposive goal-directed behavioral approach held goals to include the end reference toward or away from which the organism is moving; Hull's (1943) drive reduction theory identified conditioned appetitive drives such as thirst and hunger, as well as conditioned inhibitory drives which can develop from shock, pain, and loud noises. Eating and drinking behavior are rather humorously both positively reinforcing when engaged in (dopamine release) and also negatively reinforcing when performed (hunger pain removed), as evolutionary necessity. An example from the developmental psychology field, two attachment styles have emerged: secure attachment, in which environmental exploration, goal orientation and challenge seeking behavior is prominent.

The other is called insecure attachment, in which restraint, caution, and avoidance behaviors are common (Bowlby, 1969).

Internal motivations which are built into the human body's biochemical structure and qualitatively termed "feel good" and "feel bad" associate perceptually to environmental experience via classical conditioning, meaning that a "stimulus" which was previously neutral may acquire eliciting properties of that with which it was paired. No scientist would deny the importance of the body's natural inclination toward stimuli which nurture its growth and health (food, for example), nor could one deny the importance of the body's natural inclination to withdraw from stimuli or situations which may cause it harm (such as specific food aversion after eating food that has spoiled). In language terms we may use "desire" and "aversion", as conceptual labels for the opposing motivations which attract/repel stimuli and feeling states with respect to the individual organism. On a clinical level an overemphasis on the expectations generated by these motivations become blockades to the natural happiness, catalysts for anxiety and depression, and a major cause of suffering.

The natural importance of these motivations cannot be mistaken. Biologically speaking, the behaviors of moving toward and moving away seem to be inbuilt. The body has innate potential to experience and induce both pleasure and pain. Dopamine is released with food intake (Ahn & Phillips, 2003), sensory stimulation and sexual response, and has long been associated with reward and learning (Duarte et al. 2003). It is a key neurotransmitter in motivation, from drug addiction to Parkinson's Disease to a variety of laboratory experiments. In one study where rats were depleted of dopamine, they would not even eat, much less do anything of their own volition (Berridge &

Robinson, 1998). When dopamine is released in the brain, the organism is more likely to remember details about the environment, and is likely to perform the same behaviors in that environment in the future. Dopamine is not the only neurotransmitter known for its mood-inducing properties: Opiates, Seratonin, and Norepinephrine also are related to reward circuitry and are associated with acute motivational disorders.

The body also contains a complex system of nociception (pain). Tissue damage or extreme pressure sends nerve signals through the spinal cord to the brain, which registers as a sharp, dull-increasing, or burning sensation. Also in the brain exists an endogenous opioid system of pain reduction, and these natural endorphins are released even upon extreme pain or strenuous activity, such as one common phenomenon captures, called 'runner's high' (e.g. see Hinton & Taylor, 1986). Pain reduction may be more greatly affected by taking opiate-agonists like Tylenol or Morphine which serve to mimic the body's chemicals in their synaptic action. The body's automatic behavioral response to a burn, sharp pain, or intense stimulation is retraction, protecting, and general movement in the opposite direction of stimulus location. The reaction does not require conscious thought processes, is not learned, is innate and endowed species-wide. As we contact the particular types of stimuli, environments, and would-be controllers that associate with aversive stimulation, behaviors of escape and avoidance are naturally shaped.

These two biological systems of learning are distinct yet interactive within an organism; preservation of their uniqueness is evident in the science of medicine. So to assume that animals or humans contain only a 'single mechanism' for behavior seems rather contrived. It is another thing altogether to ask whether the energies behind the behavior are equally opposite, and perhaps spring from the same source. Since they affect motivation and behavior in opposition, it is still well worth asking whether the intensity with which an organism behaves to acquire or avoid a stimulus is observed to be equally opposite.

2. Symmetry of Positive and Negative Reinforcement

Is the mechanism of reinforcement the logical opposite of punishment or should the two be analyzed under separate domains? Another way of phrasing it would be: do consequences both rewarding and punitive share the same power of influencing the magnitude and extent of their corresponding behaviors? The issue of whether or not reinforcement and punishment have equal (and opposite) effects on behavior surprisingly remains unresolved (Dinsmoor, 2001; Hineline, 1984; Hackenberg, 2008). The 'symmetrical law of effect' (Farley & Fantino, 1978; Thorndike, 1911) assigns equal and opposite functions to positive and negative reinforcement. That is, whatever the process that accounts for an increase in behavior is said to be the same process, working in equal opposition that results in a decrease in behavior. One-Factor approaches (Farley & Fantino, 1978; Herrnstein & Hineline, 1966; Rachlin & Herrnstein, 1969; Sidman, 1962) claim a *common-mechanism* hypothesis (Critchfield et al, 2003; Magoon & Critchfield, 2008).

A general agreement in the study of animal behavior under strict environmental control leaned toward symmetry as Michael (1975) noted. Dinsmoor (1954, 1977) on the other hand, held theoretical quarrel stating that punishment was merely a variant of negative reinforcement and to be interpreted in the context of avoidance theory, with behavioral processes not comparable to those of positive reinforcement. Such an approach claims a *differential-mechanism* hypothesis of punishment. This view has less support, however, for the behavioral analytic techniques for reinforcement were shown to readily apply to punishment as well as reinforcement (Azrin & Holtz, 1966). Hineline (1984) rightly mentions the fact that for punishment to be observable, a behavior must already be present in the organism's repertoire, and the particular acquisition and maintenance histories may lead to a variety of behavioral effects. He emphasized that the 'decrease' in punished behavior necessitates a schedule of positive reinforcement which had previously maintained that behavior.

It has been found that the molar consequence of shock frequency reduction can function as the variable responsible for maintaining avoidance behavior. For example, in one study by Hineline (1970) rats could postpone shocks for a short time by lever pressing and this maintained behavior when the overall frequency was constant, however if lever pressing resulted in an increase in overall shock frequency the rats would not lever press. Another example is Sidman's (1962) concurrent avoidance procedure where he compared rats' preference for signaled shocks to unsignalled. When overall shock frequency was equal for both alternatives, rats preferred signaled shocks to non-signalled; however when overall shock frequencies varied the rats chose to stay in the schedule with the lower overall frequency of shock regardless of whether it was signaled or not signaled. Analogously, the delay-reduction hypothesis (Fantino, 1981) can be thought of as a model which illustrates a molar explanation for positive reinforcement, where temporal context is an essential variable.

Accounts have been offered as to the effectiveness and ineffectiveness of contingent and non-contingent shocks on response suppression, respectively, also in a choice setting (Schuster & Rachlin, 1968). Arranging a concurrent-chain schedule, two concurrent response-alternatives are illumined and responses are recorded on a VI schedule (choice phase), the alternative which satisfies the VI then changes to one of two terminal-link reinforcement schedules ending in food (outcome phase) while the other alternative is inoperative. In their experiment, Schuster & Rachlin (1968) arranged equal VI 2 min initial links leading to equal VI 1 terminal links (food reinforcement). Choice behavior was assessed when shocks were superimposed upon each terminal link. When shock was at all contingent upon responding, suppression occurred to terminal link responding; however when shocks occurred independently of responding, no change in behavior occurred. In a further support of this finding, when the animals were given the option to choose between either schedule they had a strong preference for the schedule with the lower rate of shock. That is, subjects responded more to the initial link which led to the terminal schedule with the lower rate of shock, regardless of whether the shocks were made contingent upon or occurred independently of behavior (Schuster & Rachlin, 1968).

Related findings from recent research have highlighted the importance of contingency in token response-cost experiments with pigeons (Pietras & Hackenberg, 2005) and monetary response-cost in humans (Pietras, Brandt, & Searcy, 2010). Data from both studies found that contingent response-cost produced significant reductions in responding when compared to non-contingent punishment (token-loss) schedules. Moreover, this occurred even when absolute reinforcement rates were held constant. It is worth noting, however, that in Pietras et al. (2010) two of the eight human subjects displayed no reduction in button-pressing behavior during response-cost monetary loss schedules, even when loss amounts and contingencies (FR1) were increased. Another possible confound exists – that reduction in responding reduces punishment rates thereby increasing positive reinforcement rates – i.e. withholding responses becomes profitable. This may affect bias, and represents a potential problem with internal validity.

Two-factor theories such as the avoidance theory of punishment (Dinsmoor, 1954) emphasize the fear association which accompanies an aversive consequence. According to this theory, the response which is punished will become associated with fear, an aversive stimulus, thus the response is avoided and fear is avoided. One key assumption of this theory is that alternative responses are negatively reinforced by fear reduction – thereby indirectly competing with the punished response. In terms of the matching law (Herrnstein, 1970), the two-factor formula would be adjusted as follows (Deluty, 1976):

$$\frac{B_1}{B_1 + B_2} = \frac{(R_1 + P_2)}{(R_1 + P_2) + (R_2 + P_1)} \qquad (1)$$

where B_1 and B_2 are rates of responding on each reinforcement schedule, R_1 and R_2 are the rates of reinforcement on each corresponding schedule, and P_1 and P_2 are the rates of punishment on each corresponding schedule. Note the interaction between response alternatives – the above equation predicts an additive function which punishment has on the behavior of the alternate component.

In contrast, one-factor theories and the negative law of effect maintain that since punishment is considered opposite in effect of reinforcement, punishment would be subtractive in nature to its reinforcing component (de Villiers, 1977):

$$\frac{B_1}{B_1 + B_2} = \frac{(R_1 - P_1)}{(R_1 - P_1) + (R_2 - P_2)} \qquad (2)$$

In an experiment conducted with pigeons, de Villiers (1980) arranged VI schedules on two response components with different rates of reinforcement in each component. Equal shock frequencies were then added to both components, Equation 1 predicts a *decrease* in responding to the richer alternative, while Equation 2 predicts an *increase* in responding to the richer alternative. Results showed that when equal shock frequency is added to each component, the preference for the key that delivered more reinforcers increased, thereby supporting the predictions of Equation 2 and one-factor theories of punishment.

deVilliers (1972) attempted to directly test this hypothesis against the predictions of Herrnstein's (1970) matching law. Responses cancelled delivery of shocks which were put on variable-interval schedules. Evidence from the experiment demonstrated consistency with what matching law predictions would be for equivalent positive reinforcement schedules, in an equal and opposite fashion. A difficulty arises, however, in the ability to equate two qualitatively different biological consequences – how can a unit of shock be equated to a unit of food?

Farley & Fantino (1978) solved this conceptual problem by first scaling effects of food and shock by taking pre-measures for each subject in a simple reinforcement schedule. Then interactions were examined in a choice situation using a concurrent chains schedule, where terminal link values were a variety of food and shock frequencies. The data collected offered strong support for the matching relation, showing empirical symmetry of positive and negative reinforcement. It was the first experiment of its kind to successfully estimate the value of shock as negative food units (and vice-versa); in addition this study was a pioneer in utilizing the matching law (Herrnstein, 1970) as a functional measurement technique for the study of choice behavior as modeled by Anderson (1974a, 1974b).

Many other studies have successfully studied animals under controlled conditions using both reinforcement and shock, to compare the subsequent changes in responding (see Azrin, Hutchinson & Hake, 1967; Herrnstein & Hineline, 1966; Pear, Moody & Persinger, 1972). Such aversive stimulation can no longer be used on human subjects, although no doubt science would learn much from such an observation. However, one can arrange contingencies which are a milder form of aversion, such as boredom (Vodanovich & Kass, 1990).

Initial experiments with humans using equal sized monetary gain and loss strongly supported the view of symmetry (Ruddle, Bradshaw, & Szabadi, 1981; Ruddle, Bradshaw, Szabadi, & Foster, 1982). Minor procedural flaws have been noted, however, so these studies demanded replication (Critchfield & Magoon, 2001). One such study by Critchfield, Palentz, MacAleese, & Newland (2003) was designed to assess predictions made by one and two-factor theories of punishment in humans where punishment was equated with monetary loss. Subjects made simple choices in a variety of concurrent schedules where points could be earned (and lost) and later exchanged for money. Using a two-alternative concurrent schedule of positive reinforcement (monetary gain) where delivery occurred on a VI, a schedule of punishment (monetary loss) on a VI was then superimposed on both alternatives. In 17 out of 20 cases across three experiments, results strongly supported matching predictions made by one-factor theory, as was shown using procedures from deVilliers (1980). A more recent study also set forth to test whether monetary loss exerts greater or equal influence over behavior when compared to equal-sized positive reinforcement (Magoon & Critchfield, 2008). Using a very similar procedure as Critchfield et al. (2003), results once again unanimously offer further support for the symmetry argument. Behavior obeyed the matching law (Herrnstein, 1961) and indicated no bias. Another experiment published almost at the same time found strikingly different results (Rasmussen & Newland, 2008). The researchers arranged equal concurrent VI schedules of monetary gain, then superimposed punishment onto only one alternative. Responding toward the unpunished alternative indicated a three-fold bias, meaning according to the matching law monetary loss had a greater impact on behavior than monetary gain. Though stark contrast exists with experimental findings regarding the symmetry of loss, differences may be due to slight procedural differences.

A controversial study of monkeys was reported to reveal human-like loss aversion tendencies (Chen, Lakshminarayanan, and Santos, 2006), however this finding was later debunked by being explainable by more simple factors of reinforcement (Silberberg, 2008). Numerous studies in the cognitive-decision making literature have concluded that losses loom larger than gains (Rachlin, 1989; Rachlin, Logue, Gibbon, & Frankel, 1986). According to the original account of Prospect theory (Kahneman & Tversky, 1979) the possibility of a loss weighs more heavily than the possibility of a gain. For example, subjects deemed flipping a coin as an unfavorable way to settle a bet, although the chances are even 50-50 (Tversky & Kahneman, 1981). Especially with risky decision-making under uncertainty, human subjects have been shown to be risk prone for losses, but risk-averse for gains, to an extent that avoiding a loss is *twice* as valuable as an equivalent gain (Kahnemen & Tversky, 1979). Such findings would appear to support two-factor theories of punishment, however many of these studies have included hypothetical, probabilistic outcomes. An additional limitation is that the previously mentioned studies operate on a single plane of reinforcement – gain vs. loss of hypothetical money. As recently stated, additional research is needed where equal amounts of appetitive and aversive consequences are programmed similarly to determine whether they have equally opposite effects on behavior (Magoon & Critchfield, 2008). Another inconsistency with monetary loss experiments is that typically subjects are informed with the knowledge that their earnings will not be ‘negative’, i.e. will not have to pay out of pocket – such is the requirement by human subjects committees.

Neuroscientific research has also been interested in the aspects of monetary gain vs. loss and the accompanying neural patterns. Blood oxygenation level-dependent (BOLD) signals from fMRI data are analyzed in the striatum, which have been widely known to corroborate closely with learning in terms of reward (O’Doherty, Dayan, Friston, Critchley, & Dolan, 2003), but no consistent conclusion is evident regarding the effects of monetary loss. One study arranged visual cues that signaled either gain or loss and BOLD activation was compared (Seymour, Daw, Dayan, Singer, & Dolan, 2007). Data revealed striatal activation reflected equally whether gain or loss had occurred, and the authors claimed evidence for a common-mechanism hypothesis. A similar study found that separate mechanisms and even separate brain areas were involved in gain vs. loss (Yacubian, Glascher, Schroeder, Sommer, Braus, & Buchel, 2006). When an outcome had a positive expected value activation occurred in the striatum, but a loss related expected value showed activation in the amygdala. The amygdala has been implicated in the prediction of aversive events in previous neuroimaging research (Buchel, Morris, Dolan, & Friston, 1998; Kahn, Yeshurun, Torshtein, Freid, Ben-Bashat, & Hendler, 2002). Though it is clear which brain region is involved with gains, exactly which part of the brain encodes for losses or whether they do so symmetrically is still under question.

The current project provides a novel addition to the experimental analysis of behavior with the incorporation of stimuli with opposing utility at stake. The tasks utilized were included to assess the question of symmetry in social interaction behaviors. Obviously more variation can potentially arise in human social interaction, so a certain level of experimental control is important.

3. Social Reinforcement

In terms of societal norms, reinforcement and punishment as processes function in a widespread fashion. The extent to which each of us is a daily behaviorist cannot go overlooked. Consider a smile and a frown, a ‘yes’ and a ‘no’, a reward and a fine; all stimuli which have opposite effects on likelihood of future behavior. All of which have been previously associated with a biological process aforementioned (of course, in addition to principles of stimulus generalization). Why behave for the betterment of society and our neighbors instead of seeking self-benefit as the ‘rational man’ argument supposes? In actuality, perhaps we behave to benefit ourselves without cognizing it: we exhibit cooperation because we have been reinforced numerous times in the past for doing so, and tend to be reinforced by others both immediately and in future interactions.

> We are likely to appeal to some such inner virtue, however, to explain why a person behaves well with respect to his fellow men, but he does so not because his fellow men have endowed him with a sense of responsibility or obligation or with loyalty or respect for others but because they have arranged effective social contingencies. The behaviors classified as good or bad and right or wrong are not due to goodness or badness…they are due to contingencies involving a great variety of reinforcers, including the generalized verbal reinforcers of “Good!” “Bad!” “Right!” and “Wrong!”. (Skinner, 1971 p. 113)

> To make a value judgment by calling something good or bad is to classify it in terms of its reinforcing effects…the sight of fruit, for example, becomes reinforcing if, after looking at the fruit, we bite into it and find it good. (p.105)

Telling the truth is called ‘good’ and telling lies are called ‘bad’ and these may be considered cultural norms, but these norms are merely statements of the social contingencies in effect for exhibiting such behaviors (for example legal vs. illegal and their respective social contingencies). Therefore to consider one noble for telling the truth loses much of its meaning, since one may do so for praise and approval (RF+) and to avoid aversive consequence (RF-) which may occur if ‘un-truth’ is told.

Complete self-less giving is very rare in our society; only 5-10% are considered altruists as replicated by laboratory studies (Bekkers, 2007). Current investigations in the

UCSD operant lab have revealed this is somewhat due to the context of the situation when it comes to altruism, finding values ranging between 1 and 20% (Fantino & Stolarz-Fantino, experiment in progress). So why do we make contributions to charities or noteworthy organizations? It is all too easy to attribute worthiness to those who give of their personal wealth. This may be questioned: the story of altruistic giving could be radically different if personal primary reinforcers were at stake instead of secondary reinforcers. Altruistic giving leads the 'giver' to many types of reinforcement: Material goods, recognition (name on plaque), and smiles as well as a barrage of thanks, handshakes, and positive attention (and perhaps religious security – 'pleasing the gods') not to mention Karma and "what goes around, comes around". It is these consequences, both current and past which may incite within us good feelings about our contributions, and makes this behavior likely in the future.

Fairness or cooperation in the sense of equality occurs not necessarily out of goodwill, but quite possibly because past cooperative behaviors have been reinforced with approval, praise, and positive reciprocation. In addition the potential for future reinforcement is likely with that individual, or in groups or society at large, with increased access to primary and secondary reinforcers, including praise and attention which are extremely potent for both children and adults. Were an individual's cooperative attempts not reciprocated, thus resulting in a violation of expectation (i.e. a loss of expected reinforcement) or even aversive stimulation, such behavior would be "punished", reducing likelihood of future cooperation with that individual and perhaps others in general (resembling 'spread of effect'). Deviation from the social norm of fairness may incur many types of unwanted consequences. Unfair, impulsive, and selfish behaviors will lead to lowered probability of immediate and future reinforcement with this individual or group, and possibly removal of personal reinforcers.

However, there is some degree of immediate reinforcement gained by taking resources for oneself (and is a central issue of impulsivity and self-control), and if one has been reinforced for ‘taking all one can get’ in the past, and has avoided negative consequences this trend will most likely continue in other types of personal and interpersonal interactions. In addition, there is much praise and reinforcement which comes from winning and demonstrating one’s dominance over an opponent, so a history of being reinforced for minimizing an opponent’s score (in a baseball game, for example) would result in a competitive motivational trend, then current and future interactions may follow this competitive pattern. Of course, the so-called ‘optimal behavior’ of self-maximization is a commonly observed phenomenon though certainly not universal.

The concept of ‘entitlement’ or ‘endowment’ is that one feels entitled to reap the benefits of an effort he or she has made. It certainly operates on a legal level, for example, in land development purchasers must go through the Entitlement Process to obtain approval for rights to develop property for a particular desired use (“re-zoning”). Social Security is a more obvious example of entitlement. An ‘endowment effect’ was described by several researchers in marketplace-like situations (e.g. Thaler, 1980; Kahneman, Knetsch, & Thaler, 1990) where buyers will demand a higher price when selling a commodity that they own than they would be willing to pay for that same commodity in order to acquire it. The concept of property rights was tested explicitly by Cherry (2001) where participants played the Dictator Game (DG) as the allocator, in which the participant was given the opportunity to divide a sum however he/she wishes between him/herself and the recipient (who must accept any offer). Participants acted as allocators where the amount to be divided was either ‘allocated money’ (given to them by experimenter) or ‘earned money’ (which participants earned money in a prior decision-making task). The author found that participants acting over ‘allocated money’ displayed self-interest in 26% of bargains whereas those acting over ‘earned money’ exhibited self-interest in 76% of bargains. Other research substantiates this finding: when participants “earned” their role in the experiment (Hoffman et al, 2004; Hoffman and Spitzer, 1985) or earned the assets (Cherry et al, 2002; Ruffle, 1998), subsequent ultimatum and dictator allocations reflected their respective sources of wealth acquisition. Even in public goods scenarios, the amount contributed to the public good depends on how the participant money was acquired. This was illustrated by Muehlbacher and Kirchler (2009) where participants earned endowments with either lesser or greater effort. It was found that contributions made to the public good were less for those who earned their endowments with greater effort compared to those exhibiting lesser effort. This finding occurred even when subjects were unaware of asymmetrical earnings of their fellow participants (which is typically disclosed to participants in prior studies to encourage ‘other-regarding behavior’, see Rapoport, 1988; van Dijk & Grodzka, 1992).

This discrepancy of self-interest behaviors in entitlement conditions informs us of potential future experiments which may target the importance between individual choice behaviors over personal vs. laboratory assets. It also effectively raises a possible confounding factor with ‘prospect theory’ style experiments which incorporate gains and losses: the former is typically a windfall gain, while the in the latter case the participant must already have money in order to lose it. The concept of entitlement is also illustrated in the present experiments (Exp 3).

One can assume that history of reinforcement of past interpersonal interactions is at play in determining a specific pattern of outcome preferences in individuals. We can then look closely at these different patterns and observe behaviors in a variety of decision-making tasks. One interest of the current project was to evaluate *Social Value Orientation (SVO)* (McClintock, 1978; Messick & McClintock, 1968; Van Lange, 2000) in humans in a variety of social interactions, and to further analyze the effects of opposing outcome motivations using a novel behavioral procedure.

The current set of experiments was designed to test whether stimuli of positive and negative utility can have equal and opposite effects in the realm of human social interaction. Three well known social interaction tasks were utilized (Ultimatum Game, Dictator Game, Prisoner's Dilemma Game) to assess cooperation, defection, fairness and self-interest behaviors. In addition, the concept of 'entitlement' will be analyzed, to determine whether self-interest follows similar patterns when the stimulus to be divided is of positive vs. negative utility.

4. The Ultimatum Game

Self-interest and fairness are alive and well in bargaining research (Blount, 1995; Handgraaf et al, 2003; Messick & Sentis, 1985). The Ultimatum Game (UG) was developed by Guth, Schmittberger, & Schwartz (1982) as a two-person interaction to discriminate between these two very different motives. In laboratory experiments, one player assumes the role of allocator and is responsible for deciding on how to split a given "pie" between himself and another (the resource to be allocated, usually an "endowment" of money), and the other is the recipient, who decides on whether to accept or reject allocator's proposed split of the pie. Acceptance of the offer results in the proposed division, while rejection of the offer results in both participants receiving nothing. The UG has covered much territory in reciprocity (Fehr, Ernst, & Gächter, 2000; Nowak & Sigmund, 1998; Hoffman, McCabe, & Smith, 1998), cross cultural bargaining (Kagel & Roth, 1995), pie size (Tompkinson & Bethwait, 1995), and gender comparisons (Eckel & Grossman, 1996b).

Game theory (for a review see Camerer, 2003) assumes that bargainers are rational in that they try to maximize their own outcome exclusively. In terms of social utility, this would mean a focus on the absolute payoff component. Game theory predicts according to rational self-interest that in the UG the minimal offer should be proposed and that the recipient should accept any positive offer. Instead, the data has repeatedly shown the modal allocation to be a 50-50 split of the pie and several studies have shown that recipients will reject even substantial offers when they are unfair (see Camerer & Thaler, 1995). For proposers, the average offer is usually between 30-40% of the pie, and less than 1% of offers conform to game theoretic predictions (offering the minimal positive amount). As for recipients, offers of less than 20% are frequently rejected, and in one study where the pie was increased to $100, forty percent of recipients rejected a 70-30 split thereby sacrificing $30 (Hoffman et al, 1996). Clearly for both allocators and recipients in the UG, self-interest and personal maximization do not tell the whole story.

A contextual factor which has been frequently manipulated in bargaining experiments is the size of the pie (amount to be divided). Some economists have argued that people will behave rationally as long as the pie is large enough. Much research has demonstrated the contrary: Regardless of pie size, there were no observed differences in allocator behavior, whether the pie was $5 or $10 or $100 (Roth et al, 1991; Hoffman et al, 1996). Even when the amount to be divided was worth three months wages, researchers still found no effect, and this finding is consistent across cultures (Slonim & Roth, 1998). However, pie size effects have been found with regards to recipient rejection rates. Specifically, when the pie was increased, recipients were more inclined to accept a certain proportion and more readily accepted unfair offers (Cameron, 1999). In addition to pie size, using real vs. hypothetical amounts has been compared. Forsythe et al. (1994) did not find a difference in either allocator or recipient behaviors when real amounts were compared to hypothetical. In Cameron (1999), however, recipients rejected offers substantially more often when hypothetical amounts were used. Overall, opinions and evidence regarding using hypothetical amounts is mixed between psychologists and economists.

Fairness has been explained by equity theory (see Adams, 1965; Messick & Cook, 1983). According to equity theory people prefer the outcomes between themselves and another to be distributed according to their ‘inputs’. In the case of the UG equal inputs is a given; both participants have put in equal time and effort in the experiment thus far, so people are expected to prefer distributions of equal outcomes. Several economic models have been proposed to try to predict behavior in a number of experimental settings, including the UG (Bolton & Ockenfels, 2000; Fehr & Schmidt, 1999; Rabin, 1993; Falk & Fischbacher, 2000). One such model is the model of equity, reciprocity, and competition (ERC) developed by Bolton and Ockenfels (2000). This model of ‘inequality aversion’ predicts that players care about their own payoff and their relative payoff compared to the interdependent other, which is equal to the average payoff (total amt / # players). Concern for equity seems to be the driving force behind this model, but some limitations have been noted, as when the context is changed even slightly from the standard UG (Falk & Fischbacher, 2000). In addition, ERC cannot capture evidence for intentionality behind player choices, nor reciprocity (Rabin, 1993; Falk & Fischbacher, 2000). Another inequality aversion model is Fehr and Schmidt’s (1999) theory of fairness, cooperation, and competition (FCC). Similar to ERC, players are assumed to care about their own payoffs, but in FCC players are assumed to care about the differences between their own and another’s payoff, and the function includes utility in terms of envy and guilt: Players dislike having lower allocations than the other player (envy) and also dislike having higher allocations (guilt). That is, they will avoid making choices that result in unequal outcomes. The authors also claim that players will sacrifice earnings in order to move toward a more equitable solution. Overall, the models which have been developed may be useful for specific purposes, but combining them into a single theory or model would prove too cumbersome and inefficient for use (Bolton, 1998). Measuring SVO can accomplish very simply what complicated models such as these attempt to capture.

A question arises: Where do individual differences fit in with bargaining situations, and how can individual differences as specified by SVO account for fairness and self-interest behavior? Scant research has included SVO in conjunction with bargaining. One such study (Van Dijk et al., 2004) combined an SVO measure into a UG paradigm to see whether prosocials were susceptible to information asymmetry. Chips were worth twice as much to allocators, who are told that recipients were aware of this discrepancy (symmetric condition) or that recipients were not aware (asymmetric condition). Results indicated that prosocials made similar offers in the UG regardless of whether the recipient knew about the chip discrepancy. The proselfs, however, displayed strategic fairness by proposing seemingly fair offers, offering 43% of the pie in the asymmetric information condition compared to 58% of the pie when recipients knew of the chip discrepancy (Van Dijk et al, 2004). Not only have these findings questioned the use of the standard UG for measuring fairness accurately, but they also offer insight into individual differences in true fairness behavior. Thus it seems in the standard UG that fairness is more difficult to capture, yet many researchers have previously referred to equal UG splits as “fair behavior” without taking these findings into consideration. Incorporation of SVO is highly informative when interdependent social situations are employed in behavioral experiments.

5. The Dictator Game

The attractiveness of the Dictator Game (DG) lies in its simplicity. Just like the UG, the DG involves a division of a pie made by an allocator between himself and a recipient. The main difference between the two games is the role of the recipient: in the DG the recipient has no power to reject an unfair offer; in fact there is no decision for recipient to make at all (hence the name Dictator), so it better suited for the study of allocator behavior. Game theoretic predictions assume that the dominant strategy for allocators is to keep all of the money for themselves. Results of many studies have shown nontrivial positive allocating behavior (Forsythe et al, 1994; Camerer & Thaler, 1995; Hoffman et al, 1996; Eckel & Grossman, 1996a, 1996b). Most commonly found in DG is a bimodal allocation distribution: a mode at 50% and a mode at zero.

When informational symmetry about the value of the chips was varied in the UG (Van Dijk & Vermunt, 2000), an effect of strategic fairness was evident. However, allocators in the DG were immune to asymmetry: they offered similar amounts to the recipient whether or not s/he knew of the chip discrepancy. Thus, it seems that when fear of offer rejection is ruled out (as in the DG), true motivations can be seen with greater clarity, as can how people truly value own and other's outcomes. As such, the DG can be an excellent tool to examine pure self-interest and pure fairness behavior.

Behavior in the DG has been shown to be stable with respect to time (Forsythe et al, 1994), replicable (Hoffman, McCabe, Shachat & Smith, 1994), and stable with respect to various game manipulations including experimenter anonymity (Bolton, Katok, & Zwick, 1998). Its simple design gives a choice between self-interest and a concern for fairness, between absolute and comparative components of the social utility model. Using a personality measurement such as SVO in conjunction with DG seems highly appropriate.

6. Prisoner's Dilemma Game

Although a narrow Darwinist evolutionary view favors selection of individualism when it comes to resources rather than for the group-based, other-based behavior termed cooperation, this apparent prosocial behavior is ever present in social dilemmas such as the commons dilemma (Brucks & Van Lange, 2007), resource dilemma (Weber, Kopelman, & Messick, 2004), public good's dilemma (Van Vugt & De Cremer, 1999), and Prisoner's Dilemma Games (PDG) (Rapoport & Chammah, 1965; Axelrod, 1984). A dilemma exists between two choices: pursuing one's own self-interest or the common interest. Whereas one choice will definitely lead to a greater immediate gain for oneself, it does so only at the price of sacrificing the future availability of positive reciprocity from interdependent others. This explanation provides perhaps the most compelling logic for the emergence of prosocial behavior in society.

The study of social dilemmas provoke multi-disciplinary interest in the fields of psychology, economics, philosophy, sociology, and others. In the traditional Tragedy of the Commons (which goes as far back as Aristotle), a fishing community suffers a depleted fishing supply as money hungry individuals provoke competition which leads to overfishing, endangering the environment and the fishing industry. Thus laws are passed limiting the amount of fish one can take out of the ocean. A wide variety of social dilemmas are constructed with regard to this phenomenon. The PDG typically involves a choice between cooperation with another person or group, or pursuing a self-interested, competitive interaction style (defection). Just as in the 'tragedy of the commons', mutual cooperation in the PDG results in the best outcome for both players, but defection always leads to a higher immediate outcome for each player, and thus it is the Nash Equilibrium for this game (that is, cooperation is strictly dominated by defection, see Figure 3.1). A strict rational self-interest view would predict one should defect on the first and all trials regardless of the other's behavior. By cooperating one leaves oneself vulnerable to exploitative self-interested players.

In the case of multiperson PD games (2 or more players), whether a subject will cooperate with his opponent depends largely on whether he believes his opponent will cooperate subsequently. Probability of Reciprocation (PR) should be lower in multiperson PD than in alone PD games, for the degree to which one trusts one's own future choices is inherently greater than the degree to which one trusts an opponent's future choices (Baker and Rachlin, 2001). In their experiment PR was explicitly varied in a PD game against a computer. There were five conditions, each with a given PR: p = 1, .75, .5, .25, and 0. If p=1, the computer is said to be playing tit for tat, where the subject's response is mimicked on the next trial by the computer; so that if the subject cooperates the computer will cooperate, and if the subject defects the computer will defect. If p=.75, then following a cooperation response by the subject the computer will cooperate with a probability of .75. Therefore, there is a chance that the computer will defect after the subject has cooperated (p=.25 in this condition), more accurately resembling the live multiperson PD game PR contingencies. In addition, the experimenters manipulated whether subjects were aware of this PR with three conditions: PR signaled with a spinner, PR unsignaled, and PR unsignaled with subjects believing they were playing a human subject. It was found that with PR = .75, subjects maximized earnings only when the PR was signaled with a spinner. This finding demonstrated that differences in cooperation with others may lie in differences in subjective PR. Typically, though, when playing a human opponent, cooperation rates are much lower than when playing alone or against a computer (Rachlin, 2000).

From a behavioral viewpoint, relevant context of a choice is not an external event but a prior experience or "history of reinforcement" (Rachlin, Brown & Baker, 2001). This applies to both a first time interaction and repeated (iterated) interactions. A one-shot PDG consists of a single interaction, whereas in the iterated PDG subjects are aware that there will be future trials. A tournament was held (Axelrod, 1984) to develop interaction strategies which would best foster cooperation in both the short term and in the long run, and the best strategy was discovered to be ‘tit-for-tat’ (Rapoport & Chammah, 1966) which effectively reinforces cooperation and punishes defection by reciprocating the subjects prior choice. It certainly seems to be a good tool to teach cooperation, however tit-for-tat may not generalize to how humans really behave toward one another.

The current project measures cooperation behavior in the PDG within the context of a one-shot and multi-trial format. The standard PDG outcome matrix was utilized (see Figure 3.1); real-time behavior took place with a tangible outcome at stake. Of major interest was whether cooperation and so called ‘defection’ behavior would occur in a similar manner when outcome utility was made to be either positive (i.e. a conditioned reinforcer) or negative (i.e. a conditioned punisher). Along the lines of individual differences, we may be able to further make a worthwhile analysis utilizing the Social Value Orientation measure (McClintock, 1978; Messick & McClintock, 1968), which assesses one’s interpersonal motivations in social transactions.

7. Individual Differences: Social Value Orientation (SVO)

According to B.F. Skinner the ultimate control over behavior belongs to association, conditioning, and history of consequence – and what one ‘thinks’ or ‘feels’ about current conditions are no more than byproducts of that same conditioning. In a wide variety of everyday situations, individuals must make decisions whether to pursue their own self-interest or pursue the collective interest with one or more others. There is much experimental support that considerations of both fairness and self-interest influence people's evaluations of outcomes in social decision making (see Messick and Sentis, 1985; Lowenstein, Thompson and Bezerman, 1989). In particular social settings there are implicit norms of fairness which may be activated, both in how we treat others and how we feel we should be treated by the other. The social utility model (Blount, 1995; Loewenstein et al., 1989) explains that two components may derive utility in interpersonal contexts: the absolute payoff component (the value assigned to increasing own outcome) and the comparative component (the value assigned to own outcome relative to that of another person). Self-Interest is at stake for the former component, while the latter component elicits "other-regarding" preferences, such as a taste for equitable distributions. However, not all social motives can be distinguished with this model.

Individuals may differentially value particular patterns of outcomes for self and other, a personality measure also referred to as one's social value orientation (SVO) (McClintock, 1978; Messick & McClintock, 1968). Three stable orientation typologies have emerged: 1) prosocial (one who maximizes self and other outcomes and equal outcomes), 2) individualist (one who maximizes own outcome regardless of other) and 3) competitor (one who maximizes the difference between own and other). Perhaps the most respected and widely used methods for measuring SVO is the nine-item Triple Dominance Measure of Social Values, where prosocial (greatest joint outcomes – 'MaxOwn + MaxOther = MaxJoint' and equality in outcomes – 'MinDiff'), individualistic (greatest outcome for the self - 'MaxOwn'), and competitive (greatest relative advantage over others' outcome – 'MaxRel') own/other outcomes are pitted against one another (Kuhlman & Marshello, 1975; Van Lange, Otten, De Bruin, & Joireman, 1997). Out of nine items, six must be answered consistently in order to be classified under a particular orientation. As a measure, the Triple Dominance method of identifying SVO is internally consistent (e.g., Liebrand & Van Run, 1985; Parks, 1994), ecologically valid (e.g., De Dreu & Van Lange, 1995; Van Lange, Van Vugt, Meertens, & Ruiter, 1998), has been shown to be stable across time (e.g. Kuhlman, Camac, & Cunha, 1986), and has revealed test-retest reliability over a period of 2-6 months (Van Lange & Semin-Goossens, 1997).

Experiments have reliably shown significant differences in cooperative, self-interest, reciprocal, and altruistic behaviors between prosocials and what have been termed “proself’s” (Van Lange & Kuhlman, 1994). Well replicated findings have repeatedly indicated that prosocials act more cooperatively, expect more cooperation, and act more in a collectively beneficial manner and demonstrate fairness while “proself’s” tend to act in a self-interested manner in a variety of settings including social dilemmas (Kramer, McClintock, & Messick, 1986; Kuhlman & Marshello, 1975), bargaining behavior (Van Dijk et al. 2003; Pillutla and Murnighan, 1995), and in real-life dilemma’s such as public transportation use (Van Vugt, Meertens & Van Lange, 1995). In addition, prosocials, individualists, and competitors are judged differently by their friends and acquaintances (Bem & Lord, 1979). The current study will maintain the distinction of individualists and competitors.

Regarding symmetry of reinforcement and punishment, very scant research has incorporated SVO as a measure. One study sought to determine whether cooperation behavior in a two-person social dilemma was similar when the outcome was a gain-frame compared to a loss-frame (De Dreu & McCusker, 1997). Results indicated that Prosocials cooperated similarly whether a gain or loss frame, and the same was found for Competitors. Individualists, on the other hand, cooperated more in a gain-frame compared to those in the loss-frame condition. The authors argued that SVO-related interdependence theory (Kelley & Thibaut, 1978) was a far better fit for the data, when compared to predictions made by loss aversion and Prospect Theory (Kahneman & Tversky, 1979).

The inherent predictive utility of SVO for interpersonal interaction preferences should easily translate to most tasks which involve such interaction. In addition, SVO allows researchers to 'peer into' the variability of the data, gaining greater insight about the distinct differences between participants in how they approach making decisions in independent and interdependent tasks. More importantly, is the current project's use of SVO to determine with greater depth whether behavior is symmetrical when utility is positive vs. negative for prosocials, individualists, and competitors.

8. Boredom

In our fast-paced society with virtually unlimited stimulation, continual bombardment of our awareness occurs in the waking state. Typically developing individuals are (somehow) able to filter sensory information, processing useful information while ignoring irrelevant stimuli. We are conditioned into this type of life, and achievement indeed results in many reinforcers as well as higher probability for continuing reinforcement (individual attention and monetary reinforcement being most prevalent). One lacks stimulation and motivation, with a general absence of any excitement. Habituation is a natural fact of conditioning; with repeated stimulation one can habituate to both pleasure and pain stimuli (Arntz & Peters, 1990). Boredom is considered a type of negative affect, and has been associated with pathological gambling (Blaszczynski, McConaghy, & Frankova, 1990), substance abuse (Iso-Ahola & Crowley, 1991), depression and anxiety (Carriere, Cheyne, & Smilek, in press), and is quite common in our everyday jobs (Fisher, 1993). The rise of the Starbuck's-driven internet generation continues to shape man into an impulsive, time-saving, overworking, convenience needing creature, making the importance of optimal time use greater than ever in the history of man. Hence boredom (which can also be considered as "wasted time" or "time in a boring task" in the current experiments) is a suitable modern candidate for use as an aversive consequence in the laboratory environment.

The current set of experiments thoroughly cross-analyze social interaction behavior within the framework of 1) initial interaction, 2) subsequent interaction, and 3) multiple interactions. Along with measuring SVO this project analyzes interactions involving outcomes of both positive and negative utility. Relatively few human studies have been able to study both reinforcing and aversive stimuli in the same context. This study attempts to determine whether fairness and self-interest is equally opposite when the utility is positive vs. negative, this being a question of "Social Symmetry".

Further research and data on symmetry of reinforcement and punishment may help us develop methods of behavioral intervention in order to shape positive social interactions in our children and developmentally challenged populations. Most importantly, however, it will give us greater insight into the dualistic nature of behavior, most prominent in social interactions, and will perhaps allow the reader to come to a greater understanding of his or her own behavior.

METHOD

Each participant filled out the nine-item Triple Dominance Measure of Social Values, where prosocial, individualistic, and competitive own/other outcomes are pitted against one another (Kuhlman & Marshello, 1975; Van Lange, Otten, De Bruin, & Joireman, 1997). Three options were presented for each item, with nine items total, where six must be answered consistently in order to be classified under a particular orientation. The second page was instructions and a sample visual analogy problem that the subject was required to attempt. The third page consisted of several long division problems (with remainders) which the subject worked on until the experimenter returned (this was mainly to prevent rehearsal of the prior SVO).

Approximately N=2100 across all experiments, subjects were UCSD undergraduate students participating in the experiment for an hour of course credit. They reported to the general laboratory area when they were approached by an experimenter and asked to sign a waiver of consent (*note: this area was quite efficient at preserving subject anonymity due to the high volume of people commuting through the laboratory area). Participants were taken individually to a separate rooms across the hallway and seated at a table alone, and were told to complete the pre-experimental questionnaires, which consisted of the SVO questionnaire, an introductory visual analogy task, and a page of long division problems. Participants were instructed to remain there until the experimenter returned. After a few minutes elapsed the experimenter would return and explain that they had been randomly assigned to all parts of the current experiment, as was the other participant.

The current study is perhaps most novel in the analysis of human behavior with the addition of a simple, yet innovative technique to test for social symmetry: ordinary tokens attained value via consequent contingencies thus operating as conditioned reinforcers of both positive and negative utility.

As previously discussed, the UCSD operant lab has experimentally demonstrated that time-off of a tedious task generates similar behavior as does money (Fantino et al, 2007), and pilot data have indicated the same. In the current study subjects were made aware that there would be a dull, boring task later in the experiment to which they would be subjected. “TIME-TOKENS”, which were just ordinary poker chips, were given one of two values to the participant: each token obtained was worth either (1) positive utility (**RF) -** minus one minute from the duration of the dull, boring task, or (2) negative utility (**PUN) –** plus one minute added to the duration of the dull, boring task. The opposing valence of utility presented here in these two contingencies make the manipulation a viable test for symmetry.

1. Experiment 1 – Dictator Game (DG)

As discussed earlier, one method of determining a person’s interpersonal preferences is via the Triple Dominance Method. Another is to employ a simple decision making task where a subject is assigned to be an allocator, and is told to divide a sum between him/herself and another subject. Just like the UG, the Dictator Game (DG) involves a division of a pie made by an allocator between himself and a recipient. The attractiveness of the DG lies in its simplicity. The main difference between the two games is the role of the recipient: in the DG the recipient has no power to reject an unfair offer; in fact there is no decision for recipient to make at all, so it better suited for the study of allocator behavior.

The experimenter allowed several minutes before returning to the subject who had been put into a separate room in order to allow completion of the pre-experimental questionnaires (consisting of (1) SVO measure, (2) Visual Analogy example, and (3) long division math problems). The subject is told that the experimenter would be going back and forth between the participants, and assured that all would remain anonymous. They are then told that their role in the experiment has been randomly assigned to be the *allocator*, while the other participant has been assigned to be the *recipient*, and is given a sheet with the following instructions:

> You have been randomly paired with another individual (Person B, who is in another room) in this experiment, but all responses are anonymous and there are no right or wrong answers.
>
> Your task is to divide *X* "TIME-TOKENS" however you wish between yourself and Person B, allocating between 0-*X* "TIME-TOKENS" to Person B, while allocating the remainder to yourself. Please indicate the division below.

A number of "TIME-TOKENS" (x = 5, 10, 19) are then placed in front of the subject and the experimenter leaves the room. There are two blank spaces below where the subject was to indicate their choice of token distribution by writing down the number of tokens (if any) that will be allocated to the other and the remainder to self. There were also two token-size circles below, where the subject would then arrange the tokens as indicated by the decision. The experimenter would then re-enter the room and take the tokens allocated to Person B (if any), leaving the room once more. The subject filled out a likert-scale survey, after which the experimenter administered the ‘dull, boring task’. It consisted of a stack of dozens of sheets given to them with visual analogy problems, more than enough to keep them working, for a default amount of time minus (RF)/plus (PUN) the number of tokens they had kept for themselves. After the time was up the subjects were given a short debriefing, given credit for participation and let go from the experiment. (In order to preserve the somewhat trustworthy nature of experiments in the future, we did not disclose that the other participant was only hypothetical; Experimenter went to great lengths to enhance the believability of the fellow participant, and that multiple subjects were involved in the experiment concurrently certainly provided a believable case).

2. Experiment 2 – Ultimatum Game (UG)

The UG is a useful tool to study transactions similar to what one might encounter in the business world, but is also prevalent in everyday situations. When two people negotiate, both parties have a certain level of power. The proposer has the power to make any proposal he/she desires, while the recipient may reject the offer and the transaction is nullified. Therefore, a proposer must take into account the interests of the other if both are to walk away with a nonzero outcome. As previously described, offers of less than 30% are rejected half of the time, and offers less than 20% are almost always rejected. This is a surprising finding for economists, as rational self-interest theories of personal outcome maximization predict that even a minimal offer should be accepted for reasons of optimality (i.e. that getting ‘something’ is better than ‘nothing’).

Experiment 2 was designed to test whether social-symmetry occurs in a business-like transaction setting, namely the reciprocal behavioral effects of either a fair or unfair offer given to a recipient. Once again, the "TIME-TOKENS" which were divided in UG were either time-off task (RF) or time-in task (PUN). A fair offer consisted of an equal split of the 10 tokens (5/5) while an unfair offer consisted of an 80/20 split (recipient was offered 2 RF or 8 PUN). In the RF condition, a rejection resulted in a zero-zero outcome, while in the PUN condition a rejection resulted in the maximum of 10 PUN for each the proposer and recipient. After the subject had finished the pre-experimental questionnaires, the experimenter approached him/her and explained the UG task, and left the room, returning with the proposer's offer (as prepared by the experimenter), below which they were to circle either 'accept' or 'reject'. The subject was left alone in the room for one minute to make a decision, upon which the experimenter re-entered the room and divided the tokens as directed by the subject's decision.

After making their choice to either accept or reject and Time-Tokens distributed (or not) by the experimenter, subjects were then informed that in the next task they had been randomly assigned to assume the position of allocator in a single trial DG. They were given a new sheet with DG instructions (see Exp.1) and 10 Time-Tokens, and left alone in the room to make their decision. The recipient was set to be either (1) the same one (Person B) with whom they had previously interacted, or (2) a new individual (Person C) with whom they had never interacted. This manipulation examines to what extent does a fair or unfair UG offer (and the reaction thereto) contribute to subsequent behavior, specifically testing the concepts of *specific reciprocity* (Person B) and *generalized reciprocity* (Person C) (*note: results did not differ based on whether the other was Person B or Person C, deeming further analysis of this unnecessary and will not be mentioned further).

Upon returning to the subject, the experimenter took the tokens allocated to the recipient away, leaving a short likert-scale survey of several questions regarding their motivations throughout the tasks. Following this the total number of tokens that the subject had collected was totalled and subtracted (RF) / added (PUN) to the duration of the dull, boring task, which began immediately. After the subjects had been working for their specific time duration they were quickly debriefed then released from the experiment and given credit for participation.

3. Experiment 3 – Prisoner's Dilemma Game (PDG)

Experiment 3 was a multiple interaction sequence designed not only to observe cooperation and self-interest behaviors in the PDG, but also to see whether Social Symmetry is observed when opposing outcomes are compared in terms of a single and repeated interaction. The particular Social Value Orientation of an individual may come into play, and any interaction effects of symmetry across SVO could provide important insights with regards to human interaction and contribute a novel addition to the experimental analysis of social behavior.

The interaction consisted of: 1) 1-shot PDG; 2) 4 sequential trials of PDG; 3) Final trial PDG; followed by 4) simultaneous DG where they allocated TIME-TOKENS to each other. The outcome matrix (see Fig 3.1) was the same for all trials, and these tasks occurred in the above order for all participants. Although the logic of the sequence follows no traditional theoretical rationale, it provides a series of realistic, consequence oriented interactions comparable to everyday interactions outside of the laboratory.

Person B's Choice

		BLUE	GREEN
Your Choice	BLUE	You get: 3 Person B gets: 3	You get: 0 Person B gets: 5
	GREEN	You get: 5 Person B gets: 0	You get: 1 Person B gets: 1

Figure 3.1. The Prisoner's Dilemma Game outcome matrix utilized in Exp. 3 where choices were BLUE (cooperation in RF, defection in PUN) or GREEN (defection in RF, cooperation in PUN). Amounts for participant and other represent number of tokens each would receive.

After signing the waiver each subject is taken one at a time to separate rooms to complete the pre-experimental questionnaires. Meanwhile the experimenter sets up the materials. The task was called "BLUE/GREEN" so as to remain ambiguous as to the nature of the PDG. A middle room is utilized for the PDG interaction, and consists of a table with chairs on opposite ends with a partition in between, so that neither subject could identify the other, however it was clear that another participant was on the other side. An upside-down stack of papers was placed beside each subject and a pile of tokens (or quarters) was visibly stacked in front of the experimenter. The following instructions were then read aloud so both could hear (according to condition):

(1) *RF tokens*: "In the following task you will have the opportunity to get "TIME-TOKENS". These tokens will DECREASE your required time later in the experiment in an arduous visual analogy task (which is dull and boring)…the more tokens you get, the LESS time you will participate in this boring task and the SOONER you will get to leave from the experiment."

(2) *PUN tokens*: "In the following task you will have the opportunity to get "TIME-TOKENS". These tokens will INCREASE your required time later in the experiment in an arduous visual analogy task (which is dull and boring)…the more tokens you get, the MORE time you will have to participate in this boring task and the LONGER you will have to participate in the experiment."

(3) *Money* (quarters): “In the following task you will have the opportunity to get QUARTERS, yes, the outcome of this experiment will involve REAL MONEY FOR YOU TO KEEP when the experiment is completed”

Subjects were then told to turn over the first page on the pile which was turned upside-down adjacent to them, and were informed to read instructions carefully before recording their decision at the bottom of the page. Instructions consisted of a matrix-style illustration of the PDG (see Figure 3.1), as well as a text version of the contingencies of choosing either option compared the other participant’s choice. Token (and monetary) outcome values were modeled after previous PDG experiments conducted both in our laboratory (Fantino, Gaitan, Meyer, Stolarz-Fantino, 2006) as well as the work of Howard Rachlin and associates (e.g. Brown & Rachlin, 1999).

On the bottom of the page they made their response by circling either BLUE or GREEN (note: in both RF and PUN conditions the choices and amounts remained equivalent, therefore a choice of *cooperation* was considered to be BLUE during RF and GREEN during PUN). A couple of minutes were allowed where the experimenter walked to an adjacent room to wait until it appeared as though the Ss had made their choices, after which the experimenter re-entered the room verbally indicating the outcome and divided the TIME-TOKENS as their choices indicated.

After the tokens were distributed the Ss were instructed to turn over the next sheet from the pile. It consisted of the same instructions and matrix as the previous 1-shot PDG, with the addition of four consecutive trials visible to the Ss. The experimenter then proceeding only 1-trial at a time as per the experimenters instructions, as was arranged on the sheet in front of each Ss. Each trial Ss were instructed to indicate their decision by circling the appropriately numbered choice. After both Ss had made their decisions tokens were distributed accordingly. The process continued in the same way for four trials.

Following the fourth trial, Ss were instructed to turn over the next sheet from the pile, upon which the experimenter notified the Ss that it was the Final Trial. The token outcome ratios remained the same however, amounts were doubled (i.e. 6/6, 10/0, 2/2). Ss were given a few moments to respond after which the tokens were distributed and the next sheet on the pile was instructed to be turned over, which consisted of a short likert-scale survey.

The final sheet was then turned over, which was a simultaneous DG where Ss assumed the position of allocator, where the other was the recipient. They were given the option of dividing a number of RF/PUN/$ in any manner they wished. Half of Ss were asked to divide the tokens they had accumulated thus far (‘DG-ent’), and half were given 10 NEW tokens to divide (DG-10; this manipulation served to study the potential symmetry of the previously mentioned ‘entitlement effect’, (Cherry, 2001). Participants were asked to read the instructions carefully before deciding, and then the experimenter walked away from the table until it appeared that both Ss had finished. Tokens were distributed as each Ss had indicated on the form, then immediately one subject was moved to another room to begin the dull, boring task. It was administered in the same manner as previous experiments, with the exception of the real money condition where there was no boring task administered.

RESULTS

Allocator behavior was collected in all 3 Experiments demonstrating similar behavior whether the subjects divided RF tokens or PUN tokens, with some exceptions. In the case of RF tokens, fairness was defined in terms of *Amount Given*, while in the case of PUN tokens fairness was defined in terms of *Amount Kept*, so the dependent measure's label was called *(p)given/kept*. This is an important point, for if symmetry is to be tested statistically one can more intuitively see the statistical similarity of behavior in opposing directions by equating along one stimulus dimension (DG allocation in Exp. 1, UG in Exp 2., and PDG in Exp. 3). In addition, non-parametric statistics were utilized for two commonly observed behaviors in the DG: *ZeroOffers,* meaning *(p)given/kept*. = 0; and *EqualOffers*, meaning *(p)given/kept* = .5 (*slightly modified for Exp. 1).

Experiment 1. Allocation data for Experiment 1 is illustrated in Figures 1.1 & 1.2 and presented in Table 1, where the dependent variable '*(p)given/kept*' was amount of *utility* (tokens) (p) *given* (RF) or *kept* (PUN) in the DG task (equated on the same continuum for purposes of analysis –both are considered symmetrically opposite elements of fairness behavior). Histogram data illustrates the observed bi-modal behavior commonly found in DG experiments (Figure 1.1), for both RF and PUN tokens, which appear to be strikingly symmetrical. Since data collected in DG experiments is largely bimodal, non-parametric statistics were also considered in addition to parametric. These other dependent variables measured: '*ZeroOffers*', and '*EqualOffers*' was coded as *(p)given/kept* > .4 (due to the fact that when pie-size is odd, i.e. (5) and (19) there can be no equitable division).

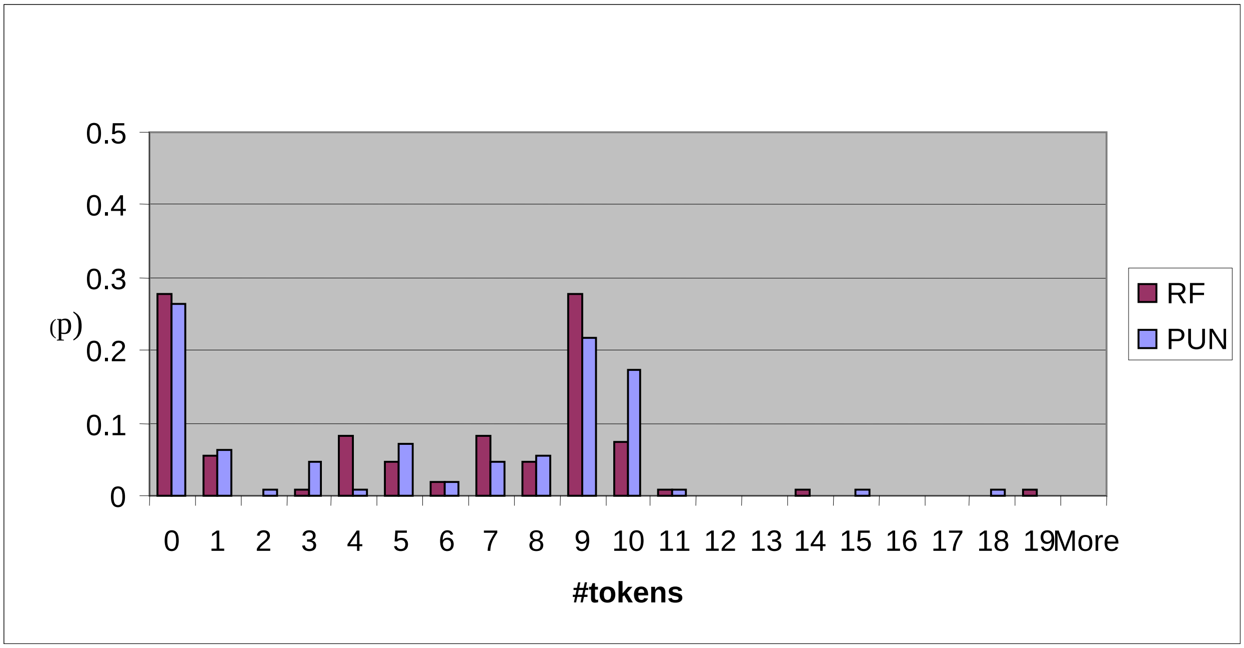

Figure 1.1. Histogram data for (p) participants dividing 19 tokens as allocator in the DG, *proportion given* of 19 RF tokens (N=108) and *proportion kept* of 19 PUN tokens (N=110)

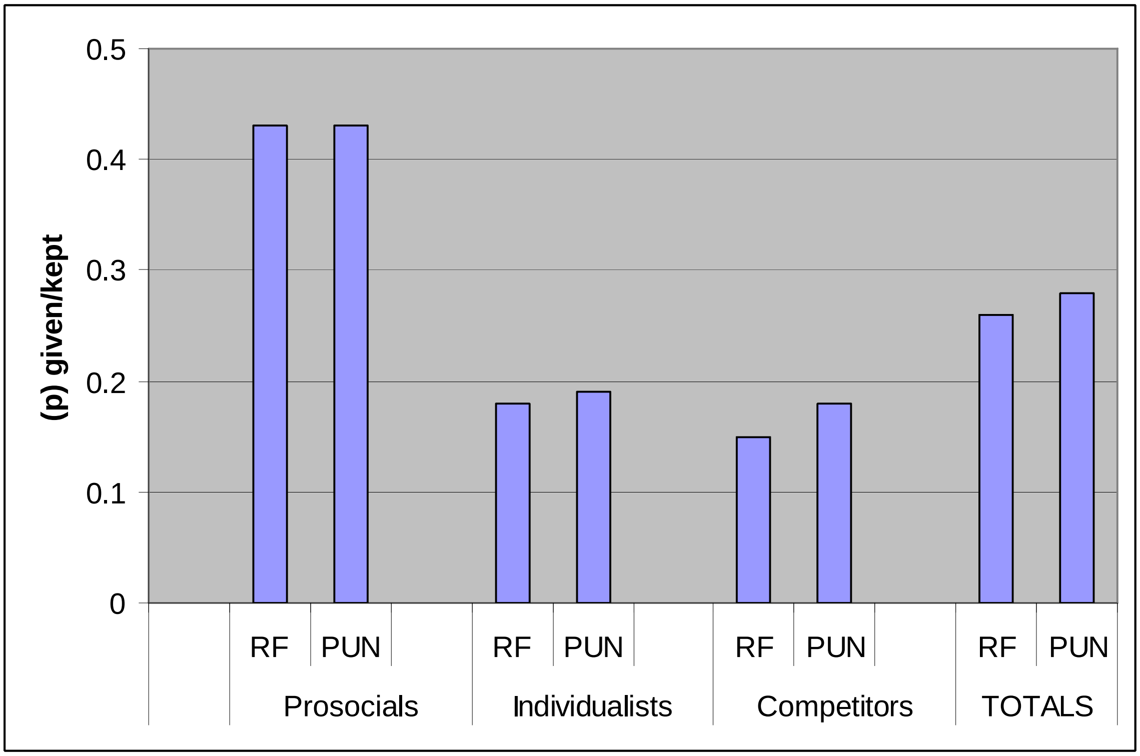

Figure 1.2. Mean proportion *given* of RF tokens, and mean proportion *kept* for PUN tokens, across Social Value Orientation (RF: n=301; PUN: n=306).

Table 1.1 Allocation means across SVO and utility for a 1-shot DG for dependent variables *(p)given/kept*, *ZeroOffers*, and *EqualOffers*.

Group		*n*	*(p)given/kept*	*ZeroOffers (p=0)*	*EqualOffers (p>=.4)*
Prosocials	RF	107	.43 (.17)	7%	81%
	PUN	113	.43 (.18)	10%	83%
Individualists	RF	142	.18 (.20)	50%	30%
	PUN	119	.19 (.21)	48%	31%
Competitors	RF	52	.15 (.21)	60%	23%
	PUN	74	.18 (.20)	45%	26%
TOTALS	RF	301	.26 (.23)	37%	47%
	PUN	306	.28 (.23)	33%	49%

(p)given/kept. A 2 (utility) x 3 (SVO) analysis of variance revealed a significant main effect for SVO [F(2, 601) = 113.6, p<.001], but revealed a non-significant main effect for utility (RF vs. PUN) [F(1, 601) = .633, p>.05]. Post-hoc analysis (Tukey's HSD) showed significant differences in *(p)given/kept* between prosocials vs. individualists [p<.001], as well as prosocials vs. competitors [p<.001], however individualists were not found to be different from competitors. Manipulation of pie size (19, 10, 5) utilizing a 3 (pie size) x 2 (utility) analysis of variance revealed non-significant main effect for pie-size [F(2, 640) = 1.06, p>.05]; non-parametric tests revealed the same finding, therefore further analysis was collapsed across pie-size.

ZeroOffers. Pearson's Chi-Square values were computed for pairwise analyses. Data revealed a non-significant difference in utility [χ^2(1, *N* = 646) = .313, p>.05], indicating that participants were equally likely to make *ZeroOffers* whether utility was RF or PUN. A significant effect for gender was found [χ^2 (1, *N* = 646) = 7.23, p=.007] indicating that males (42%) were more likely to make a *ZeroOffer* than females (31%), however there were significantly fewer male participants (n=197) compared to females (n=449) (an undergraduate psychology major phenomenon). In terms of SVO, Prosocials (9%) were significantly less likely to make *ZeroOffers* than both Individualists (49%) [χ^2(1, *N* = 481) = 91.8, p<.001] and Competitors (51%) [χ^2(1, *N* = 346) = 78.1, p<.001] however Individualists and Competitors did not differ significantly. Additional analyses were performed to see whether Prosocials, Individualists and Competitors behaved equally in RF vs. PUN. Prosocials were no more likely to make *ZeroOffers* whether RF or PUN [χ^2(1, *N* = 220) = .355, p>.05] as well as both Individualists χ^2(1, *N* = 261) = .114, p>.05] and Competitors [χ^2(1, *N* = 126) = 2.76, p>.05].

EqualOffers. Across subjects data revealed an equally likelihood to make *EqualOffers* whether utility was RF or PUN [$\chi^2(1, N = 646) = .313, p>.05$]. Once again a significant effect was found for gender [$\chi^2(1, N = 646) = 5.85, p=.016$], such that females (51%) were more likely to make *EqualOffers* than were males (41%). In addition, Prosocials (82%) were more likely to make *EqualOffers* than both Individualists (31%) $\chi^2(1, N = 481) = 128.2, p<.001$] and Competitors (25%) [$\chi^2(1, N = 346) = 112.3, p<.001$], however Individualists and Competitors did not differ significantly. Prosocials were no more likely to make *EqualOffers* whether RF or PUN [$\chi^2(1, N = 220) = .13, p>.05$] and the same for both Individualists $\chi^2(1, N = 261) = .02, p>.05$] and Competitors [$\chi^2(1, N = 126) = .11, p>.05$].

Experiment 2. Of interest in Experiment 2 was whether the trend of symmetry also applies to behavior following either a fair or unfair UG offer. This was arranged by having participants initially act as the recipient in the UG, where they experienced either a fair (50%) or an unfair (80/20%) offer from an anonymous “proposer” (convincingly manipulated by the experimenter). Participants had the option to accept or reject the offer. Following the UG the participants are then given the role of allocator in a DG task along with 10 tokens to be divided where the other (or a novel participant) was then the recipient. Data are given in Tables 2.1 - 2.3, and Figures 2.1 - 2.3.

UG Offer = 50/50. Zero participants rejected the equal UG offer in the case of either RF or PUN. Figure 2.1 and Table 2.1 illustrates the striking results from the subsequent DG10 for fair offers.

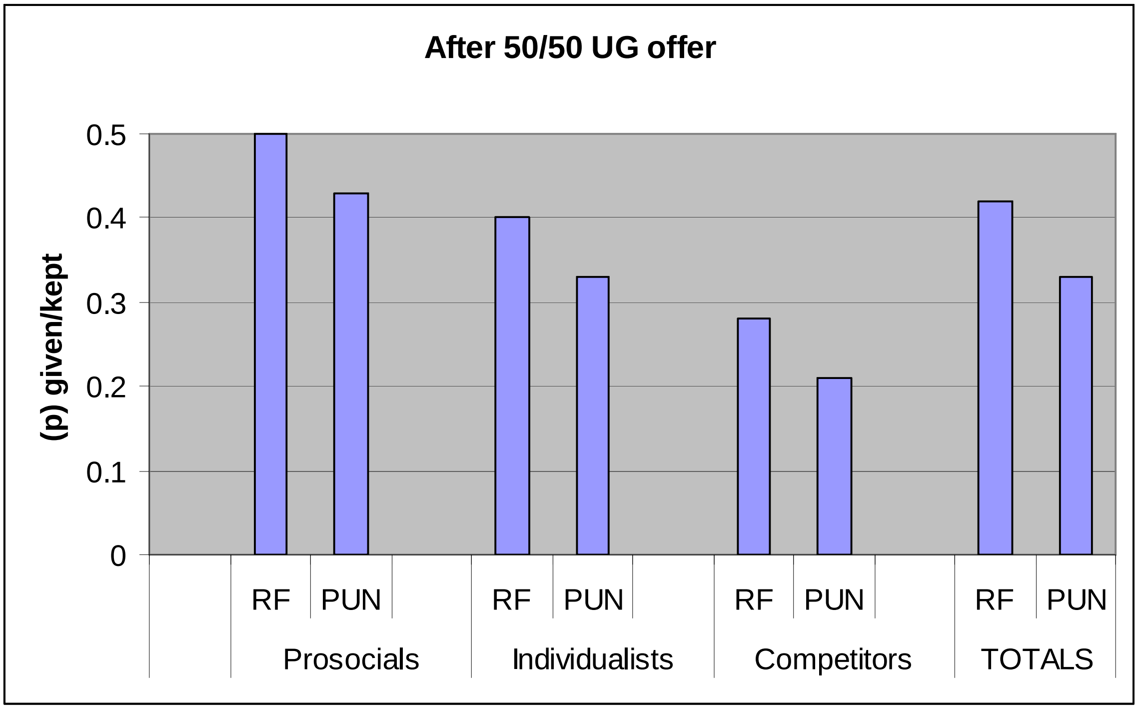

Figure 2.1. Allocation data from DG10 following an Equal UG offer of 5/5 by Social Value Orientation (RF: n=98; PUN: n=94).

Table 2.1. Allocation means across SVO and utility for a 1-shot DG following an Equal UG offer for dependent variables *(p)given/kept*, *ZeroOffers*, and *EqualOffers* (* - denotes significantly different adjacent values).

Group		*n*	*(p)given/kept*	*ZeroOffers*	*EqualOffers*
Prosocials	RF	41	.50 (.13)*	2%	88%
	PUN	38	.43 (.15)*	8%	74%
Individualists	RF	40	.40 (.16)	10%	60%
	PUN	32	.33 (.21)	22%	50%
Competitors	RF	17	.28 (.23)	35%	35%
	PUN	24	.21 (.23)	46%	29%
TOTALS	RF	98	.42 (.18)*	11%*	67%*
	PUN	94	.33 (.21)*	22%*	54%*

(p)given/kept. A 3 (SVO) x 2 (utility) analysis of variance revealed significant main effects for SVO [F(2, 186) = 21.3, p<.001] and also a significant main effect for utility [F(1, 186) = 6.67, p=.01]. The latter finding is a striking one, for it contradicts predictions made by the RF PUN symmetry hypothesis. It indicates that *(p)given/kept* was significantly less for PUN (M=.334) when compared to RF (M=.424). The model also provided post hoc pairwise comparisons of SVO (Tukey's HSD) revealed Prosocials (M=.468) significantly greater than both Individualists (M=.367) [p<.001] and Competitors (M=.239) [p<.001], who were also found to be significantly different from each other [p<.001]. Another contradictory finding was that Prosocials exhibited greater *(p)given/kept* when RF tokens were divided (M=.50) compared to PUN tokens (M=.43), [t(77) = 2.44, p=.02], however no significant differences across utility were found among Individualists or Competitors. This trend of less 'prosocial' behavior in PUN is somewhat apparent in Table 2.1 across all participants.

ZeroOffers. Pearson's Chi-Square values were computed for pairwise analyses. Data revealed a significant difference in utility [χ^2(1, *N* = 200) = 5.4, p=.02], such that there was a greater occurrence of *ZeroOffers* in PUN (23%) compared to RF (11%). In addition, Prosocials (5%) were significantly less likely to make a *ZeroOffer* than Individualists (15%) [χ^2(1, *N* = 151) = 4.39, p=.036],and Competitors (41%) [χ^2(1, *N* = 120) = 24.8, p<.001], and the latter were also significantly different from each other [χ^2(1, *N* = 113) = 9.61, p=.015]. A marginally significant gender difference was found [χ^2(1, *N* = 200) = 3.23, p=.07], such that males (25%) seemed to be more likely to make *ZeroOffers* compared to females (14%). No significant SVO differences were observed across utility for *ZeroOffers*.

EqualOffers. Data revealed significant differences in utility [χ^2 (1, *N* = 200) = 5.22, p=.022], indicating a greater occurrence of *EqualOffers* in RF (68%) vs PUN (53%). Analysis of SVO revealed that Prosocials (81%) were significantly more likely to make an *EqualOffer* than both Individualists (56%) [χ^2 (1, *N* = 151) = 11.4, p<.001] and Competitors (32%) [χ^2 (1, *N* = 120) = 28.5, p<.001], who were also significantly different from each other [χ^2 (1, *N* = 113) = 5.97, p=.015]. No significant SVO differences were observed across utility for *EqualOffers*.

UG Offer = 20/80. Participants were offered 20% of RF (2/10 tokens) and 80% of PUN (8/10 tokens) by an anonymous other 'in the other room'. Table 2.2 and Figure 2.2 illustrate subsequent DG10 behavior across SVO, and Figure 2.3 and Table 2.3 compares DG10 behavior across UG offer acceptance/rejection.

Rejection Rates. For unfair offers, the frequencies of offer rejection did not significantly differ between RF and PUN [χ^2 (1, *N* = 397) = .128, p>.05], nor gender [χ^2(1, *N* = 397) = 1.57, p>.05], nor surprisingly SVO [χ^2(2, *N* = 373) = 2.75, p>.05].

(p)given/kept. Post-UG, for DG10 a 3 (SVO) x 2 (utility) analysis of variance revealed a non-significant main effect for utility [F(1, 367) = .931, p>.05], but a significant main effect was found for SVO [F(2, 367) = 22.0, p<.001]. Post hoc analysis (Tukey's HSD) revealed significant differences in *(p)given/kept* between Prosocials (M=.328) vs. Individualists (M=.198) [p<.001] and vs. Competitors (M=.191) [p<.001], however the latter two were not significantly different from each other. No significant SVO differences were found across utility.

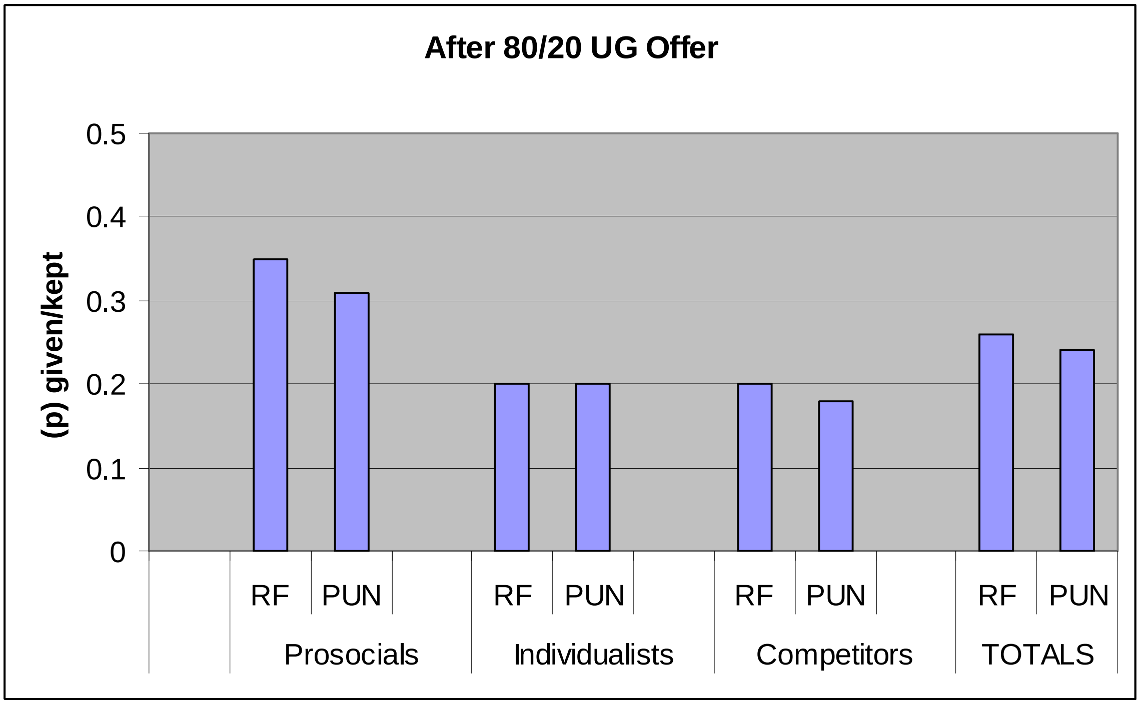

Figure 2.2. Allocation data from DG10 following an Unfair UG offer of 2/10 RF tokens or 8/10 PUN tokens, by Social Value Orientation (RF: n=191; PUN: n=182).

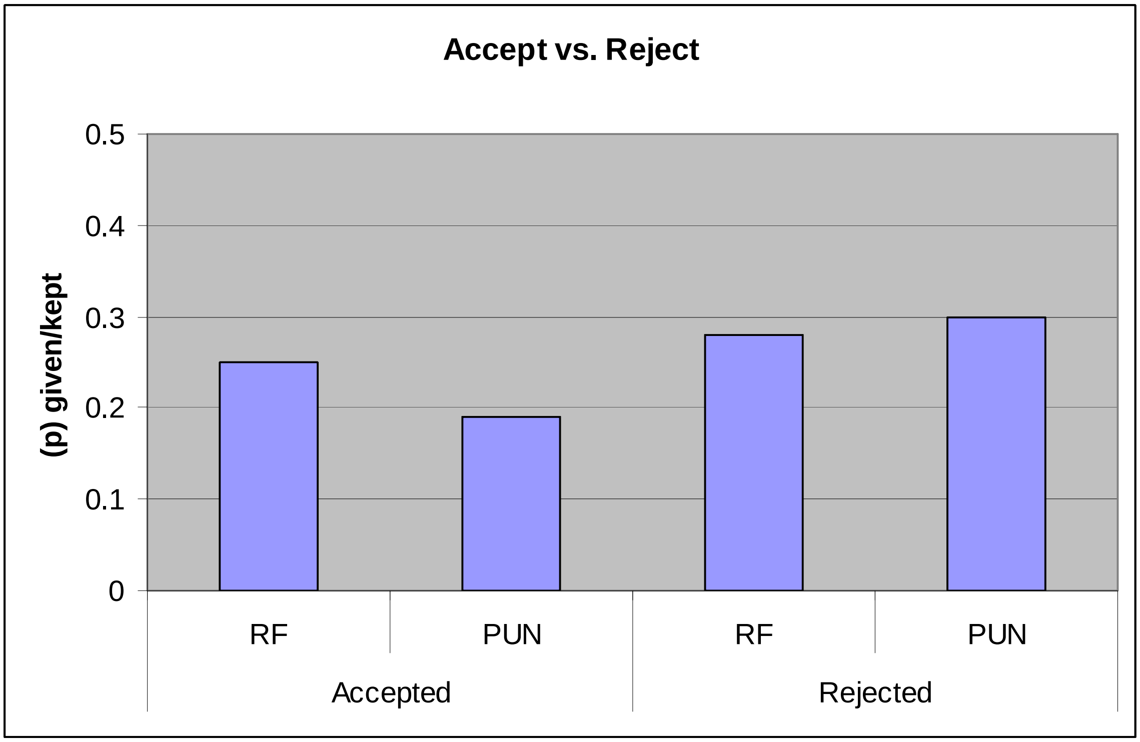

Figure 2.3. Allocation data from DG10 following an Unfair UG offer of 2/10 RF tokens or 8/10 PUN tokens, in terms of offer acceptance vs rejection.

Table 2.2. Allocation means across SVO and utility for a 1-shot DG following an Unfair UG offer for dependent variables *(p)given/kept*, *ZeroOffers*, and *EqualOffers* (* - denotes significantly different adjacent values).

Group		*n*	*(p)given/kept*	*ZeroOffers*	*EqualOffers*
Prosocials	RF	73	.35 (.17)	5%*	45%
	PUN	72	.31 (.20)	18%*	40%
Individualists	RF	79	.20 (.19)	33%	16%
	PUN	71	.20 (.19)	35%	14%
Competitors	RF	39	.20 (.20)	36%	21%
	PUN	39	.18 (.20)	38%	21%
TOTALS	RF	191	.26 (.20)	23%	28%
	PUN	182	.24 (.20)	29%	26%

Table 2.3. DG10 Allocation means for participants who either accepted or rejected an Unfair UG offer, for dependent variables *(p)given/kept*, *ZeroOffers*, and *EqualOffers* (* - denotes significantly different adjacent values).

UG choice		*n*	*(p)given/kept*	*ZeroOffers*	*EqualOffers*
Accepted	RF	101	.25 (.19)	18%*	26%
	PUN	101	.19 (.19)	34%*	22%
Rejected	RF	101	.28 (.21)	26%	32%
	PUN	94	.30 (.19)	21%	30%
TOTALS	RF	202	.27 (.20)	22%	29%
	PUN	195	.25 (.20)	28%	26%

Table 2.4. Rejection rates for participants who were given an Unfair UG offer by SVO, and DG10 Allocation means by accepted vs rejected offers (* - denotes significantly different adjacent horizontal values).

UG choice		*n*	(p)reject	*(p)given/kept acc*	*(p)given/kept rej*
Prosocial	RF	73	.41	.33 (.17)	.36 (.17)
	PUN	72	.48	.29 (.20)	.33 (.19)
Individualist	RF	79	.49	.17 (.16)*	.23 (.20)*
	PUN	71	.46	.13 (.15)*	.27 (.19)*
Competitor	RF	39	.64*	.15 (.13)*	.23 (.23)*
	PUN	39	.49	.12 (.15)*	.25 (.22)*
TOTALS	RF	202	.50	.25 (.18)	.28 (.20)
	PUN	195	.48	.19 (.19)*	.30 (.19)*

Analysis of acceptance vs. rejection of prior UG offer (Fig 2.3 and Table 2.4) shows greater *(p)given/kept* occurred after a previously rejected offer (M=.292) compared to a previously accepted offer (M=.222) [t(395) = 3.57, p<.001] when collapsing across utility. This trend was evident for those in the PUN condition, as a rejected offer resulted in significantly greater *(p)given/kept* (M=.301) compared to acceptance (M=.194) [t (193) = 3.88, p<.001], however was nonsignificant for those in the RF condition [t(200) = 1.22, p>.05]. Further SVO analysis revealed that the behavior of prosocials was similar whether they accepted or rejected the offer [t(143) = 1.15, p>.05], however individualists who rejected the offer allocated significantly more (M=.25) than those who had accepted offered (M=.15) [t(148) = 3.4, p<.001], and this same significant trend was observed with Competitors (reject M=.24; accept M=.13) [t(76) = 2.37, p=.011]. The finding that less *(p)given/kept* was exhibited after an accepted offer for these two self-oriented is somewhat interesting, and was observed for both RF and PUN tokens.

ZeroOffers. Participants were no more likely to make *ZeroOffers* in the case of RF vs PUN, [χ^2 (1, N = 397) = 1.86, p>.05] across all participants. Prosocials (12%) made significantly less *ZeroOffers* than did either Individualists (34%) [χ^2 (1, N = 295) = 27.04, p<.001] or Competitors (37%)[χ^2 (1, N = 223) = 11.04, p<.001], and the latter two did not significantly differ from each other. Prosocials made significantly more *ZeroOffers* when the tokens were RF (18%) compared to PUN (5%) [χ^2 (1, N = 145) = 5.54, p=.02], however no significant differences in utility were found among individualists or competitors.

Comparing previous UG offer acceptance vs. rejection, participants were no more likely to make a *ZeroOffer* in either case [χ^2 (1, N = 397) = .247, p>.05], and the same was found for RF alone [χ^2 (1, *N* = 202) = 1.86, p>.05]. A “marginal” significant difference was found for PUN alone, such that a greater frequency of *ZeroOffers* occurred when offer was accepted (34%) compared to rejected (21%) [χ^2 (1, *N* = 195) = 3.73, p=.053]. Further SVO analysis revealed that Prosocials behaved similarly whether they had accepted or rejected [χ^2 (1, *N* = 145) = .039, p>.05], and the same result was observed for both Individualists [χ^2 (1, *N* = 150) = .732, p>.05] and Competitors [χ^2 (1, *N* = 78) = .029, p>.05].

EqualOffers. Participants were no more likely to make *EqualOffers* in the case of RF vs PUN, [χ^2 (1, *N* = 397) = .473, p>.05], and Prosocials (43%) made significantly more *EqualOffers* than did either Individualists (15%)[χ^2 (1, *N* = 295) = 20.6, p<.001] or Competitors (21%)[χ^2 (1, *N* = 223) = 20.1, p<.001], however the latter two did not differ from each other. No SVO differences were found across utility.

When accounting for a participant’s previous UG offer acceptance vs. rejection, participants were no more likely to make an *EqualOffer* in either case [χ^2 (1, *N* = 397) = 2.46, p>.05], and the same was found for RF alone [χ^2 (1, *N* = 202) = 1.86, p>.05]; as well as with PUN alone [χ^2 (1, *N* = 202) = 1.86, p>.05]. Further SVO analysis revealed Prosocials to behave similarly whether they had accepted or rejected [χ^2 (1, *N* = 145) = .039, p>.05], however Individualists who rejected the offer made more *EqualOffers* (21%) than those who accepted (10%) [χ^2 (1, *N* = 150) = 3.23, p<.05] and the same was found for Competitors (reject = 32%, accept = 6%) [χ^2 (1, *N* = 78) = 7.91, p<.001].

Experiment 3. Several interactions were studied in this experiment, consisting of a series of interdependent situations with another actual experimental participant. This provides a realistic situation for measuring actual behavior while simultaneously maintaining anonymity (participants could not see each other). A one-shot PDG was the initial task, followed by 5 subsequent iterations. Decisions were made simultaneously and tokens distributed after each trial. The PDG matrix is depicted in Figure 3.1., while values remained the same whether the tokens were RF or PUN. In terms of data entry, for RF tokens, 'blue' = cooperation and 'green' = defect; for PUN tokens, 'green' = cooperation and 'blue' = defect. Following the six-iterations of PDG, participants each engaged in a simultaneous one-shot DG where the other participant was the recipient.

PDG-1 cooperation. Figure 3.2 illustrates the cooperation frequencies of the first PDG trial. Pearson's Chi-Square was computed for pairwise analysis. Participants were no more likely to cooperate when the utility was RF or PUN [χ^2 (1, N = 756) = 2.15, p>.05], nor whether male or female [χ^2 (1, N = 958) = .039, p>.05]. Prosocials (85%) were significantly more likely to cooperate than both Individualists (71%) [χ^2 (1, N = 695) = 19.2, p<.001], and Competitors (53%) [χ^2 (1, N = 551) = 65.5, p<.001], and the latter two were also significantly different from each other [χ^2 (1, N = 552) = 17.9, p<.001].

Total cooperation. Cooperation Data are given in Table 3.1 and Figures 3.2 and 3.3. Dependent variables were proportion of participants who cooperated on PDG trial 1, and also total number of cooperations out of 6 PDG trials.

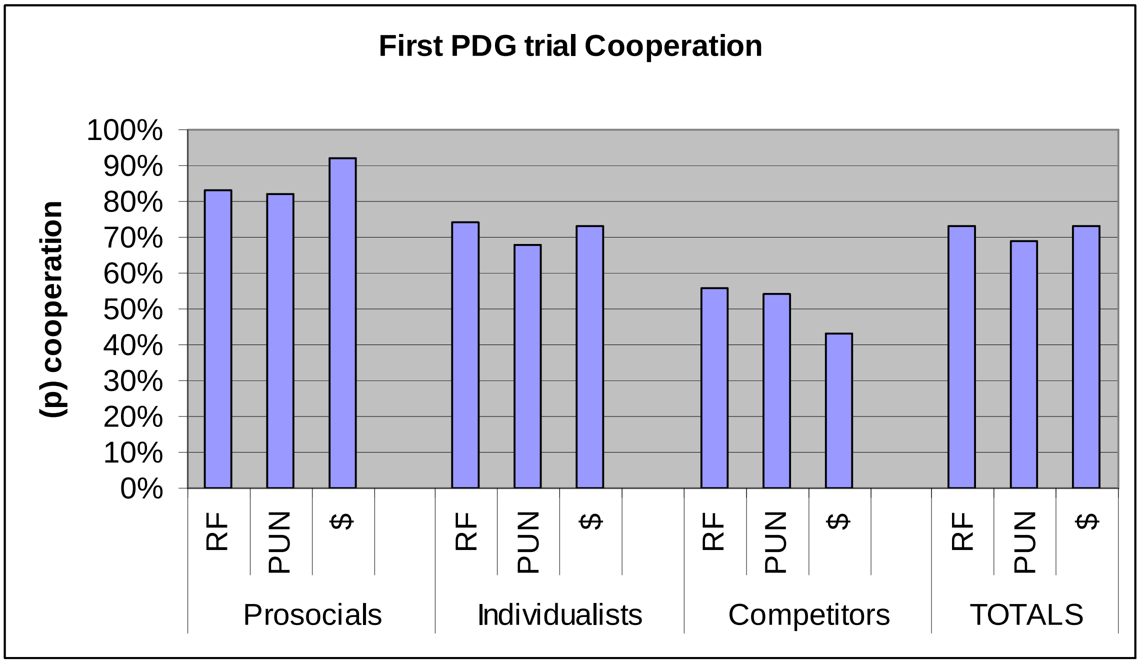

Figure 3.2. Percentage of participants who cooperated on the first PDG trial, across utility and SVO (RF: n=336; PUN: n=372; $: n=202).

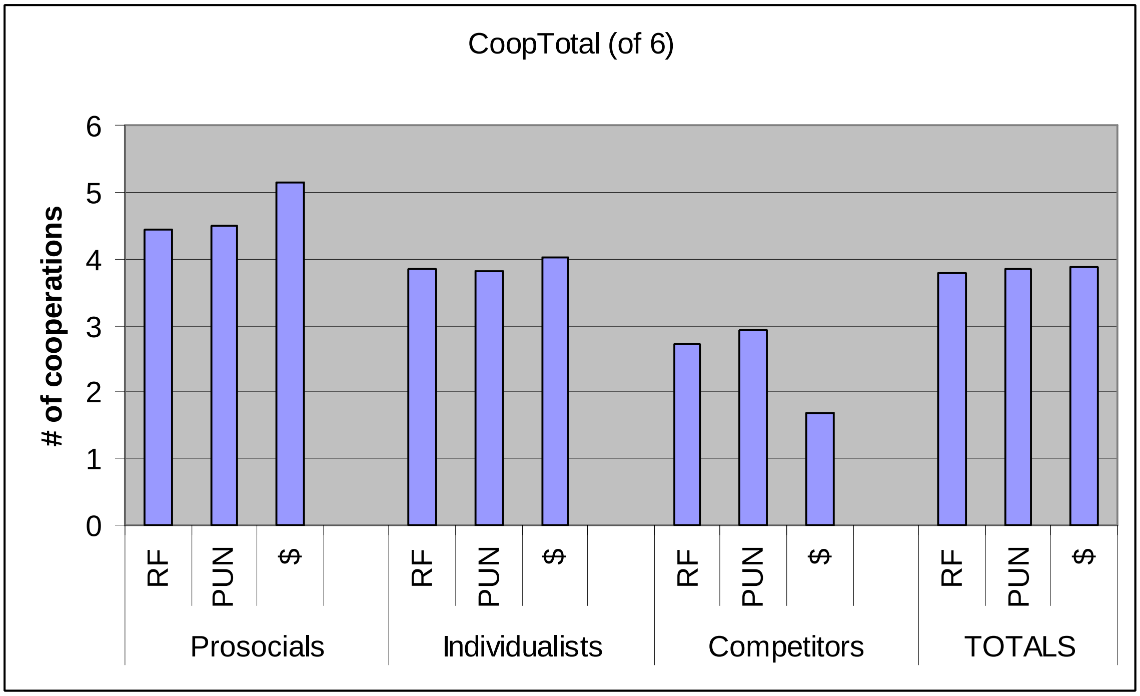

Figure 3.3. Number of cooperation choices out of 6 PDG trials, across utility and SVO. Note that the number of participants in the $ (Quarters) condition was only half that of RF and PUN groups (see Table 3.1)

Table 3.1. Cooperation means for the first PDG trial, and total number of cooperations out of 6 trials (* - denotes significantly different adjacent values; # - note the large discrepancy in number of participants which may have affected analysis).

		n	*coop PDG-1*	*CoopTotal (of 6)*
Prosocials	RF	123	83%	4.43 (2.1)
	PUN	132	82%	4.49 (1.8)
	$	92	92%	5.13 (1.5)*
Individualists	RF	129	74%	3.85 (2.2)
	PUN	148	68%	3.82 (1.9)
	$	71	73%	4.01 (1.9)
Competitors	RF	84	56%	2.71 (2.1)
	PUN	92	54%	2.93 (2.0)
	$	28	43%	1.68 (1.4)#
TOTALS	RF	336	73%	3.78 (2.2)
	PUN	372	69%	3.84 (2.0)
	$	202	73%	3.86 (2.1)

A 3 (SVO) x 3 (utility) analysis of variance was computed, yielding a significant main effect for SVO [F(2, 890) = 34.5, p<.001] however the main effect was non-significant for utility, [F(2, 890) = .32, p>.05]. Post hoc pairwise comparisons (Tukey's HSD) revealed Prosocials (M=4.64) to exhibit significantly more cooperation than either Individualists (M=3.87) (p<.001) or Competitors (M=2.67) (p<.001). The latter two were also significantly different from each other (p<.001). Prosocials behaved similarly whether the utility was RF or PUN [t(253) = .25, p>.05], and the same was found for both individualists [t(275) = .14, p>.05] and competitors [t(174) = .202, p>.05] as is seen in Figure 3.3.

DG10 – *(p)given/kept.* Participants in DG10 were given 10 additional tokens (or quarters) to divide in the DG (as opposed to the 'DGent' group). Data are given in Table 3.2 and Figure 3.4. A 3 (SVO) x 2 (utility) analysis of variance revealed a significant main effect for SVO [F(2, 307) = 25.5, p<.001], also the main effect for utility was found to be significant [F(1, 307) = 6.56, p=.011] indicating a significantly greater proportion kept in PUN (M=.405) than was given in RF (M=.334). Subsequent post hoc analysis (Tukey's HSD) revealed that Prosocials (M=.48) were significantly different than Individualists (M=.33) [p<.001] and Competitors (M=.28) [p<.001], however the latter two were not significantly different.

Additional SVO analysis revealed that Prosocials allocated greater *(p)given/kept* in PUN (M=.51) compared to RF (M=.44) [t(102) = 2.41, p=.01]. Individualists were not significantly different in RF vs. PUN [t(118) = 1.1, p>.05], nor were Competitors [t(87) = 1.35, p>.05].

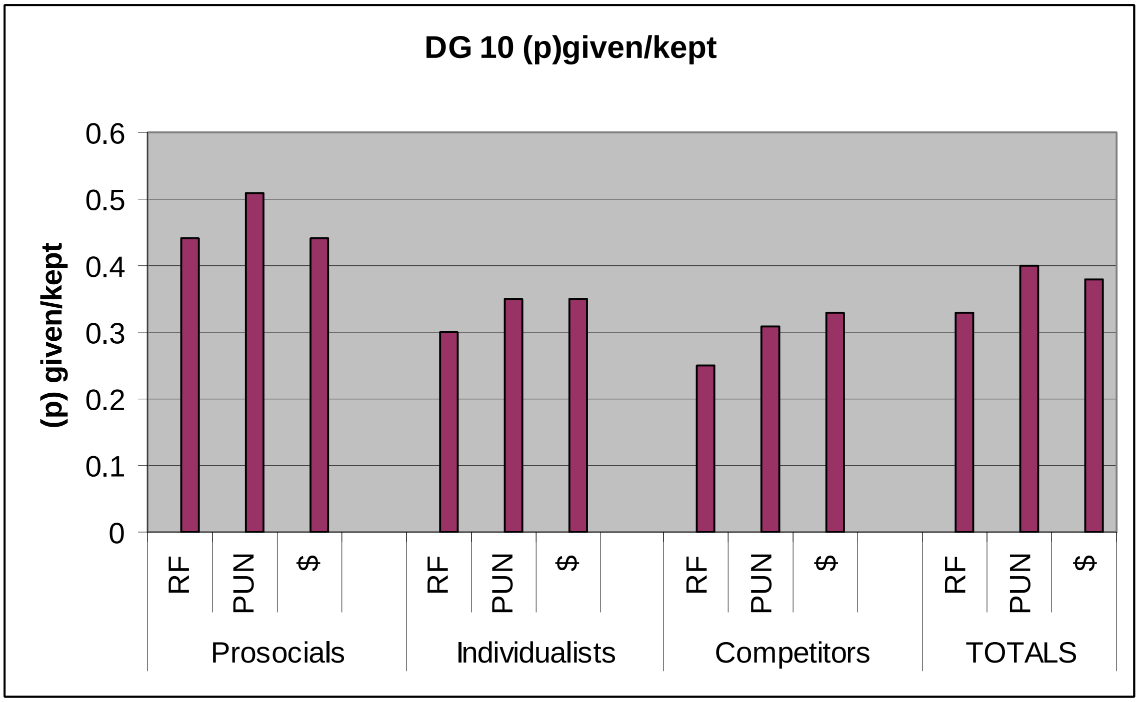

Figure 3.4. Mean proportion given of 10 RF tokens, and proportion kept of 10 PUN tokens, in a DG10 task following the PDG sequence.

Table 3.2. DG10 Allocation means for participants who already participanted in 6 PDG trials, for dependent variables *(p)given/kept*, *ZeroOffers*, and *EqualOffers* (* - denotes significantly different adjacent values; the $ condition consisted of quarters in place of tokens).

		n	*(p)given/kept*	*ZeroOffers*	*EqualOffers*
Prosocials	RF	48	.44 (.16)	8%	79%
	PUN	56	.51 (.13)*	2%	95%*
	$	92	.44 (.17)*	8%	76%*
Individualists	RF	52	.30 (.25)	33%	40%
	PUN	68	.35 (.21)	19%	57%
	$	71	.35 (.21)	21%	55%
Competitors	RF	43	.25 (.23)	35%	37%
	PUN	46	.31 (.22)	26%	52%
	$	28	.33 (.21)	25%	54%
TOTALS	RF	143	.33 (.23)*	25%*	52%*
	PUN	170	.39 (.21)*	15%	68%
	$	202	.38 (.22)	18%	64%

DG10 – ZeroOffers. It was found that *ZeroOffers* were significantly more frequent in RF (26%) compared to PUN (14%) [χ^2 (1, *N* = 336) = 7.09, p=.008]. In addition, Prosocials (6%) made significantly less *ZeroOffers* than both Individualists (24%)[χ^2 (1, *N* = 387) = 23.4, p<.001] and Competitors (29%)[χ^2 (1, *N* = 313) = 30.7, p<.001], but the latter two were not significantly different. In general symmetry was observed across utility: Prosocials behaved similarly whether RF tokens (8%), PUN tokens (2%) or Quarters (8%) [χ^2 (2, *N* = 196) = 2.59, p>.05]. The same was found for Individualists (RF: 33%, PUN: 19%, $: 21%) [$\chi^2$ (2, *N* = 191) = 3.39, p>.05] and Competitors (RF: 35%, PUN: 26%, $: 25%) [$\chi^2$ (2, *N* = 117) = 1.13, p>.05].

DG10 – EqualOffers. It was found that EqualOffers were significantly less frequent in RF (53%) compared to PUN (70%) [χ^2 (1, *N* = 336) = 10.05, p=.002]. In addition, Prosocials (82%) made significantly more *EqualOffers* than both Individualists (52%) [χ^2 (1, *N* = 387) = 40.3, p<.001] and Competitors (47%) [χ^2 (1, *N* = 313) = 42.3, p<.001], but the latter two were not significantly different. In general symmetry was observed across utility: Prosocials behaved similarly whether RF tokens (79%), PUN tokens (92%) or Quarters (76%) [χ^2 (2, *N* = 196) = 2.98, p>.05]. The same was found for Individualists (RF: 40%, PUN: 57%, Q: 55%) [χ^2 (2, *N* = 191) = 3.83, p>.05] and Competitors (RF: 37%, PUN: 52%, Q: 54%) [χ^2 (2, *N* = 117) = 2.63, p>.05].

Correlation and Regression analysis revealed a significant relationship between the variables *(p)given/kept* and *othcoop* (number of opponent's cooperations), for RF tokens: [r(150) = .36, p<.001]. The overall regression model explained a significant proportion of variance, (R^2 = .131) [F(1, 150) = 20.6, p<.001], and *othcoop* significantly predicted subsequent *(p)given/kept*, [β = .038, t(150) = 4.75, p < .001]. For PUN tokens: [r(182) = .29, p<.001]. The overall regression model explained a significant proportion of variance, (R^2 = .086) [F(1, 182) = 17.2, p<.001], and *othcoop* significantly predicted subsequent *(p)given/kept*, [β = .031, t(182) = 4.14, p < .001]. For Quarters: r(150) = .31, p<.001. The overall regression model explained a significant proportion of variance, (R^2 = .098) [F(1, 200) = 21.6, p<.001], and *othcoop* significantly predicted subsequent *(p)given/kept*, [β = .032, t(200) = 4.65, p < .001].

DGent – *(p)given/kept.* To determine the effects of 'entitlement', the roughly 400 participants in this group were given the following instructions: to "divide the tokens they had collected thus far" in the 6-trial PDG. These tokens had in a sense been "earned" through prior decisions in the tasks, thus simulating an entitlement effect. It was originally hypothesized that this would affect *(p)given/kept* behavior in the DG in the effect of Ss *keeping more in either case* (RF and PUN). As shown in Table 3.3, when comparing the proportion of RF tokens given in the DG10 group (M=.33) to the DGent group (M=.19), we see that participants are likely to keep a greater proportion of tokens for themselves in the latter condition. Similarly, when comparing the proportion of PUN tokens kept in the DG10 group (M=.39) to the DGent group (M=.56), once again participants are likely to keep a greater proportion of tokens for themselves in the latter condition. This is what one would expect when there is 'entitlement'. In terms of SVO, Prosocials (M=.23) gave similar amount as Individualists (M=.18) and Competitors (M=.20) for RF tokens. For PUN tokens, a significant effect was found for SVO [F(2, 199) = 3.19, p=.043], but Tukey's revealed Prosocials (M=.62) kept more than Competitors (M=.47) [p=.034] only.

Table 3.3. DG Allocation means by condition. The existence of a symmetrical effect of entitlement was estimated as follows: for RF and PUN tokens, the mean difference *D* in amount *(p)given/kept* between means for 'DGent' (M_{ent}) and 'DG10' (M_{10}) conditions (*negative values of D_{RF} indicate amount kept)

		DGent	*DG 10*	*D*
Prosocials	RF	0.23	0.44	-0.21
	PUN	0.62	0.51	0.11
Individualists	RF	0.18	0.3	-0.12
	PUN	0.54	0.35	0.19
Competitors	RF	0.2	0.25	-0.05
	PUN	0.47	0.31	0.16
TOTALS	RF	0.19	0.33	-0.14
	PUN	0.56	0.4	0.16

The existence of a symmetrical effect of entitlement was estimated as follows and is also displayed in Table 3.3: for RF and PUN tokens, the mean difference *D* in amount *(p)given/kept* between means for 'DGent' (M_{ent}) and 'DG10' (M_{10}) conditions is:

$$D_{RF} = M_{ent} – M_{10} = .19 - .33 = -.14$$

$$D_{PUN} = M_{ent} – M_{10} = .56 - .40 = .16$$

When one compares D_{RF} to D_{PUN}, it can be easily seen that the entitlement effect is of equal magnitude and with opposing valence. Recall that the dependent variable *(p)given/kept* was in terms of (p)given for RF tokens and (p)kept for PUN tokens, hence the negative sign in the case of D_{RF} indicating participants kept more tokens in 'DGent' for RF and PUN.

Data from the three experiments in this paper are believed to have accurately captured real-time behaviors in college undergraduates. Though the population is relatively homogeneous, results were taken over the course of several years therefore samples came from a relatively wide population. The main goal of the present study was to determine whether social behavior follows equal and opposite patterns when the outcome's utility is positive vs. negative. Allocator behavior (Exp 1 & 2) in the DG was one method of measuring behavior, as well as cooperation (Exp 3). First trial allocation behavior was found to be symmetrical in RF vs. PUN (Exp 1), rejection rates to unfair offers were symmetrically distributed in Experiment 2, and 1-shot PDG cooperation (Exp 3) behavior was similar whether outcome was RF or PUN. Overall cooperation rates followed the same symmetrical pattern, however some instances of data indicated differential behavior in terms of allocation in the DG when it was not the first interaction (Exp 2 & 3). Another goal of the current study was to measure a participants SVO in conjunction with their decisions in the actual experiment. This helped us view the data from an additional angle, from which the majority of cases were seen to observe the same symmetrical behavior as reported above. This further strengthens the validity of the findings and procedures. Finally, the concept of ‘entitlement’ was assessed (Exp. 3): participants in ‘DGent’ were more likely to keep tokens in both RF and PUN conditions when compared to DG10 participants, indicating an entitlement effect. Furthermore the effect was found to be equal and opposite in support of the symmetry hypothesis.

DISCUSSION

Data from these three experiments indicate strongly that social interaction behavior follows similar patterns whether the outcome is RF or PUN, thus supporting previous research which indicates this symmetry (Fantino, 1969), and relatively few instances of asymmetry were observed. The results presented extend symmetry to several aspects of human behavior in social interactions, where there are two parties' interests' at stake and decisions are mutually interdependent (or not, in the case of DG). Specifically, in simple situations such as division of a utility (DG), business-type transaction (UG), as well as cooperation in the PDG, fairness and self-interest behaviors are exhibited similarly in RF and PUN. Behavior was strongly related to a participant's SVO, and prosocials, individualists and competitors have distinct behavior patterns – which were found to be constant across RF and PUN. Both parametric and non-parametric statistics supported this argument.

The asymmetries were found primarily in allocation behavior (DG allocation in Exp. 2 & Exp. 3), and in addition occurred after previous inter-subject experience. Therefore researchers may encounter greater variability in behavior between subjects. Wealth effects or 'entitlement' effects (Cherry, 2001) may be inherently present in any situation where utility is at stake, whether it is money, food, or RF or PUN tokens, and this was evident in Experiment 3 for the 'DG-ent' condition but could also have been present in any other iterated situation where differential outcomes are observed. Namely, complications can arise when a subject compares his/her amount of utility with that currently possessed by the other participant, and immeasurable individual reactions to unfairness surely come into play thus making subsequent behavior appear more variable. This was not assessed in the present study but has been by other researchers who found evidence of this (Parks, Rumble & Posey, 2002). Therefore the underlying symmetry could potentially be masked by intra-subject comparisons and expectations, which may vary from one individual to another, as competing schedules of reinforcement exist in the environmental context. On the other hand, data collected on participants' initial interaction were highly indicative as to how they approach interactions with novel persons. It is in the initial interaction that the test for symmetry garnered the most support.

The initial interaction from Exp. 1 demonstrated that allocation behavior in a one-shot DG follows the predicted pattern of symmetry, such that fairness behavior indicated by *(p)given/kept* was similar whether RF or PUN tokens. Moreover, this finding was true across SVO, so that prosocials exhibited similar allocation amounts of *(p)given/kept* for RF and PUN, and the same was found for individualists and competitors. Symmetry was also observed in terms of *ZeroOffers* (subjects who give/keep none of the tokens) and *EqualOffers* (subjects who give/keep $p >= .4$), such that neither was more likely when utility was RF vs. PUN. This was true across SVO, such that prosocials exhibited equal amounts of *ZeroOffers* and *EqualOffers* whether RF or PUN, and the same with individualists and competitors (who tended not to significantly differ from each other in Exp 1). Overall the data from Exp. 1 indicate that fairness and self-interest behavior are almost perfectly symmetrical, implying that positive and negative reinforcement are also symmetrical, even across SVO.

From Exp. 2 the initial interaction could be considered the choice to accept/reject a UG offer that was either fair (50/50) or unfair (80/20). Not surprisingly, nobody rejected an equal offer, and as for unfair offers participants (and SVO types) were equally likely to reject whether RF or PUN tokens. Thus, rejection rates followed the trend of symmetry.

Exp. 3's initial interaction would be considered a one-shot PDG (although there were six total trials, the first was on its own page and there was no indication of additional trials). The proportion of 1-shot cooperations did not differ between RF (73%) and PUN (68%), however participants cooperated slightly more when Quarters ($) were divided (78%). In terms of SVO, prosocials were more likely to cooperate than both individualists and competitors, and individualists cooperated significantly more than competitors for RF, PUN, and $ conditions. In terms of cooperation all SVO's behaved similarly when utility was RF, PUN, or $. Not only are these findings supportive of a viewpoint of symmetry of positive and negative reinforcement, but do so in a way which supports the existence of three SVO types in the PDG.

In repeated trials there is naturally more potential for variable behavior, due to existence of numerous additional confounding variables which may arise due to inter-subject expectations. No doubt reciprocity is a complex subject, since those given unfair offers in UG allocated less *(p)given/kept* in the DG10 (M=.25) than those given equal offers (M=.40). However post UG – DG10 data (Exp. 2) showed one such departure from symmetry, and strangely was observed only following an Equal UG offer, such that significantly more RF tokens were given (M=.42) compared to PUN tokens kept (M=.33). There were also greater *ZeroOffers* (RF = 11%; PUN = 23%), and fewer

EqualOffers (RF = 68%; PUN = 53%) exhibited for PUN tokens. The fact that there were systematic reductions of fairness behavior with PUN tokens may give support to similar findings in Prospect Theory (Kahneman & Tversky, 1979), namely that loss weighs more heavily than gains on behavior.

Following an unfair UG offer, however, results showed that in the DG participants allocated similar amounts of *(p)given/kept* for RF (M=.266) and PUN tokens (M=.246). The fact that these values are above the exact reciprocity value (p=.20) is due to the prosocials (M=.33) who did not differ across utility in terms of *(p)given/kept*, however they did make significantly more ZeroOffers in PUN (18%) compared to RF (5%). This was the only non-symmetrical result observed for those experiencing Unfair (80/20) UG offers. Individualists (M=.198) and Competitors (M=.191) allocation behavior indicated a strong reciprocal motivation, on average matching the previous UG offer. These proself participants, in terms of *(p)given/kept*, *ZeroOffers* and *EqualOffers* behaved similarly whether RF or PUN tokens were divided. The fact that more support for symmetry was found for behavior following Unfair (80/20) offers when compared to behavior following Equal (50/50) offers is a finding for which we have no satisfactory explanation.

For RF tokens, participants seemed to behave similarly in the DG whether they had accepted or rejected the previous unfair UG offer: accepted (M=.25), rejected (M=.28), and this was true for prosocials, individualists and competitors. However, for PUN tokens this was not the case, as greater *(p)given/kept* was observed after offer rejection (M=.30) compared to those who accepted the previous UG offer (M=.19), (note: as it turns out the assumption of equality of variance was violated; Levene's test for

Equality of Variances [F = .71, p=.4]. The Mann-Whitney was performed and confirmed significance, [Z = 3.34, p<.001]). This finding indicates that after rejecting an unfair offer (thus resulting in 10 PUN tokens for each participant), allocation behavior was more generous in the subsequent DG. In addition, significantly less *ZeroOffers* occurred following a rejected UG offer (21%) compared to one which was accepted (34%). This result was particularly evident for competitors, who allocated half as much *(p)given/kept* following an accepted offer (M = .13) compared to those who had previously rejected (M = .25); and this was also found for individualists (M_{acc} = .15; M_{rej} = .25) but was not the case for prosocials (M_{acc} = .31; M_{rej} = .34). It may also be worthwhile to note that the non-parametric analysis of *ZeroOffers* and *EqualOffers* revealed no differential effects across SVO.

Repeated interaction in Exp. 3 consisted of six total trials of PDG, followed by a one-shot simultaneous DG10. Cooperation rates in the PDG demonstrated some of the strongest support for symmetry: across six trials cooperation was similar whether RF or PUN, and the same was observed across SVO. In addition the three SVO subtypes were maintained, such that in terms of # of cooperations in RF, PUN, and $ prosocials > individualists > competitors. Following the 6-trial PDG, allocations from the DG10 revealed additional discrepancies with symmetry that indicated less fairness across the board: namely less *(p)given/kept*, more *ZeroOffers* and less *EqualOffers* were observed in PUN token conditions, even in prosocials. The number of tokens the participants had in their possession was not predictive of subsequent offer (*r* = .08), but one variable which was significantly predictive of *(p)given/kept* was the number of opponent's cooperations (*r* = .33, b =.04), demonstrating that greater *(p)given/kept* was allocated to participants who cooperated more.

Departures from symmetry between RF and PUN found in Exp. 3 showed greater *(p)given/kept* DG allocation behavior in PUN, and this can be contrasted to findings from Exp. 2, which showed that participants in the PUN condition exhibited less *(p)given/kept* in the DG following a Equal UG offer. While the preceding task from Exp. 2 was a bargaining task (UG), the preceding task in Exp. 3 was a 6-trial PDG. This discrepancy in preceding task type may have influenced subsequent behavior. Another potential explanation for the inconsistent findings is that the reinforcing value of one RF or PUN token may vary between experimental participants, in terms of individual sensitivities. No measure was taken for individual sensitivity as was done in Farley & Fantino (1978). However, since each token represented a tangible unit (1 minute), this explanation seems less credible. One could argue that first trial behavior should have shown similar discrepancies if this were the case. Another reason for occurrence of these data anomalies is that perhaps they are not anomalies, but rather punishment has a differential effect on behavior in certain cases, similar to loss aversion observed in Prospect Theory (Kahneman & Taversky, 1979). If this were the case, however, one would have seen many more violations of symmetry, and in the same direction in terms of fairness. Not only did the current findings indicate a majority of symmetry in initial interactions in all three experiments, but also supported this view in 18/22 cases in Exp. 2 and 14/18 cases in Exp. 3 in terms of extended interaction.

Making tasks similar for RF tokens and PUN tokens is not always straightforward. Where bargaining and business-type transactions are concerned (Exp. 2

– UG), matters may have been complicated due to the difficulty of symmetrically equating the task across utility, i.e. RF-UG vs. PUN-UG or RF-PDG vs. PUN-PDG. Consider, for instance whether accepting a UG offer of 2/10 RF tokens is symmetrical to accepting 8/10 PUN tokens. Another ambiguity can potentially arise when the offer is rejected: resulting in 0/0 outcome for RF, resulting in10/10 outcome for PUN. One may question as to whether this is the best manner to equate RF and PUN in order to capture symmetry in the UG.

Certainly effects of wealth and entitlement can lead to variability in allocation behavior, which was demonstrated in Exp. 3 in the ‘DGent’ condition. After participants had played 6 trials of PDG, they were then told to divide “All the tokens they had collected thus far”. The results were that for both RF and PUN tokens participants *kept more tokens in both cases*, indicating an ‘entitlement’ effect (see Table 3.3). This was determined by calculating the mean difference *D* in amount *(p)given/kept* between means for ‘DGent’ and ‘DG10’ conditions:

$$D_{RF} = M_{ent} – M_{10} = .19 - .33 = -.14$$

$$D_{PUN} = M_{ent} – M_{10} = .56 - .40 = .16$$

When one compares D_{RF} to D_{PUN}, it can be easily seen that the entitlement effect is of equal magnitude and with opposing valence. Recall that the dependent variable *(p)given/kept* was in terms of (p)given for RF tokens and (p)kept for PUN tokens, hence the negative sign in the case of D_{RF} indicating participants kept more tokens in ‘DGent’ for RF and PUN. As can be seen in Table 3.3, the trend of ‘DGent’ participants keeping a greater proportion of tokens than DG10 participants is clear for both RF and PUN, and is also evident across SVO. Prosocials, individualists, and competitors kept more tokens than did their DG10 counterparts however difference *D* was not perfectly symmetrical in these individual cases (but are still in the predicted direction).This rather unconventional way of looking at the 'entitlement effect' not only demonstrates its durability, but also shows support for the argument of symmetry. More research is needed to provide a definitive answer to this question, however.

In conclusion, data presented here from approximately N=2100 subjects have indicated that human social interaction behaviors are symmetrical across utility. The strength of cooperation, fairness, and self-interest behaviors was similar whether the outcome stimulus utility was positive or negative. Not only was this true for participants in general, but also when individual motivations were accounted for (SVO) this trend of symmetry was similarly maintained, adding to the strength of the conclusions drawn. Although instances were noted which would violate predictions made by symmetry, they never were observed in first-time interactions but rather in relatively few of the reciprocal interactions. Potential immeasurable external variables such as wealth or 'entitlement' effects, as well as symmetrical task-design issues (UG) may have contributed to the discrepancies which contradicted predictions made by symmetry. An alternative explanation is that in certain cases PUN carries connotations with it indicating a potential heavier weight on it's utility, similar to that observed in Prospect Theory (Kahneman & Tversky, 1979). If this was the case in the current experiments, data might have reflected a more substantial fairness bias in one direction or the other; however this was not observed, therefore a more likely explanation is simply natural variability.

Future research would do well incorporating similar methods of using RF and PUN in other types of experimental contexts such as resource and public-goods dilemmas, economic games, as well as numerous other human interactions employed in behavioral experiments. The neurological research would benefit to investigate symmetry in interpersonal interactions and MRI measurements. One can also envision the use of this technological symmetry in educational classrooms, especially those with language-delayed and developmentally disabled individuals who can greatly benefit from such behavioral programs.

Overall these findings highlight the presence of symmetry between positive and negative reinforcement in general; in addition they extend to social behavior emitted where conditioned rewarding stimuli (RF) vs. conditioned aversive stimuli (PUN) were at stake across several interaction types. The utilization of SVO measures afforded the present study the ability to observe variability within data which would otherwise go unnoticed, and perhaps provides the strongest evidence of SVO’s internal validation that experimental research has seen thus far. Lastly, additional research would benefit greatly by incorporating gain and loss within the current project’s framework, in order to close the gap between these results and research that indicates asymmetry between losses and gains (Kahneman & Tversky, 1979).

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