ALTRUIST DETECTION IN HUMANS: AN EVOLUTIONARY ANALYSIS

by

William Michael Brown

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The undersigned hereby certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "Altruist detection in humans: An evolutionary analysis" by William Michael Brown in partial fulfillment for the degree of Doctor of Philosophy.

Dated: February 28, 2003

External Examiner: [redacted]

Research Supervisor: [redacted]

Examining Committee: [redacted]

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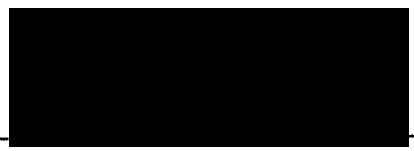

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DEDICATION

I dedicate this thesis to my father. You no longer have an exuberant voice due to selfishly replicating cells. However your commitment to me, Sean, Thomas and Liam voices the deepest of paternal love. Thank you.

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ABSTRACT

In five independent studies evidence is presented consistent with the altruist-detection assumption of Frank's (1988) commitment model. What is unique about these findings is that they were attained using different methodological paradigms from different disciplines. Study One and Two's methodology was borrowed from cognitive psychology and suggests that humans have decision rules designed to detect an altruistic reputation. Study Three uses a standard social psychological methodology, i.e., the zero-acquaintance video-presentation paradigm in an inter-cultural context. Specifically, in zero-acquaintance video encounters with students speaking Dutch, Canadian students detected altruism level. Study Four (A & B) departs from an experimental approach by exploring the spontaneously occurring nonverbal behaviours of altruists and non-altruists in two cultures, i.e., Canadian and Dutch. Findings corroborate the nonverbal behaviour pathway to altruist detection, which claims that hard-to-fake facial expressions vary with altruism level. Finally, Study Five uses an experimental economics approach to test whether smile symmetry and reputation influence resource allocations. As predicted, subjects delivered more resources to cartoon icons with an altruistic reputation and cartoon icons with symmetrical smiles. These results are consistent with Frank's (1988) reputation and nonverbal pathways to altruist detection. If cooperative individuals are reliably identified, they may form alliances, which could have allowed for the selection of genes predisposing altruism in ancestral environments.

LIST OF ABBREVIATIONS

ESS: Evolutionarily Stable Strategy

TFT: Tit-for-Tat

M: Mean

SD: Standard Deviation

df: Degrees of Freedom

χ^2 : Chi-square

$M\chi^2$: McNemar's Chi-Square

F: Variance due to experimental treatment controlling for error variance

n^2: Eta sqaured

t: Observed t-value

B: beta, the slope of a regression line

R: Multiple regression coefficient

R^2: Variance accounted for by the criterion

r: Correlation coefficient

p: Probability that the observed effect was a chance effect

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CHAPTER I

Introduction

"Good people do not need laws to tell them to act
responsibly, while bad people will find a way around the laws."
Plato (427-347 B.C.)

Evolutionary biology defines altruism as a behavior that apparently reduces the fitness of the donor and increases the fitness of the recipient (Hamilton, 1971; Trivers, 1971). The prevalence of (and design features mediating) altruism between non-kin has presented a paradox for evolutionary theory, specifically, why would altruism (and its associated design features) be prevalent in modern populations if there were fitness costs to altruists in ancestral environments? In order for altruistic behaviour to evolve there must be some benefit to the genes that predispose the donor to perform self-sacrificial acts. In contrast to definitions of evolutionary altruism above, "psychological altruism" is a cognitive adaptation and/or behaviour motivated by a concern for others without conscious concern for one's self-interest (Sober & Wilson, 1998). For the purpose of this thesis psychological aspects of altruism are the proximate causes of altruistic behaviour (e.g. motivations and emotions). Explaining the evolution of psychological altruism entails demonstrating the hypothesized inclusive fitness benefits (either direct or indirect). The indirect fitness benefits for human altruism proposed in this thesis reside in increased social status and social cohesion (which could influence the effectiveness of between-group natural selection).

The study of altruism from an evolutionary perspective has a long history with specific theories for different classes of altruistic acts. The following sections provide a brief background of the major theories that may account for the evolution of human altruism: a) inclusive fitness theory; b) reciprocal altruism theory; and c) commitment signalling theory. At the core of these theories altruists do better when there is some degree of positive assortation (i.e. altruist recognition and the subsequent forming of altruist-altruist partnerships). As soon as the frequencies of altruists is higher in some groups compared to others (due to positive assortation) there is a possibility for altruism to evolve by trait-group or multilevel selection (Williams, 1992; Wilson & Dugatkin, 1997; Sober & Wilson, 1998; Michod & Roze, 2001; Wilson, 2002). Trait-group selection is often used inter-changeably with the term multilevel selection (Williams, 1992). However Multilevel Selection may be a better term (D.S. Wilson, personal communication 1998), since a "levels of selection" approach is not restricted to explaining the existence of traits such as altruism [e.g. a multilevel approach has been successfully applied to ecosystems (Swenson, Wilson, & Elias, 2000) and even helped explain why microbes influence cloud formation (Hamilton & Lenton, 1998)].

Multilevel Selection Theory (MST) allows for a reasonable biological synthesis of the various theories for the evolution of human altruism because at the core of this approach is a partner preference for altruists (which is also the important premise for all models explaining the evolution of cooperation whether altruism is between kin or non-kin). A difference between the evolutionary

accounts of altruism discussed in this chapter (i.e. inclusive fitness, reciprocity, and commitment) are the mechanisms involved in positive assortation and the level of selection responsible for the phenotypic design.

To synthesize the various approaches attempting to explain the evolution of altruism this thesis uses a triangulation approach (Crano, 1981). Triangulation is a scientific method that uses a variety of ways of investigating a proposed phenomenon (Crano, 1981). There are a number of different types of triangulation techniques used in the social sciences. For this thesis two are used: (a) *theory triangulation*, which consists of using more than one theoretical scheme in the interpretation of positive assortation among altruists; and (b) *methodological triangulation*, which involves using more than one method to demonstrate commitment signalling (one source of positive assortation) in humans. If results from each method correspond, then it provides good evidence that commitment signalling and partner preference are biologically meaningful concepts, not simply procedural artifacts or perhaps by-products of unrealistic mathematical models.

Inclusive Fitness Theory

All evolutionary models attempt to take the altruism out of altruism (Trivers, 1971). This means that at some level of organization the net benefit of the altruistic design feature must outweigh its net cost. In Hamilton's (1964a; 1964b) model for the evolution of altruism, fecundity (i.e. the state of being fertile; capable of producing offspring) is only one component of fitness. For example,

an individual may leave more descendants in the long run by producing fewer total offspring but ensuring a greater probability of offspring survival to reproductive age. In general, an individual may 'promote' future representation of its own genes, even if it leaves no offspring itself, by contributing to the fitness of close relatives. For example, in eusocial insect colonies (e.g. ants, bees and wasps) with a reproductive queen, daughters are sterile altruists. Hamilton (1964a; 1964b), with the use of "inclusive fitness" theory, helped to explain the evolutionary benefits of reproductive altruism (i.e. non-reproductive daughters). Since the coefficients of relatedness are higher between sisters than between mothers and daughters in eusocial insects (due to haplodiploidy), helping the queen reproduce sisters pays more in terms of inclusive fitness than having offspring of one's own. Inclusive fitness is calculated from a focal individual's reproductive success plus the effects it has on the reproductive success of relatives, each effect weighted by the coefficient of relatedness to the focal individual. A coefficient of relatedness (r) is a measure of kinship varying from 0 to 1. The coefficient represents the probability that a rare allele will be shared in two individuals by descent from a recent common ancestor. For example in humans, full siblings' (siblings who share the same mother and father) r = .50, half siblings' r = .25, parent and offspring's r = .50, grandparents and grand-offspring's r = .25, and cousins' r = .125. To calculate the coefficient of relatedness between two individuals (e.g. in humans), simply halve the probability that the relative shares the gene in half every time it is transmitted between generations (unless inheritance is haploid).

One reason kin selection has had a major impact on the study of social evolution is that Hamilton's rule has specific predictions generated from an easily understandable mathematical model. Hamilton's rule makes the prediction that genetically influenced behaviour that benefits another organism, at some cost to the donor, will spread by selection when the relation $rb - c > 0$ is satisfied; where r = coefficient of relatedness between the donor and recipient, b = improvement of individual fitness of recipient caused by the behaviour and c = cost to the donor's individual fitness as a result of the behaviour. One example of "kin selection" is reproductive altruism found in social insects. Eusocial insect (e.g. ants, bees and wasps) reproductive altruism may be due to haplodiploidy reproduction. Haplodiploidy increases the coefficient of relatedness to .75 between sisters because they have the same haploid father. Indeed from the paternal genome's perspective daughters have a coefficient of relatedness of 1.00. Ahypothesis generated from kin selection models is that kin are recognizable. Evidence supporting kin recognition mechanisms in humans has been found in a number of experiments (for review see Porter, 1998). Another way that kin selection has been investigated is whether or not kin receive preferential treatment. In the laboratory, Burnstein, Kitayama, and Crandall (1994) demonstrated in studies involving decisions to help in hypothetical life-or-death situations that undergraduate students chose to aid close kin over distant kin. Human children who are monozygotic twins have been shown to be highly cooperative compared to regular siblings (Segal, 1984). Specifically monozygotic twins are more coordinated in cooperative tasks (e.g. completing a joint puzzle)

and work harder to provide benefits to co-twins (compared to regular sibling pairs). Since monozygotic twins are undeniably close relatives (i.e. there is little chance that they are half-siblings) higher levels of cooperation would be expected based on kin selection theory.

There is experimental and naturalistic evidence for kin selection having operated on human psychological mechanisms of perceived kinship (for review see Davis & Wilson, 1997). For example, DeBruine (2002) used computer-morphing software to alter facial resemblance in pictures of "other players" in a series of Prisoner's Dilemma-like games. Although game-players did not detect that the images were altered, they trusted the other players whose pictures had been adjusted to resemble the participant more than those whose pictures had been morphed to resemble another person. Control procedures using morphs resembling famous people did not elicit such an effect (resemblance to oneself may facilitate cooperation because it is a cue to genealogical relatedness). In the field, Chagnon (1999) has found that the Yanomamö classifiedkin in line with actual genetic relatedness. In a broader cross-cultural investigation of the ethnographic record Essock-Vitale and McGuire (1980) found that reciprocation was not expected from kin.

Cooperation between non-kin also occurs in nature (Dugatkin, 1997). It should be apparent that kin selection does not explain cooperation among non-kin where the coefficients of relatedness approach zero (because the donor and the recipient do not share a recent common ancestor like a father or a mother). Price (1970) re-formulating Hamilton's (1964) inclusive fitness equations realized

that selection for altruistic behaviour among distant relatives can occur when there is a coefficient of relationship between altruists (e.g.due to the recognition of altruists and assortation). Price (1970; 1972) and Hamilton's (1975) work on positive assortation is now referred to as Multilevel Selection Theory or MST (see Wilson & Dugatkin, 1997). Positive assortation could occur via spatial segregation and/or partner preference.

Interestingly, like kin selection, the most commonly used models for understanding the evolution of non-kin human cooperation (i.e. reciprocity and indirect reciprocity) can be re-interpreted in light of MST because both theories have components of positive assortation (see Sober & Wilson, 1998). Reciprocal altruism and commitment signalling theories are explored in the following sections.

Reciprocal Altruism Theory

A well-studied model for the evolution of non-kin cooperation is reciprocal altruism theory (Trivers, 1971). Parallels will not be directly drawn between multilevel selection theory and reciprocity in this thesis[1]. However, it should be pointed out that reciprocity is an

[1] Reeve and Keller (1999) described a class of models involving analyses of the factors influencing the evolutionarily stable partitioning of reproduction among potential breeders in an animal society. These models assume that the dominant member(s) of the society control reproduction by the subordinate(s). If the dominant benefits from retention of the subordinate, it may pay the dominant to yield some reproduction to subordinates as inducements (i.e. a type of indirect reciprocity) for these subordinates to remain in the society and cooperate peacefully rather than to leave or fight for exclusive control of the group's resources. Inducements preventing subordinates from leaving the group are

alternative perspective rather than an alternative theory to multilevel selection. Specifically multilevel selection theory uses a "levels of selection" approach to altruism where the evolutionary benefits can reside at a variety of levels of organization while reciprocity primarily focuses on one level of selection (i.e. the individual).

Trivers (1971) suggested that the performance of an altruistic act might increase the likelihood that the recipient reciprocates the altruism in the future. Reciprocal altruism is likely to evolve when withholding reciprocity is detected and punished, thus shielding the altruist from exploitation. Mathematical and computer simulation work using the Prisoner's Dilemma game suggest that reciprocity can be evolutionarily stable in ecologies of exploiters. Specifically, in the iterated Prisoner's Dilemma tournament reported by Axelrod and Hamilton (1981), the best strategy was Tit-for-Tat (TFT). Tit-for-Tat calls for cooperation on the first move and the copying of each subsequent move made by its opponent. Recent work however suggests that pure strategies (even TFT) are vulnerable to invasion by mixed strategists (Dugtakin, 1997). For example, Nowak and Sigmund (1993) demonstrated that Tit-for-Tat is not always an evolutionarily stable strategy.

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called staying incentives; inducements preventing subordinates from fighting to the death for complete reproductive control are called peace incentives. Theoretically, the magnitudes of the peace and staying incentives yielded by dominants will direct the evolution of other key societal attributes, such as the frequency and intensity of dominance interactions and the sharpness of the division of labor within the social group (i.e. multilevel phenomenon). Reeve and Keller's (1999) work suggests that incorporating reciprocal transactions with a multilevel perspective may be fruitful in generating empirical tests of colony-level consequences of reproductive asymmetries within insect societies.

Reciprocal altruism is a deceptively simple idea in that the benefits of altruism accrue to donors because they are more likely to receive the return favour in the future (Trivers, 1971). Despite its simplicity there are a number of assumptions that must be met for reciprocal altruism to evolve including: (a) individual recognition; (b) memory for cheaters; (c) punishment of cheaters; (d) low dispersal; and (e) a long life span. Perhaps only a few species are cognitively capable of reciprocal altruism. A further criticism of reciprocal altruism theory is that it is rare in nature (Clements & Stephens, 1995). Clements and Stephens (1995) suggest that cooperative behaviour among non-relatives based on reciprocity (e.g. Tit-for-Tat) has not been adequately demonstrated in any animal, including humans. Despite Clements and Stephens' (1995) claims, human cooperation between non-kin appears to be partially based upon reciprocity in Prisoner Dilemma-like games (see mini-review of the experimental economics literature demonstrating reciprocity in humans - Palameta & Brown, 1999). The Prisoner's Dilemma follows a particular payoff inequality in which mutual cooperation is the second highest payoff (only cheating on your partner's cooperation pays better). However mutual cooperation pays better than mutual defection. The worst payoff is, of course, the 'sucker's payoff' (i.e. when your cooperation is exploited by an opponent).

Strategies that retaliate against defection (e.g., Tit-for-Tat) can only evolve in an ecology where cheating is detectable. Therefore, a clear prediction from reciprocal altruism theory is that humans should possess specialized information processing capabilities to detect cheaters (Cosmides, 1989; Cosmides and

Tooby, 1992). In support of this prediction, Cosmides (1989) and Cosmides and Tooby (1992) found evidence for the existence of a cheater-detection *Darwinian Algorithm* using the Wason selection task (Cosmides and Tooby, 1992). This result has been replicated in a Canadian sample (Brown & Moore, 2000) and more recently in the Shiwiar of Amazonia (Sugiyama, Tooby & Cosmides, 2002). The reason the Wason selection task was used to study cheater detection is because content effects were known to exist. Specifically some tasks elicited good performance relative to the original Wason selection task. Cosmides (1989) hypothesized that the content effects were due to the activation of a cheater detection cognitive mechanism. Indeed the Wason task that elicited superior performance asked participants to detect a cheater (i.e. an underage drinker who snuck into a bar). The traditional Wason selection task asks a participant to see whether a conditional statement of the form "If P, then Q" has been violated by any of four instances represented by four cards (Wason, 1983). Cosmides and Tooby (1992) used the Wason task to demonstrate the existence of an evolved cognitive adaptation to detect cheaters in social contracts by showing what cognitive mechanisms humans are lacking (e.g., humans cannot solve logic word problems unless they are worded so that a participant is asked to detect a cheater in a social exchange situation[2]). Detecting a cheater requires a person to

[2] Cheater-detection is not the *only* reason that humans may be good at solving a particular Wason task. Evolutionary psychologists predict that Wason selection tasks can be solved when the task activates an evolved inference engine. For example, Fiddick et al. (2000) reported that humans are good at solving Wason selection tasks asking participants to avoid threats and hazards (e.g. spoiled food). Indeed this thesis hypothesizes that humans should be good at solving Wason selection tasks that ask participants to detect an altruistic reputation.

look for the individual who takes the benefit without paying the cost (Cosmides and Tooby, 1992).

Experiments using methodologies other than the Wason selection task are consistent with the existence of a cheater-detection information processing mechanism in humans (Mealey et al., 1996; Oda, 1997). Specifically humans appear to have enhanced recall for faces of cheaters (Mealey et al., 1996; Oda, 1997). Furthermore, individuals who have been defected upon in a Prisoner's Dilemma exhibit increased activity (using an fMRI) in the face recognition areas of the brain, such as the fusiform gyrus (Rilling, 2001). Detecting cheating and trustworthiness may also be impaired in individuals with bilateral limbic system damage (Stone et al., 2002).

Reciprocal altruists who assortate are expected to do better evolutionarily since they would be shielded from free-rider exploition (i.e. defectors who are attempting to secure the maximum payoff in any given round of a Prisoner's Dilemma game). Indeed, Trivers (personal communication June, 2002) expects that reciprocal altruists may be particularly good at detecting other reciprocal altruists. Much of the modeling literature has attempted to explain how cooperators can pair up and ensure the payoff of mutual cooperation. For example, spatial distribution of cooperators (Michod, 1999) and partner preference (Bull & Rice, 1996) appear to be particularly important for the evolution of reciprocity-based strategies.

Although much of the evidence from human studies conforms to reciprocal altruism theory, some forms of cooperation are less obviously explained (Palameta and Brown, 1999). For example, 50% of individuals cooperated in a Prisoner's Dilemma-like game even when told they would be playing a randomly selected counterpart only once (McCabe et al., 1996). These findings may contradict standard utility maximization theory in economics. There are a number of explanations for the high cooperation rates in the absence of retaliation. For example, inflexible norms of reciprocity could have evolved in the environment of evolutionary adaptedness (EEA). These inflexible norms could force the participant to 'believe' they will be punished for their non-cooperation even in one-shot anonymous encounters (McCabe et al., 1996). An alternative evolutionary explanation for one-shot cooperation suggests it may benefit us to be habitual altruists who are driven by 'irrational' benevolence (see Frank, 1988). To understand this counter-intuitive hypothesis, envision a division of labour alliance that requires trusting your partner (e.g. a marriage). People may benefit from having prosocial emotions that commit them to cooperative moves because those emotions are potentially detectable by your partner (allowing others to make reliable predictions of another's likelihood to cooperative when not being monitored).

Division of labour situations (pair-bonds, foraging, friendships etc.) may render cheating undetectable and could have characterized much of human evolution (Frank, 1988). The proximate mechanisms mediating cooperation (e.g. prosocial concern for others) may be adaptations to commit cooperation. The fact

that some individuals cooperate even when cheating cannot be punished suggests that human decision-making is not strictly based on simple rules of self-interest maximization (Palameta and Brown, 1999; Schuster, 2002). Indeed cooperation in the absence of direct reciprocity (e.g. one-shot social encounters) is a problem for traditional rational choice theorists in economics (Frank, 1988).

Commitment Signalling Theory

The second model for the evolution of non-kin cooperation discussed is by Frank (1988). Frank (1988) refers to his theory as "the commitment model." For this thesis I will refer to Frank's hypothesis for the evolution of human cooperation as "Commitment Signalling Theory" which is more descriptive of the underlying assumptions behind the model (i.e. Commitment and the Signalling of Commitment). Commitment Signalling Theory suggests that humans have varying degrees of prosocial inclinations, which commit them to future cooperation (Romer et al., 1986; Batson et al., 1995; Eckel & Grossman, 1996). For example, sympathy for others could predispose one to cooperate even when not being monitored by others (i.e. one-shot cooperation).

What are the evolutionary pressures that maintain polymorphism in prosocial emotions? Frank (1988) has constructed a mathematical model to explain polymorphism in honesty and the evolutionary maintenance of prosocial emotions in humans. Hirshleifer's (1987) and Frank's (1988) models extended Trivers' (1971) speculation that there are reliable motivational indicators of future altruism. Specifically, the prosocial emotions (e.g. sympathy) are viewed as

guarantees or commitment devices of future altruistic behaviour. Frank (1988) hypothesized that altruistic individuals signal their prosocial emotions nonverbally. Other altruists subsequently pay the decoding costs (e.g. time and effort to decode facial expressions and properties of speech) to determine prosociality in others. Since cheaters will likely be avoided by altruists (i.e. especially when cheaters are common in a population) it does not pay for the cheater to decode nonverbal cues to underlying altruism. The evolutionary utility of having commitment-based emotions is that they are *signalled* to others and allow the signaler to be perceived by others as a trustworthy partner for social dilemmas requiring trust.

Commitment Signalling Theory makes predictions about the proximate mechanisms and frequency-dependent selective forces that influence the formation of altruist-altruist partnerships. The difference between reciprocal altruism and commitment signalling theories is that the latter is an indirect reciprocity model (i.e. third party observers rather than original recipients make return payments to donors. When re-payment occurs by the original recipient the returned altruism may be of a different kind – e.g. providing social prestige to those who share food). Indirect reciprocity may evolve because the third parties who deliver benefits to individuals who have given them nothing could increase their own prestige within the group (this could lead to others finding them to be an attractive social partner– see Nowak & Sigmund, 1998a).

It is easy to see how altruists would be at a disadvantage due to subtle cheating in division of labor situations (i.e. alliances where a partner's behaviour

cannot be consistently monitored due to task specialization – see Frank, 1988) and disappear from the population over evolutionary time. Subtle cheating is best seen as covert cheating compared to overt cheating where the cheater takes the benefits without paying the costs while being monitored by others. In contrast, a subtle cheater may only partially repay acts of altruism (Trivers, 1971) or only engage in gross forms of cheating when not being watched (Brown & Moore, 2000). *Prospective altruist-detection* could be a possible mechanism to solve the adaptive problem of subtle cheating (Brown & Moore, 2000). In order for altruists to pair up and receive the payoff for mutual cooperation there must be some way for them to reliably detect one another.

Prospective altruist-detection is the reliable detection of genuinely altruistic intentions before one enters a cooperative venture. A difference between a Tit-for-Tat strategy and prospectively detecting altruists is that Tit-for-Tat interacts randomly and as a result detects cheaters after it gets exploited. Unlike Tit-for-Tat, *prospective altruist-detection* allows nonrandom partner preference and therefore excludes interaction with cheaters before exploitation. Partner preference is ecologically realistic and allows for the evolution of cooperation in computer simulations (Cooper and Wallace, 1998). In many mathematical simulations and modeling it appears that alliance formation among altruists cognitively equipped to detect one another may evolve (Frank, 1988; Peck, 1995; Wilson & Dugatkin, 1997; Cooper & Wallace, 1998; de Vos, Smaniotto, & Elsas, 2001).

If altruists can detect one another and form social support networks, this may allow for the selection of genes predisposing altruism. If character assessments are reliably made, altruists may form stable alliances. The benefits of altruistic partnerships would be high in a population of exploiters. These benefits accrue due to the costs of random assortment, which could increase the chances of exploitation (Frank, 1988).

In some respects Frank's (1988) commitment model is analogous to Wilson and Dugatkin's (1997) and Trivers' (1971). The similarity between Frank (1988) and the multilevel accounts of non-kin cooperation (e.g. Wilson & Dugatkin, 1997) is that both emphasize the existence of cognitive machinery designed for altruist detection and subsequent positive assortation among altruists. However for Frank (1988) the benefits of altruism accrue at the individual level (not the group level as in Wilson & Dugatkin's 1997 model). This focus on traditional individual selection makes Frank's (1988) and Trivers' (1971) models for the evolution of non-kin altruism quite similar. Indeed, Frank's (1988) model may best be thought of as an indirect reciprocity model as first described by Alexander (1987). Indirect reciprocity is when a third party observer of the donor's altruism returns the favour rather than the recipient. Indirect reciprocity does not require that the exact favour be returned. For example, if a donor helps an elderly recipient gain food and others observe this helpful act they may reward the donor with some other resource in the future (e.g. increased social prestige).

Within-Group Natural Selection and a MST Synthesis

Reciprocal altruism and commitment signaling theories focus on the within-group component of natural selection. For Trivers (1971) and Frank (1988) the fitness costs to individual altruists within a group must be compensated by fitness benefits within the group. However Price (1970; 1972) determined that there are two components to natural selection, the within- and between-group components (S.A. Frank, 1998). Therefore, fitness benefits to altruistic alleles could be found at a higher level of selection (i.e. the between-group level, see Sober & Wilson, 1998).

Multilevel selection theory (Price, 1970; 1972; Hamilton, 1975; Frank, 1998; Stearns & Hoekstra, 2000) suggests that natural selection operates at multiple levels of the biological hierarchy simultaneously (e.g. genes, cells, individual organisms, trait-groups, the global population, species, ecosystem etc.). Each of these levels can potentially affect the frequency of genes in subsequent generations (Keller, 1999).

Multilevel selection theorists (e.g. Sober and Wilson, 1998) envision inclusive fitness theory (or kin selection) as a special case of trait-group selection. For example, imagine a population containing two types of organisms, altruistic and non-altruistic, and that the population is further divided into two sub-populations. Sub-population one contains few altruists and sub-population two contains mostly altruistic types. Within each sub-population altruists by definition have lower fitness and therefore are decreasing in frequency from generation to generation. However this does not mean that altruism cannot be maintained in

the meta-population. As fitness is group dependent (in this example), an organism's fitness not only depends upon whether it is altruistic or non-altruistic, *but also* upon the sub-population it finds itself. Fitness is higher for subpopulation two than one due to the higher frequency of altruists. With properly chosen parameters (i.e. when the within-group costs are outweighed by the between-group benefits) altruism increases at population level in the second generation *despite* small decreases within a sub-population. To understand how kin selection is a special case of trait-group selection is rather straightforward. In kin selection models the coefficient of relatedness is a crucial factor. However relatedness is one of multiple ways in which a donor and recipient can share an altruistic allele (Hamilton, 1975; Wilson & Dugatkin, 1997). Hamilton (1975) replaced the coefficient of relatedness with a correlation coefficient, which indicated the likelihood that a donor and a recipient shared an altruistic allele independent of genealogical relatedness: "it obviously makes no difference if altruists settle with altruists because they are related…or because they recognize fellow altruists…" (Hamilton, 1975, p. 337).

Based on the above example it can be understood that multilevel selection is quite different than pre-1966 'naïve' group selection (Williams, 1966; Dugatkin, 1997). For example it was once thought that all adaptations are produced for the good of the species. George C. Williams (1966) argued that such naïve group selection was not parsimonious and furthermore group selection can only occur under stringent mathematical conditions (e.g. Sewell Wright, 1932). Williams (1966) suggested how one should proceed to model altruism operating at the

group level only when selection operating at the individual level is included in the formulation (see description in last paragraph). Wade and Goodnight (1991) and Swenson, Wilson, and Elias (2000) have shown theoretically and empirically that multilevel selection occurs in computer simulations and in the laboratory (e.g. flower beetles and ecosystems). Multilevel selection is when two or more targets of selection operate simultaneously (Hamilton, 1975; Hamilton & Lenton, 1998). What is open to empirical question is how common it is in nature that a higher level of selection outweighs the selective forces at a lower level (Williams, 1992). Wilson and Dugatkin's (1997) multilevel model for the evolution of human altruism operates so that gene frequencies predisposing altruism increase at the between group level while simultaneously decrease within the group (the within group costs to altruism must be low relative to the between group benefits).

One assumption behind Wilson and Dugatkin's (1997) multilevel model is that altruists assortate with one another via sophisticated cognitive mechanisms designed for altruist recognition that are only present in a few species (e.g. humans). Altruistic assortation allows for some groups to contain more altruists than others and facilitates selection targeting group composition in the selection of altruistic genes (Wilson & Dugatkin, 1997; Sober & Wilson, 1998). It is generally assumed that multilevel selection is rare in nature (Williams, 1992) even though it can easily occur in laboratory experiments (Wade & Goodnight, 1991; Swenson et al., 2000). Demonstrating multilevel selection (or even individual selection) in humans is difficult because of the long life history characteristic of primates (Bradley, 1999). Nevertheless, one could investigate

whether the psychological and neural machinery mediating a trait was designed to influence within- and/or between-group fitness variation (Reeve, 2000).

Evidence for multilevel selection in humans comes from ethnographic sources. Wilson's (1997; 2000; 2002) cross-cultural exploration of an ethnographic electronic database (i.e. Human Relations Area Files) suggests that group beneficial norms are widespread. The design of these social norms appears to reduce within-group fitness variability and enhance between-group fitness variability (Wilson, 1998; 2002). The idea is that conformity to group norms reduces the fitness differences between individuals within a group. This is certainly what a multilevel selection approach would predict (Wilson, 1998; 2002). However, a fundamental assumption of multilevel models (i.e. partner preference among altruists) has been infrequently tested in humans. Wilson, Near, and Miller (1997) asked participants who took the Machiavellian Scale (a measure of social manipulation) to write stories about being stranded on an island with two other individuals. The stories by High and Low Mach's were then presented to undergraduate perceivers for a study of personality assessment of the writer. Perceived Machiavellianism correlated with the writers' self-reports. Furthermore the character constructed by Machiavellian writers was rated as more untrustworthy, aggressive, selfish, and uncaring compared to the main character constructed by non-Machiavellian writers. Perceivers rejected the main characters created by High Mach's as a social partner. However for situations where there was competition against a rival group (e.g. members of debating team) High Mach's were preferred partners over Low Mach's. These

findings appear consistent with a multilevel perspective if one accepts the idea that within group cooperation and between group conflicts contribute to trait group selection (Wilson & Dugatkin, 1997). According to Sober & Wilson (1998) and Wilson (2002) a multilevel selection view of human moral impulses predicts within-group benevolence and between-group hostilities (i.e. Wilson, 2002 refers to this possibility as the dark-side of between-group selection). Specifically, altruism within a group may be culturally encouraged to reduce individual fitness variation while exploiting a rival group could increase the fitness variability between groups (Wilson, 2002).

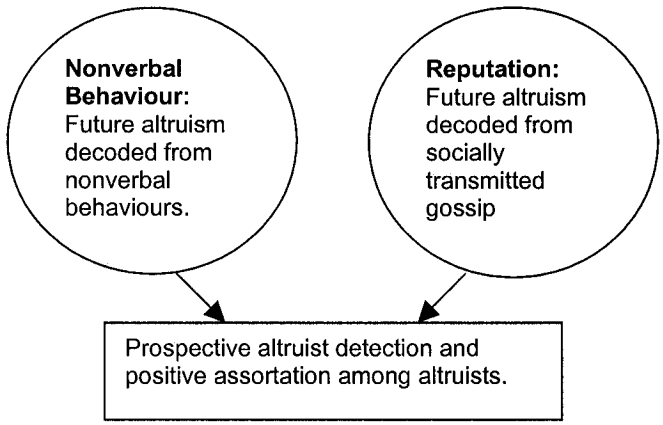
All models for the evolution of cooperation must contend with the problem of selfish mutants (morphs that are willing to reap the benefits without paying the costs – see Michod & Roze, 2001). What is needed is a mechanism that shields altruists from free-rider exploitation in division of labour encounters. In order for altruists to pair up and receive the maximum mutual payoff, they need to *reliably* decode their partner's intentions prospectively (Frank, 1988; Frank et al., 1993; Hirshleifer, 1987; Trivers, 1971). How can intentions be reliably decoded? There must be strong selection pressures to prevent others from reading your intentions to defect in social dilemmas requiring trust (Trivers, 2000). According to Frank (1988) there may be two distinct pathways to detecting altruistic intentions in others (i.e. the expression of prosocial emotion and the social transmission of an honest reputation). Previous research suggests that individuals may benefit via indirect reciprocity if they are known to be trustworthy or nonverbally signal their

cooperative disposition (Frank et al. 1994; Nowak & Sigmund, 1998a; Wedekind & Milinski, 2000; Brown & Moore, 2002; Brown, Palameta & Moore, in press).

Two Pathways to Accurate Altruist Detection

Frank's (1988) two proximate pathways to altruist detection are (see Figure 1): (a); perceivers scrutinize nonverbal emotional expressions that are physiologically constrained and; (b) perceivers receive and trust gossip

Figure 1. Two pathways to reliable and prospective altruist detection



regarding a target's reputation. The basic prediction is that others scrutinize the presence or absence of either indicator of future altruism so they may decide whether or not to form a partnership.

The Nonverbal Behaviour Pathway

Frank's (1988) explanation of human non-kin cooperation has specific predictions regarding the design of the prosocial emotions that commit individuals towards costly acts of altruism. Unlike Trivers' (1971) reciprocity

account, Frank (1988) believes that his model can explain anonymous tipping on vacation and other acts of 'irrational' altruism in one-shot encounters. Frank's (1988) account attempts to explain helping behaviour in the absence of direct reciprocity (also see Alexander, 1987). Frank's (1988) commitment signalling theory differs slightly from indirect reciprocity in that a 'Zahavian' view (see Zahavi & Zahavi, 1997) is provided for the existence of the proximate emotions that influence cooperative behaviour. Specifically, Frank (1988) hypothesizes that expressions of prosocial emotions are costly to fake for selfish individuals analogous to the costs faced by a sick peacock attempting to display a robust parasite-free tail to a peahen.

According to Frank (1988), the costs associated with nonverbal signals of altruism are low for altruists (because the actually experience the emotion needed to produce the nonverbal signal) compared to the costs for the mimic (who does not experience the prosocial emotion). Also further costs preventing deception may be social punishment for displaying false signals. In addition, decoding costs are crucial to Frank's mathematical formulation of commitment. Specifically, time spent scrutinizing facial expressions and paralinguistic cues to ensure 100 percent accuracy is time lost doing other activities. Indeed, the equilibrium between cooperators and defectors can only be reached in Frank's (1988) model when there are costs to scrutiny. It does not pay for defectors to pay the costs if altruists will not interact with them. However, a good mimic who may be an attractive partner to an altruist would likely benefit greatly from paying decoding costs. As pointed out by Frank (1988), perfectly distinguishable signals

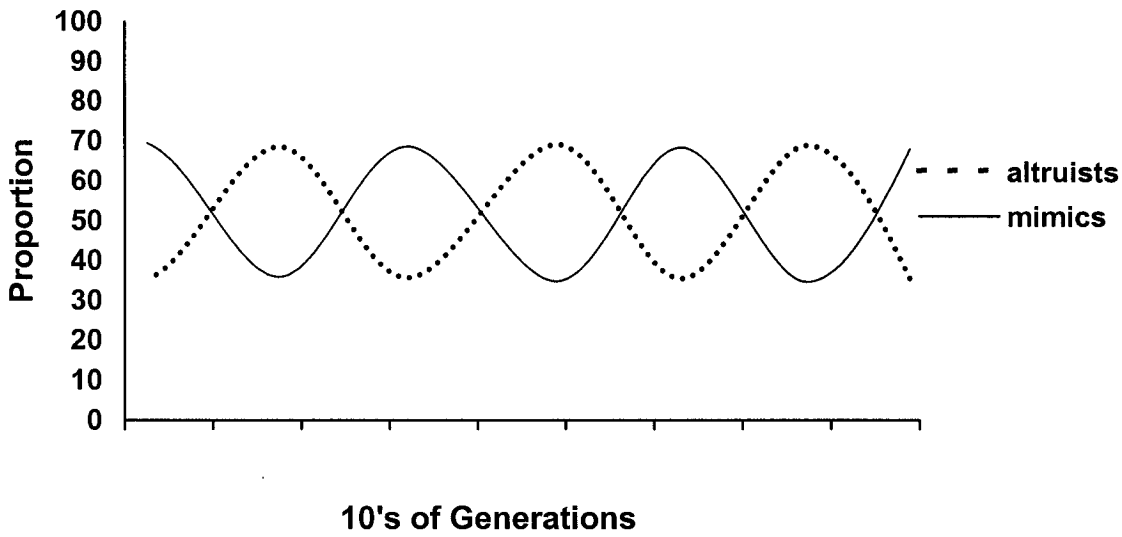
of altruism suffer from a fatal conceptual flaw. Imagine a population where the signal for altruism was an easily recognizable "A" on the sender's forehead. Over evolutionary time cooperators will assortate, leaving defectors to interact with one another. The frequency of defectors should gradually disappear from the population. In this type of ecology there would be large fitness benefits to a signal mimicry counter-adaptation. If mimicry were possible natural selection would favour it and altruists would begin to interact randomly.

Deception and frequency-dependent selection

From the point of view of altruists, the costs of random interaction depend upon the frequency of defectors in the population (this would be increasing due to added benefits of exploiting others' cooperative efforts). Since the benefits of deception are great when deceivers are at low frequency (Frank, 1988), it is expected that natural selection may favour adaptations to avoid detection. Counter adaptations to avoid deception-detection may be selected for once altruism signals lose reliability. All other things being equal, when prosocial signals fail to maintain reliability, altruists (or signalling intentions) would likely decrease in frequency. It should be pointed out that signalling and mimicry of altruistic emotions may resemble a predator-prey arms race. As seen in Figure 2 when the frequency of altruists is high there will be a niche for deceptive communication. This is due to altruists not bothering to pay the costs of scrutiny (e.g. time and effort to decode signal – see Frank, 1988) when the probability of interacting with another altruist is high. Once mimics master the signal, altruists

will begin to decrease in the population (relative to mimics). However, mimics do not have a monopoly on evolving effective counter-adaptations. As soon as the signal becomes meaningless altruists could begin discriminating intentions based on some other cue – thus increasing in frequency via assortative interactions once again. Frank's (1988) model predicts that there

Figure 2. A frequency-dependent balanced polymorphism whereby mimics and altruists are fluctuating around equilibrium point over evolutionary time.



have been frequency-dependent oscillations between signal detection and signal deception over evolutionary time. Trivers' (1985) has a similar discussion of a hypothesized arms race between deception and deception-detection. Trivers' (1985; 2000) suggests self-deception may have been a cognitive adaptation to avoid one's deception being detected by others. Trivers (2000) argued that the best way to avoid the physical symptom (i.e. facial expressions etc.) leaking your inner selfishness to others is to deceive yourself. However, one may predict that

if self-deception is an effective form of other-deception, perceivers may have evolved counter-adaptations to detect symptoms of self-deception (Trivers, 1985).

Nonverbal Commitment as an Index Signal

Charles Darwin (1872) was one of the first to hypothesize a specific nonverbal cue signalling likelihood to cooperate: "Slyness is also, I believe, exhibited chiefly by movements about the eyes; for these are less under the control of the will, owing to the force of long-continued habit, than are the movements of the body." (Darwin, 1872, p. 18). Little has changed since Darwin's (1872) hypothesis. Some researchers believe (rightly or wrongly) that involuntary emotions guarantee the expression of hard-to-fake symptoms of trustworthiness (Scharlemann et al., 2001; Brosig, 2002; Manzini et al., 2002). Searching for the involuntary expression of prosocial emotions (like sympathy) may be a good evolutionary strategy (if such emotions commit future cooperation in division of labour partnerships). That is, when help is motivated by self-interest (e.g. conscious concerns of future reciprocity) the donor may not perform future acts of altruism when they are not being watched. Indeed, if prosocial emotions compel altruists to cooperate it is possible that selfishness compels subtle cheaters to cooperate while being monitored (to avoid the costs of punishment). A problem of coordinating cooperating partnerships is determining the likelihood that a potential partner will cooperate in the future and do so even when he or she is not being monitored. The key to Frank (1988) and Hirshleifer's (1987)

models is that the emotions, which guarantee selfish and/or cooperative moves, can be reliably discerned (Zahavi, 1987; Grafen, 1990). How can perceivers reliably discern the emotions signalling commitment? Ekman (1985) has reviewed the literature on nonverbal communication and suggests that body language, pitch / timbre of the voice and facial expression can be reliable indicators of underlying affective states. If the linkages from emotional states to the expression of these states are under involuntary control (i.e. physiologically constrained), perceivers may be exposed to reliable index signals. Specifically, for mimics the costs of placing involuntary neural pathways and facial muscles under conscious control may be exorbitantly costly (in terms of practice and/or re-configuring the neuro-physiology involved in the putative signals). Nonverbal signals of commitment are only reliable indicators of underlying intent when there are sender and/or receiver-imposed costs (Frank, 1988; Adams & Mesterton-Gibbons, 1995; Guilford & Dawkins, 1995; Brown & Moore, 2000). For example, when signals are cheap to fake, mimics should proliferate and drive a population of honest signallers towards extinction. However, when mimics are unable to fake the signal, honest signallers can continue to transmit accurate information. Therefore if altruism level (low or high) is signalled nonverbally in humans, there must be some mechanism maintaining signal reliability. Indeed, selfish and/or deceptive mutants are a general problem for evolutionary models of cooperation and reliable signalling at a variety of levels of biological organization (Michod & Roze, 2001). To understand how natural selection may maintain signals of altruism an integration of the literature on human altruism detection (i.e. Frank,

1988; Wilson & Dugatkin, 1997; Brown & Moore, 2000) with the field of animal signalling is needed (Zahavi, 1987; Grafen, 1990; Adams & Mesterton-Gibbons, 1995; Guilford & Dawkins, 1995; Maynard Smith & Harper, 1988; 1995; Maynard Smith, 1991; Vehrencamp, 2000). It is argued that some nonverbal behaviours could be "index signals" of altruism while information indicating altruism (e.g. reputation or verbal information regarding a target's likelihood to be altruistic) are best envisioned as "conventional signals".

In the study of animal behaviour a reliable signal is a cue that honestly reveals an aspect of the sender to one or more receivers (for review see Vehrencamp, 2000). Why should animals (including humans) ever reveal anything about themselves? There appears to be a number of conditions in which reliable signals can evolve when there are sender- and/or receiver-imposed costs (Vehrencamp, 2000; Brown & Moore, 2002). The index signal can be defined as a signal that it is reliable due to physiological constraints on the sender. Therefore, sender-dependent costs are predicted to maintain signal reliability. That is, the index signal is a receiver-independent process. Signal reliability is stabilized by a physical constraint (or a physiological ceiling) that invariably forces the signal to reveal honest information. Signals stabilized by this mechanism are called index signals, assessment signals, or un-bluffable signals (Maynard Smith & Harper 1988, 1995; Maynard Smith 1991). The form of an index signal is absolutely linked to the information transmitted by the signal, and such signals by definition convey information about intrinsic sender attributes. Examples of index signals given in agonistic contexts include displays that reveal

body size and fighting ability such as vocalization frequency in frogs, tail-beating and mouth-wrestling in fish, and height of scratches on trees by mammalian carnivores (Davies & Halliday 1978; Jakobsson et al. 1979; Ramer et al. 1983; Robertson 1986; Thapar 1986). Signals that are obligatorily linked with aging processes or health may be used by females to select high quality males. Pointing displays that indicate direction of gazing or attention are also index signals (Hasson 1997).

If there are neural mechanisms controlling involuntary facial expressions of emotions they may qualify as reliable index signals of future altruism. With the index signal there are no fitness costs to signal production, only to signal mimicry. This thesis investigates the possibility of physiologically constrained index signals of altruism. The reason for this focus on index signals is that there is evidence in the field of cognitive neuroscience that spontaneous (i.e. 'heartfelt') emotional expressions are physiologically constrained via dedicated neural pathways (Gazzaniga, Ivry, & Mangun, 1998). Some forms of nonverbal display could qualify as index signals if they were reliably linked to likelihood of future altruism.

Are Smiles Index Cues to Altruism?

One possibility for an altruism / facial expression link is the human smile. Typically this expression is given by a symmetric contraction of the zygomatic major, slight exposure of the teeth and wrinkling of the orbicularis oculi (Ekman & Friesen, 1982). The usual finding is that more than 80 percent of different

populations agree that smiling photographs signal happiness. However, while a smile generally yields a clear emotional meaning, this does not imply that all smiles are equivalent. In an early paper discussing smiles, Ekman and Friesen (1982) argue that false smiles usually do not involve the "crinkly-eye" effect where muscles at the corner of the eyes contract. Such false smiles tend to be asymmetrical, occur at inappropriate times and have excessively long duration (Ekman & Friesen, 1982).

Duchenne de Boulogne (1862/1990) observed that authentic smiles are distinguished from posed smiles by contractions of the *orbicularis oculi* muscle that surrounds the eye. Hager and Ekman (1985) subsequently reported that the "Duchenne smile" is discriminated specifically by contractions at the *outer* corners of the eyes ("crows feet" wrinkles). Little is known of the visuo-cognitive strategies that underpin perception of the Duchenne smile. Williams et al. (2001) examined ocular dynamics (pattern of eye fixations of perceivers) of Duchenne smiles. The spatio-temporal fixation indices were number and duration of foveal fixations to the crows feet area relative to the total face area. Williams et al. (2001) found that participants made proportionately more fixations of longer duration to the crows feet area for smiling, compared to negative (sad) and baseline (neutral) control expressions. Williams et al. (2001) suggest humans might have evolved to distinguish the Duchenne smile because of its important communicative role.

Due to neuro-architectural constraints on spontaneous facial expressions of emotion (e.g. the human smile – see Gazzaniga & Smylie, 1990) an

individual's self-interested tendencies may be detected before they cheat. For example when conditions require a target to perform (or return) a favour their facial expressions may be scrutinized. If a cooperator produces 'half-hearted' facial expressions (e.g. a phony smile) in the context of helping others, the receivers of these cues may conclude that the target lacks the prosocial motivation to help. Alternatively, when genuine altruists are required to perform (or return) a favour, their facial expressions should appear more genuine and interested in helping.

There appear to be physiological constraints on the human smile (Meihlke, 1973; Myers, 1976; Ekman, Hage & Friesen, 1981; Wylie & Goodale, 1988; Gazanniga & Smylie, 1990; Smith, Smith, & Ellgring, 1996; Gazzaniga, Ivry, & Mangun, 1998). Most of this work rarely has an evolutionary perspective and does not consider the possibility that aspects of the smile may be a reliable signal of altruism in the biological sense. Humans have two neural systems for controlling smiles: one under involuntary control and the other under voluntary control (Gazanniga & Smylie, 1990; Gazzaniga, Ivry, & Mangun, 1998). The left hemisphere of the brain has been found to control voluntary smiles (Gazzaniga & Smylie, 1990). The left-side of the brain sends messages to the contralateral VII nucleus, which then innervates the facial muscles on the right side of the face (Gazzaniga & Smylie, 1990). Simultaneously, the left hemisphere also sends information across the corpus callosum to the right hemisphere, which functions to innervate the facial muscles on the left-side of the face. The latter only occurs during posed, voluntary smiles. Wylie and Goodale (1988) have shown that

posed smiles are asymmetrical (i.e. the right-side is higher than the left-side of the mouth). For spontaneous or involuntary smiles a different neural pathway is involved. In contrast to posed smiles (which are only triggered by the left hemisphere) spontaneous smiles can be triggered by both hemispheres. When an individual experiences a spontaneous emotion, a signal travels directly through the midbrain to the brainstem nuclei, bypassing the cortex (Gazzaniga et al., 1998). Both hemispheres send signals directly down through the midbrain to the brainstem nuclei. Further evidence for two neural pathways in smiling comes from lesion studies. Specific lesions in the pyramidal system can impair an individual's ability to smile on request, but the same person can smile normally if amused (Meihlke, 1973; Myers, 1976). The reverse is true for other neurological disorders, such as Parkinson's disease. In Parkinson's disease, the patient cannot spontaneously smile when happy but can produce a posed smile upon request (Smith, Smith, & Ellgring, 1996).

When humans experience pleasure they spontaneously smile and the left side of the smile shows more displacement compared to a posed smile (Wylie & Goodale, 1988). Wylie and Goodale (1988) in a controlled study measuring smile asymmetries found that during a spontaneous smile the left-side of the mouth is more displaced than during a posed smile resulting in a smile that is more symmetrical in appearance. Strobe cameras and computer analysis of reference points on the corners of the mouth revealed that the left side of the mouth moved more during spontaneous than during posed smiles in the same targets. This indicates that the right hemisphere is more involved in spontaneous emotional

expression as compared to the left hemisphere. If involuntary (i.e. reliable) positive emotions are signalled on the left-side of the face then it would make sense that individuals would attend to the left more than the right-side. Indeed humans scrutinize the left side of the face more than the right when assessing facial expressions (Burt & Perrett, 1997).

Are there Adaptive Benefits to the Human Smile?

Is there evidence that the human smile is a signal of trust or altruism? Research suggests that humans trust smiling individuals more than non-smiling individuals (Otta, Lira, Delevati, Cesar & Pires, 1994; Lafrance & Hecht, 1995). For example, smiling newscasters can influence political candidate choice (Mullen et al., 1986). Recent experimental work shows that smiling individuals are trusted more (i.e. receive more resources) than non-smiling individuals in resource allocation games (Scharlemann, Eckel, Kacelnik, & Wilson, 2001). The human smile is expressed in social situations and could be viewed as a revealer of underlying intentions. For example, if an individual is smiling while helping others, perceivers may assume that the smiling person is in fact genuinely motivated to help.

Natural selection should discourage simply assuming that a smiling individual is trustworthy. Specifically, a con artist could easily put on a false smile while helping and trick perceivers into trusting him or her. Perhaps natural selection has favoured skeptical perceivers who scrutinize smiles according to asymmetry and other indicators of prosocial commitment. This would only be the

case if some nonverbal cues (e.g. smile asymmetries) were reliable indicators of underlying emotional states.

Previous Findings on Nonverbal Altruist Detection

As can be seen in the previous discussion, there is considerable theory and mathematical support for altruist detection capacities in humans. However empirical data has been lacking until recently. Frank, Gilovich and Regan (1993) tested the nonverbal altruist detection hypothesis in an uncontrolled setting. Specifically, participants were brought into the laboratory and interacted freely for 30 minutes. At the end of the social interaction participants were asked to predict whether their partner would cooperate or defect in a Prisoner's Dilemma game. Participants were extremely accurate (~80%) in their assessments (Frank et al., 1993). A major limitation to this study is that participants could have made promises to cooperate and/or offered information regarding their past behaviour (e.g. volunteerism in the community etc.). Based on the methodology used by Frank et al. (1993) this possibility cannot be excluded. Indeed, participants who participated in the study were selected from economics classes in which the Prisoner's Dilemma game was on the course syllabus (Frank et al., 1993).

Inspired by Frank et al's (1993) finding that an individual's tendency to cooperate or to defect was discernable by others, Brosig (2002) attempted a more controlled replication. In contrast to Frank et al. (1993), Brosig (2002) not only excluded participants from the sample who personally knew their partners before communicating, but also excluded those participants who stated verbally

during the communication period that they would defect. Brosig (2002) also reduced the amount of time that participants interacted before making their predictions to 10 minutes. Participants were significantly better than chance at recognizing cooperators and defectors. Furthermore, Brosig (2002) found that cooperators were slightly better at detecting intentions than defectors. This is convincing corroboration of Frank et al.'s (1993) original findings. However, it is still unknown what (if any) nonverbal cues participants are basing the accurate perceptions upon.

Motivated by a recent study demonstrating that smiling individuals receive more resources than non-smiling individuals (see Scharlemann et al. 2001), Manzini et al. (2002) attempted to vary the costs of smiling in a resource allocation setting. Specifically, participants situated in separate rooms played each other on a computer where they communicated via artificial smiles of varying costs (costs were determined by a point deduction) before making resource allocation decisions. Participants who chose costly smiles (i.e. by pushing a button) were trusted more than participants who chose low cost smiles (Manzini et al., 2002). The Manzini et al. study (2002) suggests the importance of smiling for game players, so much so that they are willing to pay a cost to display this affiliative cue. However, Manzini et al. (2002) do not demonstrate that cooperative pairs smile more often. Rather the cooperating pairs simply pushed a button displaying an artificial smile (albeit there was a cost that they were willing to incur).

Frank's (1988) thought experiments on the commitment problem used marriage partners in addition to non-romantic alliances. Specifically for married couples the commitment problem is infidelity. Since one cannot always monitor infidelity in a marriage, the partnership is often based on trust. Gonzaga et al. (2001) hypothesized based on Frank's (1988) work that commitment signalling should exist in romantic relationships. As expected, the experience of romantic love correlated with sympathy. In addition, Gonzaga et al (2001) provided evidence for a nonverbal display of love, that affiliation cues (i.e. head nods, Duchenne smiles, and forward leans) positively correlated with self-reports and partner estimates of love. Finally, the authors found that the display of love correlated with commitment-enhancing processes (i.e. conflict resolution) when the relationship was threatened (Gonzaga et al., 2001).

How can experiments be designed to test whether or not perceivers can detect altruists based on *nonverbal cues*? In everyday situations, humans interact with strangers briefly and make character assessments. However, when people interact freely it is difficult to test whether or not assessments of altruism are based on nonverbal cues (as interactants could give verbal information regarding past acts of altruism). For example 'I volunteer regularly to help the sick at the hospital'. A method is needed that can control for potential confounds and still be analogous to how people meet for the first time. One methodology that is ideal for controlling for promises to cooperate and verbal information is the "zero-acquaintance video presentation paradigm" (see Ekman, 1985). By moving away from actual face-to-face encounters a variety of potentially confounding factors can be minimized.

Research in social psychology has used the "zero-acquaintance video presentation paradigm" to investigate whether or not naïve perceivers can detect 'tell-tale' cues to personality or lying from video segments (Ekman, 1985; Frank, 1988). The zero-acquaintance video presentation paradigm in nonverbal behaviour experiments (Ekman, 1985) entails presenting a large group of perceivers a small number of video-clips depicting target individuals performing a particular task. Perceivers then assess the videotaped individuals on a variety of attributes (e.g. job suitability, physical attractiveness, lying etc.). There are several advantages to using this methodology to test the altruist-detection hypothesis. For example, length of 'interaction' with the video-clip, physical attractiveness, emotional expressiveness, and verbal information can be controlled. The paradigm is similar to meeting several individuals for the first time and making character assessments. There is an additional theoretical advantage to this method if evidence consistent with altruist-detection is found. Most studies using the zero-acquaintance video presentation paradigm (DePaulo, 1994) have shown that detection accuracy of lying is no better than chance among individuals (Ekman, O'Sullivan & Frank, 1999; Lippa & Dietz, 2000). Furthermore, the accurate assessment of individual differences in personality is trait-specific. Specifically "sociability" and "extraversion" (which are both positive correlates of altruism) are the only Big Five personality traits accurately decoded from nonverbal cues (Albright, Kenny & Malloy, 1988; Borkenau & Liebler, 1993; Funder & Colvin, 1988; Funder & Dobruth, 1987; Kenny, Horner, Kashy & Chu, 1992; Levesque & Kenny, 1993; Lippa & Dietz, 2000; Watson, 1989). If evidence for altruist detection is found this may suggest that

natural selection specifically shaped such a capacity since most personality traits (and lying) cannot be accurately decoded.

Brown (1996; 1998) designed experiments in an attempt to control for verbal information regarding cooperative tendencies without removing paralinguistic information (e.g. pitch and timbre of the voice). In general, small numbers of video-clips of altruists and non-altruists were presented to a large group of perceivers naïve with respect to altruism level. Brown (1996) used a valid and reliable altruism questionnaire (Johnson et al., 1989) to select eight female undergraduates (i.e. four self-reported altruists and four self-reported non-altruists). All eight targets re-told the Little Red Riding Hood Story in their own words to control for promises to cooperate and declarations of previous generosity (e.g. volunteering to help the needy). It was predicted that targets' willingness to cooperate would be signalled nonverbally to a group of perceivers naïve with respect to altruism level of targets. Indeed, perceivers could detect altruism level based on 1-minute video-clips of strangers at significantly higher than chance accuracy. Brown (1998) replicated this finding with altruists and non-altruists performing a different task. Ten undergraduates were selected based on their scores on Johnson et al.'s (1989) altruism scale (5 self-reported altruists - 3 females and 2 males; 5 self-reported non-altruists - 3 females and 2 males). A different task was selected to isolate the nonverbal components of selfishness from altruism. Specifically, altruists and non-altruists played a game requiring them to cooperate for their own or their partner's benefit. The prediction was that perceivers naïve with respect to altruism level of targets would perceive an

increased nonverbal "concern" by altruists working for their partner's benefit and an increased nonverbal "concern" by non-altruists working for their own benefit. Findings were consistent with predictions and suggest that nonverbal behaviours may reveal degree of altruistic motivation as predicted by Frank (1988). These results taken together suggest that nonverbal behaviours may differentiate altruists from non-altruists.

The Reputation Pathway

Frank (1988) also hypothesized that a reputation of altruism could be a pathway to positive assortation among altruists. This section discusses the reputation pathway of Frank's (1988) model and attempts to link the hypothesis to the animal literature on conventional signalling.

The second pathway for the formation of altruist-altruist partnerships is basing assessments on conventional signals of reputation. A reputation for honesty is valued cross-culturally (Brown, 1991). A standard definition of "reputation" is the estimation in which one is held or the character attributed to a person, thing, or action (www.dictionary.com). An altruistic reputation is something that others bestow upon you based on the image you have developed within the group. Reputations are socially transmitted via gossip between group members. Detecting motivations for helping may sometimes occur through word of mouth or gossip (Alexander, 1987; Frank, 1988). Individuals may exchange information regarding an individual's motives for helping in the past. Forming a consensus about a person's ability to be trusted may be beneficial and be

involved in indirect reciprocity (Alexander, 1987; Nowak & Sigmund, 1998). Repeated altruistic acts mediated by a concern for the recipient contribute to an altruistic reputation being bestowed upon the altruist by others. When character assessments by multiple individuals (with unique perspectives and/or sensory capacities) are involved in the formation of an altruistic reputation, then reputation may help decrease the costs associated with individual scrutiny (i.e., in the assessment of nonverbal indicators of altruism). [3]

Altruistic reputations are referred to as 'conventional signals' because they appear to be low cost displays in which deception should be heavily punished (Alexander, 1987; Frank, 1988; Nowak & Sigmund, 1998). Indirect reciprocity via the social transmission of reputation is evolutionarily stable (Nowak & Sigmund, 1998a; 1998b; Roberts & Sherratt, 1998; Sherratt & Roberts, 1998). There is not necessarily a cost for holding an altruistic reputation as long as you live up to your reputation. However costs are imposed if you do not meet the expectations of the community in which you reside. It has recently been suggested that conventional signals could occur in intersexual contexts if females retaliate against dishonest males by divorcing them (Viljugrein 1997). This option of not playing the game is crucial to Frank's (1988) model. Specifically once a non-

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[3] Essentially, a reputation system of altruist-detection may be analogous to mate-choice copying in sexual selection models. That is, if everyone trusts individual 'x' then it may pay to befriend that individual since they are likely altruistic. A system of partner-preference copying could be vulnerable to cheats due to an initially poor assessment that is subsequently copied by others indiscriminately. As well some individuals may not pay the costs associated with detection and reap the benefits of other's scrutiny. Thus, facial expressions may be the most reliable way to assess an altruistic character.

altruistic reputation is detected prospectively individuals may opt out of interacting with the signaler before exploitation.

An altruistic reputation can be viewed as a conventional signal much like a status badge in some bird species (Vehrencamp, 2000). A conventional signal can be arbitrary in its form[4] and does not entail production costs for the honest signaler. Rather, receiver-imposed costs inflicted (e.g. punishment or ostracism) upon dishonest senders, maintains honest signals in a conventional system. Color badges of status appear to be good examples of conventional signals, where the size of the color patch is correlated with dominance status (Maynard Smith & Harper 1988).

Many signals are neither costly to produce nor risky to execute (Vehrencamp, 2000). Such signals appear to be associated with specific contexts by arbitrary convention, and they have therefore been called conventional signals (Guilford & Dawkins 1995). Conventional signals can be evolutionarily stable without costs if there is no conflict between senders and receivers. Specifically

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[4] Since there is no obligate link between signal form and information content, the design of conventional signals can be arbitrary (e.g. cultural conventions regarding altruistic reputation). The 'arbitrariness' of an altruistic reputation may be found in the cultural psychology literature. In the case of human altruism any convention (e.g. culture-specific indicators of reputation, such as dialect, shibboleths, and/or sociolinguistic conventions) could become associated with likelihood to be altruistic. For example, recent work in cultural psychology has found that Chinese students view individuals who brag about their altruism as deceptive and individuals who conceal their altruism as trustworthy. However, Canadian students perceive individuals who conceal their altruism as deceptive (Fu et al., 2001). Cultural conventions such as these may signal altruistic reputation, however they may be arbitrary in the sense the convention is only understandable within the culture (or sub-culture). Therefore, one may have to test the detection of an altruistic reputation differently in different cultures keeping in mind social norms and sociolinguistics contexts.

the sender and receiver agree about the optimal receiver response (Davies 1981; Maynard Smith 1994). However, conventional signals may occur in situations where there are conflicts of interest between a sender and receiver. In such cases, there must be some type of stabilizing cost. A receiver retaliation or punishment rule is hypothesized to be the stabilizing factor (Vehrencamp, 2000). Conventional signalling models in agonistic contexts have been developed and expanded by Enquist (1985), Johnstone and Norris 1993, Hurd (1997), and Hurd and Enquist (1998).

Alexander (1987) pointed to the benefit of indirect reciprocity whereby individuals cultivate a reputation for altruism among third party reciprocators. For example, helping the sick or elderly who cannot reciprocate could facilitate third party altruism directed towards the donor. In order for an altruistic reputation to be a conventional signal there must be punishment of individuals who foster an altruistic reputation as they subtly cheat others.

Alternative signal variants in a conventional signalling system need not differ in production costs, however the selfish versus altruistic signals should be easily distinguishable and thus antithetical in form (Hurd et al. 1995). In the case of human cooperation it should be easily distinguishable when an individual cooperates or defects. Honesty is maintained by the high retaliation cost of signaling an altruistic state when actually selfish, i.e., other altruistic individuals will punish such cheaters.

Predictions generated from modelling indirect reciprocity through image scoring have been tested in the laboratory. An 'image score' is one's reputation

for altruism within the group. Wedekind and Milinski (2000) suggest that humans are more helpful toward non-kin than evolutionary theory would predict. "Indirect reciprocity" could help explain the high rates of cooperation in humans according to Wedekind and Milinski (2000). Wedekind and Milinski (2000) hypothesized that if indirect reciprocity occurs and is based on image scoring (which reflects the way an individual is viewed by a group) the high levels of cooperation among non-kin may be partially explained by evolutionary game theory. Wedekind and Milinski (2000) found that donations were more frequent to receivers who had been generous to others in earlier interactions. This suggests that image scoring promotes cooperative behavior in situations where direct reciprocity is rare or impossible. Furthermore, the altruistic image score is scrutinized before perceivers decide to deliver benefits to a third party (Wedekind & Milinski, 2000).

Selfish individuals may cooperate when being observed by others to gain a higher image score, however when they are not being monitored they can subtly cheat their partner's cooperation. Trivers (1971) saw the problem of subtle cheating as a problem for reciprocity theory and predicted that humans should search for the presence of the emotions committing cooperation in the future (i.e. Frank, 1988).

Cosmides and Tooby (1992) designed an altruist-detection Wason selection task for control purposes (i.e. the task was not designed with Frank's theory in mind and was used to show that humans reason better about cheaters than altruists, because altruists would have been rare in ancestral environments). Cosmides and Tooby's (1992) altruist version told participants to look for altruism

by a ruthless tyrant (an altruistic act was defined as paying the costs without taking the benefits). Cosmides and Tooby's (1992) altruist detection Wason task may have confused participants because the character of the presumed altruist was called into question in the vignette (i.e. he was described as a ruthless tyrant). Frank's (1988) model of an altruist is not an individual who randomly delivers unexpected acts of kindness but rather a 'habitual' altruist (i.e. an individual committed by other-interested emotions to deliver help to others regularly). Perhaps, if the leader was not described as a ruthless tyrant but rather as a benevolent leader who was committed by prosocial emotions to habitually help others, participants would have exhibited better abilities at reasoning about altruism. The finding that humans cannot detect altruism in Cosmides and Tooby's (1992) Wason selection task may be important from the point of view of Frank's (1988) reputation pathway to altruist detection. An individual who is described as having a "reputation for being ruthless" may result in a 'black mark' on the target that is extremely difficult to erase from the perceiver's perspective.

In order for an altruistic reputation to function as a conventional signal there must be some way to penalize deception. A possible cost to fostering an altruistic reputation when in fact you are selfish is punishment. There may be punishment for the deceptive boasting (bragging about altruism). Cooperating in front of others may not be sufficient to cultivate an altruistic reputation (Brown & Moore, 2000). Rather helping others with an apparent emotional regard for the recipient's interest may be a crucial criterion for receivers to deliver third party benefits in human societies (Brown & Moore, 2000). Information-processing

mechanisms for altruist-detection may be designed in such a way to scrutinize the underlying motivations for helping (i.e. self-interested vs. other-interested helping). The reason that underlying motives for helping are important is that individuals who perform a helpful act mediated by selfishness may be less likely to cooperate in the future when payoffs cannot be envisaged (Romer et al., 1986).

In relation to signals of reputation in humans a similar process may be operating as elucidated by conventional signalling models. For example, a critical feature of conventional signalling models is the presence of two individuals who each know their own willingness or ability to commit an act of altruism, but not that of the conspecific. Both individuals possess one of two alternative signals, 'A' or 'S', and then base their responses on the joint result. The evolutionarily stable decision policy is: 'When signal A is presented the individual is altruistically motivated and when signal S is presented the individual is selfishly motivated; punish individuals who signal A but act selfishly and reward individuals who signal S but act altruistically.' A policy such as this one implies that competitive senders frequently test each other, especially those competitors where there is some doubt regarding their reputation. The meaning of the alternative signals is therefore established by convention, not by differential production costs. A prediction of the model is that one could exchange the meaning of signals A and S (i.e., the coding rule) and still maintain an honest signaling system.

Two hypotheses must be tested regarding Frank's (1988) reputation pathway to altruist detection. First, it must be shown that humans are particularly

good at detecting an altruistic reputation. One method that is suited for this hypothesis is the Wason selection task, which is a reasoning problem implemented by Cosmides and Tooby (1992) to demonstrate that participants were particularly adept at detecting cheaters in social exchanges but not altruists in social exchanges.

A conventional signalling approach to Frank's (1988) hypothesis that an altruistic reputation is detectable could help construct a Wason problem that is a more suitable test of the evolved decision rules used for reputation assessment in humans. One can imagine a signal in the reputation pathway to be the overt behaviour (helped others vs. did not help others). In this case the convention (i.e. social rule) is individuals who help must not be demanding benefits. An individual who signals altruism (i.e. helps others) but secretly has selfish desires would be a costly partner (from the point of view of perceivers) in indirect reciprocity games. Pseudo psychological altruists who help only when they consciously perceive benefits would be less likely to help in the future (when the benefits are absent). An important second assumption of Frank's (1988) reputation pathway that must be tested is that once a pseudo-altruistic reputation is detected, the deceptive signaller is punished and altruists are rewarded.

Triangulating Commitment Signalling Theory

The general evolutionary utility of altruistic partner preference appears 'justified' using theoretical triangulation. Specifically, multiple but distinct theories (e.g. kin selection, reciprocal altruism, and commitment signalling) suggest that

altruism can evolve if altruists (kin or non-kin) recognize and assortate with one another. Commitment signalling theory offers clear hypotheses in the domain of the expression and detection of human altruism. For example, altruists should be detectable based on hard-to-fake nonverbal cues and/or reputation cues. Also, the commitment signalling approach predicts that upon detection of these reliable signals altruists are rewarded and non-altruists are penalized. Assumptions generated from commitment signalling theory were tested using methodological triangulation (i.e. using more than one method to assess an idea's empirical worth). If results from each method correspond then this is good evidence that the phenomenon (in the case of this thesis, altruist-detection and partner preference) is not a procedural artifact. Different methods were used to test the two pathways to altruist-detection hypothesized by Frank (1988): the nonverbal behaviour and reputation pathways. Finally the partner preference assumption of commitment signalling theory was investigated. Specifically, do nonverbal and/or reputation cues to altruism increase the benefits delivered to altruists? Methods were borrowed from cognitive psychology, cultural psychology, social psychology, ethology, and experimental economics.

Summary of Studies

Detection of Altruistic Reputations

Using the Wason selection task commonly implemented in cognitive psychology Studies One and Two tested whether humans pay special attention to information regarding genuine altruism. Altruist detection cognitive

mechanisms may operate so that participants scrutinize the reason why an individual cooperates (e.g. whether helping others was selfishly or unselfishly motivated). Such a finding would be consistent with Frank's altruist detection hypothesis via the reputation pathway. If humans could not detect altruists in the Wason selection task, but could detect cheaters this would suggest that only overt cheating mattered to our ancestors. This suggests that as long as an individual cooperates, the reasons for doing so are unimportant in terms of the recipient's (or third party observers') future fitness. It is hypothesized based on Frank's (1988) reputation pathway to altruist detection that more participants will solve altruist detection Wason problems that ask them to detect instances of genuine altruism (i.e. not selfishly motivated pseudo-altruism) compared to control Wason selection tasks.

Detecting Nonverbal Cues to Altruism

Study Three (which employs an experimental social psychology methodology called the zero-acquaintance video presentation paradigm) tested Frank's (1988) nonverbal altruist detection hypothesis. One-minute videoclips of students (speaking Dutch) from the University of Grongingen were presented to Canadian students. If Canadian perceivers detect altruism level there must be some nonverbal aspect of the target's behaviour indicating prosocial character. It was hypothesized that participants' ratings of prosociality of video-targets would positively correlate with measures of actual prosociality of the video-targets.

Measuring Nonverbal Cues to Altruism

Study Four A/B attempted an ethological investigation of specific nonverbal behaviours in hope of isolating the putative nonverbal cues that differentiate altruists from non-altruists. Frank (1988) suggested that hard-to-fake nonverbal cues should be reliable indicators of altruism. Therefore it is predicted that nonverbal behaviours associated with hard-to-fake emotions (e.g. Duchenne smiles) should positively correlate with altruism level. That is, as video-targets increase in altruism level the greater the expression of hard-to-fake nonverbal behaviours. This hypothesis was explored in Dutch and Canadian samples.

Nonverbal and Reputation Cues Confer Benefits

Frank (1988) predicted that individuals with an altruistic reputation would be preferred partners for social dilemmas requiring trust. It also appears that a specific nonverbal behaviour may be associated with altruism (i.e. smile asymmetries – see Brown & Moore, 2002). Specifically non-altruists may produce more asymmetrical smiles. Study Five used an experimental economics paradigm to test whether an altruistic reputation and smile symmetry in cartoon icons influence resource allocations in a dictator game. If cartoon icons with symmetrical smiles do not receive more resources than icons with asymmetrical smiles this could suggest that this aspect of the smile is not a sufficient cue to altruism (alternatively it could simply mean that the stimuli were artificial). If cartoon icons with an altruistic reputation do not receive more resources than

non-altruistic icons this could raise doubts regarding the validity of Frank's evolutionary model for human cooperation.

It was hypothesized that cartoon icons with symmetrical smiles would be perceived as more altruistic than icons with asymmetrical smiles; and receive more resources in an experimental economics game. Also it was predicted that icons described as genuinely altruistic would be perceived as more altruistic than icons described as pseudo-altruists and receive more resources in an experimental economics game.

CHAPTER II

Altruist Detection in the Wason Selection Task – Study One

Apparent acts of altruism may not be sufficient for others to bestow an altruistic reputation. Rather helping others with an emotional regard for the recipient's interest may be a crucial criterion for receivers to deliver third party benefits (Trivers, 1971; Frank, 1988; Brown & Moore, 2000). Recall from Chapter I Frank's (1988) commitment signalling theory suggests that altruist detection may occur via the social transmission of an altruistic reputation. Furthermore, Chapter I suggested that the social transmission of an altruistic reputation requires that perceivers scrutinize apparent altruistic behaviours to determine if they are genuine or not (i.e. not motivated by selfishness).

Previous evolutionary work using the Wason selection task (Cosmides & Tooby, 1992) demonstrated that humans are good at detecting cheaters (i.e. defined as individuals who take the benefits without paying the costs) but not good at detecting altruists (i.e. defined as not taking the benefits but paying the costs). Two reasons that participants may have performed poorly on the altruist version is that reputation was confounded (i.e. the supposed altruist was described as ruthless) and altruism defined by Frank (1988) should include the act of helping and the reason for doing so.

To test the hypothesis that humans have information processing capabilities designed to detect whether a helpful act was motivated by genuine concern for others, the Wason selection task was implemented in a similar manner as Cosmides and Tooby (1992). An altruist-detection version of the

Wason selection task should test whether people search for the presence of other interest motivating an altruistic act. An altruist-detection Wason task contains the following rule structure: "If X helps, then X demands credit." Participants can choose any of the following cards: (1) "X helps"; (2) "X does not help"; (3) "X does not demand credit"; and (4) "X demands credit." The correct answer in terms of altruist detection is "X helps" and "X does not demand credit." These card choices denote a genuine altruist (i.e. one who is likely to cooperate in the future). However, a pseudo-altruist is an individual who helps others only if they receive credit for their assistance. The cards denoting a pseudo-altruist are "X helps" and "X demands credit". Individuals that demand payment for help provided are presumably less likely to help in the future when it is not in his or her self-interest (e.g. when the target is not being monitored by others). The present study was designed to test for the existence of an altruist-detection algorithm. Specifically, altruist-detection problems were tested against control Wason selection tasks (e.g., an abstract and familiar Wason problems). It was predicted that a higher frequency of participants would solve the Wason tasks designed to detect altruists than the control problems.

Methods - Study One

Participants, Instruments and Procedure

Sixty participants from Introductory Psychology classes at Dalhousie University were recruited and asked to solve three cognitive tasks. Participants received a 1% credit toward their class grade. All participants signed a consent

form and were debriefed after participation (Appendix 1). Participants received an abstract Wason task (Griggs & Cox, 1983). This abstract Wason task was used (Appendix 2) as a control to determine a baseline frequency of correct choices for our sample on the traditional Wason task. In previous research, 4% to 10% of participants typically get the abstract version of the Wason selection task correct (Wason, 1983). The correct answer in logical terms is "P" and "not-Q" for an "If P, then Q" statement. In our problem of letters and numbers (A = P, 5 = Q, 8 = not-Q, and K = not-P), the logically correct response is "A" and "8." The two altruist-detection problems follow this "if P then Q" structure. Version 1 (Appendix 2) asked the participants to imagine that they are in need of a trustworthy babysitter. A genuinely altruistic babysitter in this Wason problem is the person who volunteers to help sick children for the sake of helping rather than consciously seeking self-gain. Version 1's rule is: "If they volunteer, then they seek credit." The four card choices are (1) seeks credit; (2) does not seek credit; (3) volunteers; and (4) does not volunteer. Altruist-detection Version 2 (Appendix 2) has the same rule structure as Version 1; however, the situation is different. Specifically, Version 2 (Appendix 2) asks participants to imagine that they need to choose a friend who can help them adjust to a new city without taking advantage of them. A likely candidate is the person who gives blood but does not accept the payment for doing so. Version 2's rule is: "If they give blood, then they accept payment." The four cards read (1) accepts payment; (2) does not accept payment; (3) gives blood; and (4) does not give blood. In both altruist-detection Versions 1 and 2, the logically correct choice ("P" and "not-Q") corresponds to

detecting an altruist (person helps and does not seek gain). The switched versions of problem 1 and 2 are identical to the standard versions except the "If...Then" statement was reversed: "If they seek credit, then they volunteer" and "If they accept payment, then they give blood." The purpose behind switching the problems was to make sure that participants were detecting altruism rather than reasoning by formal logic (Cosmides, 1989; Cosmides & Tooby, 1992). According to Cosmides (1989) if participants were reasoning using formal logic only, they would always choose "P" and "not-Q." However, if the participants were detecting altruists, they would choose "not-P" (i.e. does not seek credit) and "Q" (i.e. volunteers) in the switched version. Specifically, this manipulation can test the hypothesis that the straightforward wording of the task is doing more than facilitating formal logical reasoning. Specifically if participants choose "not-P" and "Q" cards in switched tasks they are not logically processing[5] the conditional rule but choosing the cards denoting a genuine altruist ("X helps" and "X does not seek credit"). For all five problems participants were instructed to "select only the card(s) they definitely need to turn over to determine whether" (1) "the rule has been violated" (abstract version); (2) "whether any of your co-workers are potential friends" (altruist-detection problem 1 standard and switched

[5] It is true that the participants who do not solve switched tasks by formal conditional reasoning (choosing the "P" and "not-Q" cards) but instead detect altruists are being logical (since the tasks are designed to cue students in this direction). However, without the switched version of the Wason task developed by Cosmides (1989) one would not know if this was the case. That is standard versions of the cheater and altruist detection tasks could just afford clearer thinking so individuals could solve formal conditional rules using "P" and "not-Q" formal logic.

versions); and (3) "whether a candidate is acceptable to you as a baby-sitter" (altruist-detection problem 2 standard and switched versions).

Participants were brought into the lab in groups of 15. Problem order was counterbalanced to avoid any effect of order of presentation. Each participant received three problems; the two altruist detection versions, one standard and one switched rule version, and an abstract (control) problem. Half the sample (n=30) received a standard version of altruist-detection Version 1 and switched form of altruist-detection Version 2. The other half of the sample (n=30) received a switched version of altruist-detection Version 1 and a standard version of the altruist-detection Version 2. All participants received the standard control problem (abstract version). Participants were given instructions before they began to work on the problems. Instructions were limited so as not to bias performance. Participants were instructed that their participation would require them to complete three problem-solving tasks that had logical answers.

Data Analyses

To compare the frequency correct on the altruist-detection tasks versus control tasks McNemar's test was used. According to Siegel (1988), McNemar's test is a suitable nonparametric statistic for comparing frequencies in matched samples. McNemar's test is based on a Chi-square test for goodness of fit that compares the distribution of counts expected under the null hypothesis to the observed counts. However, unlike the Chi-square test for goodness of fit and the Chi-square test for independence, it does not have the assumption of

independent observations. This is a between-participants and within-participants design. Therefore, McNemar's test was applied for the within-participants comparisons and regular Chi-square tests for the between-participants comparisons. To distinguish between McNemar's Chi-square and regular Chi-square tests, an "M" prefix was used to denote McNemar's test (e.g., $M\chi^2$).

Results – Study One

The content differences between altruist-detection problems 1 and 2 did not affect performance. Fifteen of 30 participants selected the "P" and "not-Q" cards (i.e., detected the altruist) in the standard form of altruist-detection Version 1 compared to 17 of 30 who selected the "P" and "not-Q" cards in altruist-detection Version 2. The proportion of correct choices for the two altruist-detection Versions with the standard rules did not differ significantly [Table 1; $M\chi^2$ (1) = 0.70, $p > .05$]. For the switched version of the altruist-detection Version 1, 18 of 30 participants selected the "Q" and "not-P" cards (i.e., detected the altruist) compared to the 17 of 30 who selected "Q" and "not-P" cards (i.e., detected the altruist) in altruist-detection Version 2. The proportion of 'correct' choices for the two altruist-detection versions with the switched rule did not differ significantly [$M\chi^2$ (1) = 0.20, $p > .05$]. Therefore, the results of the two problems were combined for further analyses.

As predicted, more participants (32/60) detected the altruist by solving the altruist-detection problems correctly compared to the number of participants

(1/60) who correctly solved the control abstract Wason task [Table 1 - $M\chi^2$ (1) = 29.03, $p < .00001$, $n = 60$]. Performance on the abstract task was somewhat

Table 1 Percentage of participants choosing "P and not-Q" and "Q and not-P" for standard rules (altruist-detection and abstract control) versus percentage of participants choosing "Q and not-P" and "P and not-Q" for switched rules (altruist-detection)

Percentage choosing	Problem Type	
	P and not-Q	Q and not-P
Standard versions (if P, then Q):		
Altruist-detection	53	0
Abstract control	1.7	0
Switched version (if Q, then P):		
Altruist-detection	1.7	58

lower in our sample compared to previous studies using the abstract Wason task (around 10%). Therefore, a Chi-square test for goodness of fit compared the frequency correct on the altruist-detection task versus the base-line frequency usually found in previous studies using the abstract Wason task. Consistent with the hypothesis, significantly more participants (53%) got the altruist-detection version correct than expected, χ^2 (1) = 125.19, $p < .0001$, $n = 60$. It was also hypothesized that the selection of "P" and "not-Q" cards would decrease for switched altruist-detection rules. Recall that the justification for this hypothesis is that people are not solving the problems using formal logic; rather, they are attempting to detect the genuine altruist. It was found that 32 participants selected the "P" and "not-Q" cards when they received a standard rule, and 35

participants selected "Q" and "not-P" when they received the switched version of the same rule. Specifically, this finding indicates that participants preferred the cards "X helps" and "X does not seek credit" in both standard and switched altruist-detection problems, even though this answer is "logically" incorrect in switched versions (i.e. logically incorrect if subjects were testing an if-then conditional rule). The proportion of "P" and "not-Q" choices was significantly higher for the altruist-detection problem with the standard rule compared to the altruist-detection problem with the switched rule [Table 1; χ^2 (1) =29.03, $p <$ .00001, n=60]. This result suggests that the wording of the altruist detection versions are not allowing participants to reason using formal propositional logic, but rather participants appear to be detecting altruists (as predicted). In fact, as seen in Table 1, 58% of participants chose "not-P" and "Q" cards in the switched altruist-detection problem compared to the 1.7% who chose "P" and "not-Q."

Discussion - Study One

The main hypothesis of Study One was that participants would be able to solve problems designed to detect altruists better than the abstract Wason control problem. The results were consistent with this hypothesis. More participants detected the altruist than would be expected if humans did not pay particular attention to information related to a conspecific's underlying altruism. Altruist-detection was not mediated by logical reasoning as participants solved switched altruist-detection problems illogically, but correctly from the perspective of detecting the altruist. Specifically, the logically correct answer would be "P"

and "not-Q," but most participants chose "not-P" and "Q" for switched problems. Put into altruist-detection terms, most participants chose the cards "Does not seek credit" and "X helps" regardless of whether participants received standard or switched rules. It is this combination of cards that reflects genuine altruism. The results of Study One suggest that people are superior at reasoning about altruistic intentions compared to abstract problems in Wason selection tasks. Furthermore, this result is not due to altruist-detection tasks facilitating logical reasoning. If the conditional rule was not switched it could not be ruled out that for some reason participants are able to think more clearly in terms of formal logic to solve the task correctly. These results parallel those of Cosmides (1989), who found that cheater-detection tasks were more easily solved than the abstract version and that this effect was not mediated by logical thinking. In the second experiment these findings were further explored in two ways. In Study One 2% of participants solved the abstract control problem correctly. Participants typically perform better with familiar content (Cosmides and Tooby, 1992). Therefore, in Experiment 2, a control Wason task was included with concrete wording (i.e., not letters and numerals) that was matched for approximate word count to that of the altruist-detection problem.

CHAPTER III

Altruist Detection in the Wason Selection Task - Study Two

In Study Two performance on the altruist-detection problem was compared to performance on the "school problem" (Appendix 3), a control Wason selection task taken from Cosmides (1989). Study Two also made comparisons between a cheater-detection version of the Wason task (Appendix 3) and our altruist-detection version. No a priori predictions were made regarding participants' performance on the altruist-detection problem versus the cheater-detection problem. Without a good evolutionary model, it is difficult to predict on which type of problem (altruist vs. cheater detection) participants should exhibit better performance. The cheater-detection version of the Wason selection task follows a social exchange structure: "If X receives the benefit, then X must pay the cost." One side of the card tells whether or not X takes the benefit, and the other side of the card tells the participant whether or not X paid the cost. The four cards presented are (1) "X takes benefit"; (2) "X does not pay the cost"; (3) "X does not take benefit"; and (4) "X pays the cost." Participants are asked to determine whether any individual is violating this rule. The correct answer is "X takes benefit" and "X does not pay the cost." About 76% of participants get this problem correct (Cosmides and Tooby, 1992). As before, the altruist-detection and the cheater-detection problems were switched. A switched version of the school control problem was also employed. It was predicted that participants would choose "P" and "not-Q" cards for standard altruist-detection and standard cheater-detection problems, but when the problem rules are switched it was

expected that participants would detect altruists and cheaters by choosing "not-P" and "Q." However, for the school control problem it was expected that switched rules would not increase "not-P" and "Q" card choices. This is because in terms of logical reasoning "P" and "not-Q" is always the correct answer for control Wason selection tasks.

Methods - Study Two

Participants and Procedure

Forty-six participants from Introductory Psychology classes were brought into the laboratory in groups of approximately 15 and administered three Wason problems in counterbalanced order of presentation (4 of the 6 possible orders were used 8 times, the other 2 possible orders were used 7 times): (1) the altruist-detection problem (Appendix 3); (2) the cheater-detection problem (Appendix 3); and (3) the school problem (Appendix 3). Half the sample (n = 23) received standard versions and the other half of the sample (n = 23) received switched versions. Before participants were permitted to attempt the problems, they were given the same brief instructions as in Study One. They also were given class credit and recruited in the same manner.

The correct answer on an altruist-detection task consists of choosing the "X helps" and "X does not seek credit" cards. The cheater-detection problem is a standard social contract ("If X receives the benefit, then X must pay the cost"). The version used was the Drinking Age problem (Cosmides and Tooby, 1992) in which participants are presented the conditional statement: "If a person is

drinking beer, then they must be over 18 years old." In a cheater-detection problem, the correct answer is "benefit accepted" and the "cost not paid" cards. Since the Drinking Age problem was used, the functional equivalent answers are the "drinking beer" and "16 year old" cards. The School Problem contains the conditional statement: "If a student is to be assigned to Halifax High School, then that student must live in Halifax." The card choices are Halifax High School, Dartmouth, Halifax, and Dartmouth High School. For the "School Problem" the logical correct answer is "P" (Halifax High School) and "not-Q" (Dartmouth). Whether the "School Problem" rule is standard or switched, participants should still choose "P" and "not-Q."

Results – Study Two

Thirteen of 23 participants selected "P" and "not-Q" cards for the altruist-detection problem with standard rules, whereas 16 selected "P" and "not-Q" cards for the cheater-detection task and 8 selected "P" and "not-Q" cards for the school control problem with standard rules. No statistically significant differences were found between cheater-detection and altruist-detection problems with standard rules [Table 2; $M\chi^2$ (1) = 0.45, p > .05]. In addition, there was no statistically significant difference in performance on the altruist-detection problem versus the school control problem with standard rules [Table 2; $M\chi^2$ (1) = 0.64, p > .05, n = 23]. There was no significant difference between the frequency of participants selecting the "not-P" and "Q" cards for altruist-detection and cheater-detection versions with switched rules [Table 2; $M\chi^2$ (1) = 0.08, p > .05, n =23].

Finally, significantly more participants selected "not-P" and "Q" when solving a switched altruist-detection (14/23) compared to the number of participants who

Table 2 Percentage of participants choosing "P and not-Q" and "Q and not-P" for standard rules (altruist-detection, cheater detection, and "school problem" control) versus percentage of participants choosing "Q and not-P" and "P and not-Q" for switched rules (altruist-detection, cheater detection, and "school problem" control)

Percentage choosing	Problem Type	
Standard version (if P, then Q):	P and not-Q	Q and not-P
Altruist-detection	56.5	0
Cheater-detection	69.6	0
"School problem" control	34.8	0
Switched version (if Q, then P):		
Altruist-detection	13	60.4
Cheater-detection	4.3	69.6
"School problem" control	26.1	0

selected "P" and "not-Q" on the school control problem (6/23) [$M\chi^2$ (1) = 4.08, $p < .05$, n = 23].

Descriptive analyses in Table 2 revealed that for the altruist-detection and cheater-detection problems, participants chose the "not-P" and "Q" cards when the problems were switched. However, this trend was absent for the school control problem. As in Study One, the switched altruist-detection problem had significantly fewer "P" and "not-Q" choices than the standard altruist-detection

problem [Table 2; χ^2 (1) = 17.67, p < .0001, n = 46]. As seen in Table 2 56.5% of participants chose the "P" and "not-Q" cards (which is logically correct *and* correct in terms of "altruist-detection") in the standard version. However in switched problems only 13% of participants chose "P" and "not-Q" (correct logically, but incorrect in terms of "altruist-detection"). This result suggests that participants are attempting to detect altruists rather than solving the problem via logical thinking. An analogous effect appears for the cheater-detection problem. Specifically, as seen in Table 2, 69.6% of participants chose the "P" and "not-Q" cards when solving a standard cheater-detection task; however only 4.3% chose "P" and "not-Q" when the same problem rule was switched. This difference was significant [χ^2 (1) = 46.28, p < .0001, n = 46]. This is consistent with previous findings suggesting that participants are detecting cheaters rather than simply solving the problem logically (Cosmides & Tooby, 1992). However, as expected, this "switching effect" disappears for the school control problem. Specifically, as seen in Table 3, "P" and "not-Q" was chosen approximately the same number of times for standard (34.8%) as well as the switched rule (26.1%). This difference was not significant [χ^2 (1) = .77, p = .38, n = 46]. This suggests that participants who do manage to solve the task chose the "P" and "not-Q" cards regardless of whether the conditional rule was switched. Given that the same pattern exists across standard and switched versions, the data for the different versions were combined for further analyses. When the frequency correct for standard and switched were combined, more participants (27/46) were correct on the altruist-

detection problem than on the school control problem[6] (15/46) [Table 2; $M\chi^2$ (1) = 6.86, p < .01, n = 46]. Likewise, the frequency of participants solving cheater-detection problems correctly (32/46) was significantly greater than the frequency solving the school control problem correctly (15/46) [Table 2; $M\chi^2$ (1) = 14.09, $p < .0001$, $n = 46$]. However, the frequency of participants correctly identifying the cheater (32/46) did not differ significantly from the frequency of participants correctly identifying the altruist (27/46): [Table 2; $M\chi^2$ (1) = .45, $p > .05$, $n = 46$].

Discussion - Wason Findings

As in Study One, participants tended to perform better on altruist-detection tasks (i.e., detected the altruist) than on the control task. This result was not mediated by formal logical reasoning (i.e. testing if-then conditionals). This finding provides support for the idea that humans scrutinize the proximate motives behind why an individual helped others (Frank, 1988). This is exactly what would be expected if subtle cheating has exerted selection pressures on human cognitive architecture to search for information regarding the genuineness of an altruistic act (Trivers, 1971; Frank, 1988). The second finding in Study Two was that there was no significant difference in performance on the altruist-detection versus the cheater-detection versions. It is difficult to draw definite conclusions from this null result. It is possible that the sample size was too small to detect a significant effect. However, it is clear that both cheater-detection and altruist-detection are occurring in these situations.

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[6] Logically correct responses for standard and switched versions of the school

Overall this study suggests that participants can solve altruist-detection Wason problems significantly better than control Wason problems (abstract and school versions). This finding is analogous to the findings on cheater-detection by Cosmides (1989). Altruist-detection tasks elicit the switching response (i.e., "not-P" and "Q") for reversed rules. This switching response supports the notion that participants are detecting altruists rather than reasoning in terms of formal or conditional logic. Furthermore, participants did not solve cheater-detection tasks better than altruist-detection tasks. These results are consistent with the evolutionary hypothesis that humans are sensitive to information regarding the genuineness of the altruistic behaviour performed (Trivers, 1971; Frank, 1988). The result that participants can detect altruists in a Wason selection task at first glance contradicts a finding by Cosmides and Tooby (1992) suggesting that participants could not detect altruists. However, their "altruist version" of the Wason selection task was not designed with reference to any theory that predicts the existence of altruist-detection (Frank, 1988). Rather, the altruist version of the Wason task utilized by Cosmides and Tooby (1992) was a control, and the character was not portrayed as a genuine emotion-based altruist, but as one who displayed occasional "random" acts of indulgence. It is possible that one of the reasons that participants performed poorly on Cosmides and Tooby's (1992) "altruist version" of the Wason selection task is that the context of story was not appropriate for testing the hypothesis of genuine altruism detection proposed by Frank (1988). The conditional rule used in Cosmides and Tooby's (1992) altruist

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control problem were combined for this analysis.

version was different from the rules in altruist detection versions used in here. That is, Cosmides and Tooby (1992) used social exchange rules (i.e. if you take the benefits, then you must pay the costs). According to Cosmides and Tooby (1992) the altruist is one who pays the costs but does not take benefit.

Cosmides and Tooby (1992) have proposed the existence of cheater-detection information processing mechanisms. This is what an evolutionary approach would predict in a species that routinely engages in social contracts where detection of cheating is necessary for protection from free riders (Axelrod and Hamilton, 1981; Trivers, 1971). Experiments have generally presented convincing evidence of the existence of a cheater-detection information processing mechanism in humans (Mealey et al., 1996; Oda, 1997). When participants solve a Wason task correctly, can it be concluded that there exists an altruist-detection "Darwinian Algorithm"? Maybe participants are good at reasoning about intentions rather than altruist-detection per se. Likewise, humans could have refined abilities for detecting individuals to exploit. And genuine intentions could be a signal of who can be exploited, that is, who is a "sucker." However, as long as altruists' detection abilities are no worse than exploiters' detection abilities, they can form partnerships to avoid such exploitation.

An alternative interpretation of our findings is that our altruist-detection problems activated a social exchange "search for cheaters" algorithm. Specifically, participants may have read the problem as asking, "who is definitely not the cheater?" Future research needs to clarify whether an "altruist-detection

cognitive mechanism" functions independently from a "cheater-detection cognitive mechanism." Detecting cheaters in a social exchange situation could be different from detecting altruistic commitments or aspects of an individual's character. That is, the work by Cosmides (1989) demonstrates that humans are adept at reasoning about cheating in social exchange situations, whereas the present study suggests that humans are good at reasoning about attributes indicating an altruistic character. Tooby and Cosmides (1996) also suggested that, evolutionarily, one should expect to find different psychological mechanisms in the domain of friendship as opposed to social exchange.

Evolutionary researchers have implied that cooperators may assortate with one another to gain the benefits of mutual cooperation (Bull and Rice, 1991; Peck 1993; Wilson and Dugatkin, 1997). One adaptive benefit of reliably detecting altruists is that an altruist would accrue inclusive fitness benefits from trustworthy friends and allies (Alexander, 1987; Tooby and Cosmides, 1996). What is needed for these models is a theory for the evolution and stability of altruists reliably signaling their intentions (Grafen, 1990; Zahavi, 1987). Perhaps deceptive displays of pseudo-altruism were kept in evolutionary check via frequency dependent selection (Frank, 1988; Trivers, 1985; see also Surbey and McNally, 1997 for a study of the psychological mechanisms involved in this proposed coevolutionary struggle). Semple and McComb (1996) have suggested that selection may favor honesty when the high costs of being deceived leads to the selection of skeptical perceivers who only respond to intrinsically unfalsifiable signals. Frank (1988) has offered such a mechanism, and evidence consistent

with one of the assumptions of his model (i.e., altruist-detection) has been provided here.

Altruist detection in the Wason task demonstrates that information regarding a prosocial character is scrutinized. This is consistent with Frank's (1988) "reputation" pathway to altruist detection. An untested alternative pathway is via nonverbal behaviour. The following studies attempted to elucidate if nonverbal information is also important for altruist detection in humans.

Chapter IV

Study Three – Intercultural Altruist Detection

Study Three explores the nonverbal pathway to altruist detection hypothesized by Frank (1988). Specifically as discussed in Chapter I Frank (1988) hypothesized that humans transmit difficult to fake nonverbal cues revealing level of prosocial commitment.

Frank et al. (1993) were the first to test Frank's (1988) model suggesting that humans can detect altruists based on nonverbal cues. Participants were brought into a lab and interacted freely for 30 minutes and afterwards were asked to predict whether the individuals they interacted with would cooperate or defect in a Prisoner's Dilemma game. Participants were able to predict whether their partner would cooperate or not cooperate in a Prisoner's Dilemma game following the 30-minute interaction. Accuracy rate was approximately 80 percent. Results supported the nonverbal pathway to altruist detection; however a substantial alternative explanation was available. That is, participants could have promised to cooperate and/or offered verbal information regarding their past benevolence (e.g. volunteer work etc.).

A better way to control for promises to cooperate and perhaps analyze the nonverbal expressions associated with altruism level is the zero-acquaintance video presentation paradigm. As discussed in Chapter 1, social psychological research has used the "zero-acquaintance video presentation paradigm" to investigate whether or not naïve perceivers can detect 'tell-tale' cues to personality or lying from video segments (Ekman, 1985; Frank, 1988).

Recall that many studies utilizing thezero-acquaintance video presentation paradigm (for review see DePaulo, 1994) demonstrate that detection accuracy of lying and personality are no better than chance (Ekman, O'Sullivan & Frank, 1999; Lippa & Dietz, 2000). Interestingly the accurate assessment of individual differences in personality is trait-specific. In particular, "sociability" and "extraversion" (these personality traits are positive correlates of altruism) are the only Big Five personality traits accurately decoded from nonverbal cues (Albright, Kenny & Malloy, 1988; Borkenau & Liebler, 1993; Funder & Colvin, 1988; Funder & Dobruth, 1987; Kenny, Horner, Kashy & Chu, 1992; Levesque & Kenny, 1993; Lippa & Dietz, 2000; Watson, 1989). Therefore any evidence for altruist detection using the zero-acquaintance video presentation paradigm could indicate that natural selection specifically shaped this capacity since most personality traits cannot be detected.

Brown (1996; 1998) employed the zero-acquaintance video presentation paradigm to test the nonverbal pathway to altruist detection. Brown's (1996; 1998) experiments were designed in an attempt to control for verbal information regarding altruism level without removing paralinguistic information (e.g. pitch and timbre of the voice). In Brown (1996; 1998) the self-report altruism scale (Rushton, Chrisjohn, & Frekken, 1981; Johnson et al., 1989; Chau et al., 1990) was used to select four altruists and four non-altruists. Altruists and non-altruists were filmed telling the "Little Red Riding Hood" story. The *Little Red Riding Hood* story was used in an attempt to control for verbal content. In addition, variables such as physical attractiveness, role-playing ability and expressiveness were measured.

Perceivers viewed 4 altruist / non-altruist pairs and judged which individual in the pair was more helpful. It was predicted that perceivers would differentiate altruists from non-altruists based on cues provided in short video-segments. Perceivers of these video-clips could detect altruists at significantly higher than chance accuracy.

In a follow up study Brown (1998) selected 5 self-reported altruists and 5 self-reported non-altruists and filmed them under two different conditions believed to amplify signals of altruism. Specifically altruists and non-altruists were videotaped while working for their partner's benefit and working for their own benefit. One purpose of Brown (1998) was to provide a more social context for observing altruists and non-altruists. The new context was cooperative game playing. The cooperative game context allows for a manipulation that can isolate helpfulness from other components of the targets' nonverbal behavior. In Brown (1998) altruist / non-altruist pairs played a cooperative game and points were awarded to one of the players based on the success of the pair. One member of the pair provided instructions to the other member of the pair. The individual to whom the points were awarded varied across games. Targets were videotaped under these conditions when playing the role of the instructor and the video-clips were played to perceivers in the same manner as Brown (1996). Perceivers were asked to rate helpfulness, concern, attentiveness, and expressiveness. It was predicted that altruists and non-altruists would still be differentiable to perceivers with respect to helpfulness. However, the manipulation of point assignment would reveal differences in how targets were rated by perceivers. In

particular, it was predicted that perceivers (blind with respect to altruism level and payoff conditions) would distinguish between altruists and non-altruists' non-verbal behaviour depending upon whether or not they were helping others receive a payoff. It was hypothesized that perceivers would detect altruists' signals of other-interest more easily when altruists were helping others than when non-altruists were helping others. Likewise it was predicted that perceivers would detect altruists' lack of selfishness relative to non-altruists when the payoffs were for self. It was expected that these differences in self- and other-interest should be revealed in perceivers' ratings of concern, attentiveness and expressiveness. As predicted, altruists were rated as more concerned when working for their partner's benefit as compared to non-altruists who were working for their partner's benefit. In addition non-altruists were rated as more concerned when working for their own benefit as compared to altruists working for self. Effect sizes were medium to large.

One criticism of these studies is that the perceivers assessed individuals speaking the same language. Therefore it cannot be ruled out that subtle semantic information did not partially account for perceivers' accuracy in assessments. In Frank's nonverbal pathway to altruist detection semantic information is presumably not a factor. Regardless there is no solid evidence that nonverbal altruist-detection is possible in the absence of semantic information. Granted the audio portion of the videos could be removed. However, Frank (1988) does hypothesize that emotional cues to prosocial commitment are signaled paralinguistically. To investigate whether or not altruist detection can

occur without semantic content, an inter-cultural zero-acquaintance video presentation paradigm was used. Specifically students from the University of Groningen were video-taped speaking Dutch and presented to North American students (who do not understand Dutch). Dutch targets' altruism should be detectable by English-only perceivers even in the absence of semantic cues.

Methods - Study Three

Targets and Procedure

Forty-nine individuals (25 males and 24 females) speaking Dutch from the University of Groningen were filmed during a self-presentation after giving written informed consent. The self-presentation entailed participants stating their name, their likes and their dislikes while being video-taped. Tapes were made available courtesy of Dr. Detlef Fetchenhauer (Appendix 4). Experimenters (i.e. Brown and Fetchenhauer) were blind to target altruism level. Dutch targets were pre-assessed for actual and self-report altruism at the University of Groningen. Specifically resource allocation games assessed "actual altruism levels" and "self-report altruism" was assessed using the same reliable and valid scale used by Brown (1996; 1998). Brown sent the self-report altruism scale to Fetchenhauer at the University of Groningen.

Actual Target Altruism vs. Self-reported Altruism

In the Dutch component of this study targets were filmed at the University of Groningen. Actual cooperation was assessed using dictator games. Dictator

games are resource allocation tasks where participants are given money and may divide the resource between themselves and a stranger (Eckel and Grossman, 1996). The dictator game has been used in multiple studies in experimental economics and is believed to be a measure of altruism (Bolton et al., 1998). Participants' altruism was also pre-assessed using the self-report altruism scale (Appendix 5) and helping orientation questionnaire (Appendix 6).

Validity of the Self-reported Altruism Scale

The self-report altruism scale (used by Brown, 1996; 1998 to distinguish self-reported altruists and non-altruists) contains 56 items measuring how often an individual has given up time, effort, goods, status, and safety to help others (Johnson et al., 1989). Since the Altruism Scale asks participants to recall helpful behaviours performed in the past, it is less susceptible to deceptive responding than a scale asking one to report whether or not he/she would help in a hypothetical situation (Romer, Gruder & Lizzadro, 1986). This scale asks participants to indicate how often they have performed each act described in 56 statements from 1 (never) to 5 (very often). This measure showed high internal consistency with coefficient alpha ranging from 0.89 to 0.94 across seven different cultures (English and non-English speaking). Johnson et al. (1989) found that the scale had a test-retest reliability of 0.94 after a two-week period.

It is reasonable to suspect that even self-reported instances of helping behaviour in the past could be correlated with trying to deceive experimenters. This was not the case. In the current sample the Altruism Scale was not

significantly correlated with the Marlowe-Crowne Social Desirability Scale (Crowne & Marlowe, 1960; a measure of deceptive responding): $\underline{r}$ (141) = 0.10. The Altruism Scale (Johnson et al., 1989) includes 20 items from the "Self-Report Altruism Scale" (Rushton, Chrisjohn, & Frekken, 1981) that were shown to be internally consistent across 5 samples (Cronbach's alphas ranged from 0.78 to 0.87) and showed good discriminant validity from 20 personality tests. Discriminant and convergent validity was demonstrated for the full 56-item altruism scale (Chau et al., 1990). More specifically, self-reported altruism is positively associated with intrinsic religiosity (genuine religious involvement for its own sake), but negatively correlated with extrinsic religiosity (e.g. religious involvement simply to meet people at church). Importantly, peer ratings of altruism were significantly positively correlated with individual's self-reports. Rushton et al. (1981) found that whether or not an individual signed the organ donation card on driver's licence was significantly positively correlated with the self-reports on the Altruism Scale.

Validity Check of the Self-report Altruism Scale

Concerned about whether the entire 56-item self-report altruism scale is a valid measure of actual altruistic behaviour, Brown and Moore (2002) selected altruists and non-altruists who then participated in a one-shot Prisoner's Dilemma-like scenario called the "dictator game" (Eckel & Grossman, 1996). The prediction is that altruists (individuals who scored in the top 10^{th} percentile) should give more lottery tickets away to strangers than non-altruists (individuals

who scored in the bottom 10th percentile). Results conformed to the prediction: Altruists gave 24.50 tickets on average (SD = 7.79) while non-altruists gave 17.33 tickets (SD = 7.18). This significant mean difference [t (22) = 2.34, p < .05] suggests that the Altruism Scale is a valid measure for altruistic tendencies in humans.

Perceivers and Procedure

Fifty English-speaking Dalhousie University students (20 males and 30 females) viewed and assessed the video stimuli for credit toward class grade. All participants gave written consent to participate and received a debriefing form after participation (Appendix 7). Perceivers (blind to conditions) were randomly assigned to view tapes of females or males.

Dalhousie audiovisual staff edited the Dutch tapes so that same sex targets were presented together. This was performed to reduce the likelihood that perceivers would make assumptions that females are more altruistic than males. Canadian participants viewed video-clips and were asked to predict how much money they believed each target would give to a stranger anonymously (see Appendix 8). It was predicted that actual and self-reported altruism level of targets would positively correlate with perceivers' predictions.

Statistical Analyses

The variables were self-reported altruism, actual altruism in anonymous dictator games, and perceivers' ratings of targets altruism level (i.e. how much

money they (i.e. the perceivers) predicted targets to give under anonymous conditions).

To analyze whether perceivers can detect altruism in strangers, Spearman correlations were performed. It was predicted that perceivers' ratings of altruism would positively correlate with targets' self-reported and actual altruism levels.

Results – Study Three

Prior to analysis, data were examined to evaluate fit between the distribution of the variables and the assumptions of a correlation analysis (see Descriptive statistics in Table 3). Residuals were examined and skewness and kurtosis were tested. Results were within the normal limits. There was no significant difference between male and female responses to female or male targets. In a factorial MANOVA sex of target and/or sex of perceiver did not significantly impact perceivers' assessments of targets [all F's $(2, 47) < 2.85$, $p > .10$]. Therefore gender of target or perceiver was not included in the analyses.

Table 3. Descriptive statistics for Study Three target and perceiver variables.

Measure	Mean	Standard Deviation
Target self-reported Altruism	72.44	27.83
Target actual Altruism	17.06	8.31
Perceivers' assessments	45.18	26.89

Spearman correlation analyses were used to test the hypothesis that associations between target altruism and perceivers' assessment of actual altruism would be significant and positive (see Table 4). Self-report altruism

Table 4 Intercorrelations between measures (*$p < .01$).

	Actual Altruism	Perceiver' Assessments
Targets' self-reported altruism	.56*	.31*
Targets' actual altruism		.32*

scale score positively correlated with perceivers' assessments ($r = .31$, $p < .01$). Specifically self-reported target altruism correlated with perceivers' perceptions of how much money the target would give in an anonymous game to a stranger. Thus increases in self-reported target altruism corresponded to increases in perceivers' assessments of generosity (money given in anonymous games).

Targets' altruistic decisions in a dictator game correlated with perceiver's assessments of actual altruism ($r = .32$, $p < .01$). Targets that made more altruistic choices in a dictator game were assessed as more likely give anonymously to strangers. Specifically increases in target's actual generosity corresponded to increases in perceived generosity.

Discussion – Study Three

Behavioural and self-reported altruism of Dutch targets was detectable by Canadian perceivers that were blind to level of self-reported and actual altruism. Specifically both self-reported altruistic intentions and altruistic allocations in dictator games were detectable from nonverbal cues provided in a 1-minute self-presentation.

This is encouraging evidence that altruism level is signaled nonverbally in humans and the cues are detectable by perceivers. These findings have ramifications for Frank's (1988) nonverbal pathway to detecting commitment. Specifically, if altruists signal prosocial commitment they may be preferred partners in social exchanges and division of labour partnerships requiring trust. Positive assortation among cooperators is a mathematically realistic explanation for the evolution of altruism since donors are shielded from free-rider exploitation and group level benefits (even if epiphenomenal) can facilitate the selection of 'altruistic' genes (Frank, 1988; Wilson & Dugatkin, 1997; Pepper & Smuts, 2002).

The current findings are good evidence that altruist-detection capacities (via the nonverbal pathway) exist and are not solely due to language-specific semantic information. However, the putative cues signaling underlying altruism are not known. Furthermore it is premature to suggest that universal altruism signaling has been demonstrated, as Dutch and Canadian cultures are quite similar. However this study is the first to provide evidence consistent with Frank's (1988) altruist-detection hypothesis between cultures.

Two independent studies (Brown, 1996; 1998) have shown that perceptual cues provided in videos are triggering altruist detection in humans. Considering the variation between tasks the altruist detection effect appears not to be "act" related. Recall Brown (1996) had targets tell the Red Riding Hood story to a camera. Telling a story is different task than the cooperative game used by Brown (1998). Granted Brown (1998) showed a substantially increased effect size. Surely the signals to underlying altruism evolved in cooperative contexts. In Study Three a self-presentation task was used and an altruist detection effect was found. One similarity among all three studies is that targets were being filmed by an experimenter (indeed this is an unavoidable social interaction whereby the target is being observed by the film-maker). Further research should explore the limits to altruist detection in non-social contexts.

If altruists are detectable, what are the putative cues that perceivers are basing their judgments upon? An ethological analysis of nonverbal expressions could help elucidate what the putative cues may be.

CHAPTER V

Study Four A/B – Nonverbal Cues to Altruism

Regardless of the frequency of altruists in a population, index cues are hypothesized to exist – even if perceivers are not willing to pay decoding costs (Frank, 1988). If signals of altruism are under involuntary control then they may qualify as reliable indices to future behaviour. The literature on nonverbal ethology (e.g. Gazzaniga & Smylie, 1990) implicates two types of facial expression (i.e. the spontaneous and the posed). For example spontaneous smiles have more orbicularis oculi activity (i.e. muscles around eyes that produce 'crow's feet'), appear symmetrical and exhibit short duration (Ekman & Friesen, 1982). Previous researchers have coded facial expression using a variety of instruments (e.g. Grant, 1969; Rime et al., 1978; Shrout and Fiske, 1981; Ekman & Friesen, 1982; Noller & Gallois, 1986; Simpson, Gangestad & Biek, 1993). Items were selected with special reference to facial expressions under involuntary control and linked to affiliative behaviour. Specifically, orbicularis oculi activity, the concern furrow, short and symmetrical smiles occur spontaneously in most people. However, eyebrow raises, head nods, and open smiles are voluntarily controlled. It is predicted that altruists as compared to non-altruists should exhibit more involuntarily controlled nonverbal behaviours. Affilative facial expressions (e.g. smiling in general) may not covary with altruism if Frank's (1988) involuntary signaling hypothesis is correct.

In two independent studies nonverbal analyses of facial expressions were performed on Canadian and Dutch students. It was predicted that nonverbal

expressions associated with spontaneous emotion would correlate with altruism level in both cultures.

Methods - Study Four A

Altruist and Non-altruist Target Selection

Canadian Introductory Psychology students (n = 103; 73 females and 30 males) with a mean age of 20.18 (SD = 6.11) participated in the study to select altruists and non-altruists in exchange for 1% credit toward grade. All participants signed consent forms and received a debriefing form after participation (Appendix 9). Participants completed the Altruism Scale (Appendix 5) designed by Johnson et al. (1989). Participants' scores were transformed into percentiles. The 90th percentile and above (scores greater than 106) were categorized as altruists while the 10th percentile and below were categorized as non-altruists (scores less than 46). Ten altruists (5 females, 5 males) and 10 non-altruists (5 females, 5 males) were contacted (by an experimenter blind to altruism level) and participated in the study for additional credit. The 20 individuals were each brought into the lab separately. Each target was asked to make a 1-minute self-presentation (i.e. stating name, general likes and dislikes). Close-up head-shots of targets were video-taped.

Coding Nonverbal Expressions

Two observers blind with respect to the purpose of the study independently coded video targets. Observers coded nonverbal expressions with the audio

portion of the tape turned off. Facial expressions were coded using items gathered from several non-verbal behaviour studies based on applicability to involuntary signalling hypothesis and conceptual links to affiliative behaviour (Grant, 1969; Rime et al., 1978; Shrout and Fiske, 1981; Ekman & Friesen, 1982; Noller & Gallois, 1986; Simpson, Gangestad & Biek, 1993). Items, definitions and inter-observer reliabilities can be seen in Table 5. The location of the major muscles involved in the production of these facial expressions is available in Figure 3. This figure was provided to the observers so that they would make more accurate facial expression analyses.

Degrees of orbicularis oculi muscle activity and smile symmetry were assessed on 6-point likert scales (see Table 5). For example 1 represented "extremely asymmetrical" and 6 would represent "extremely symmetrical". Smile asymmetry was defined as the left-side of the mouth being lower than the right-side. Smiles may also be asymmetrically genuine in that the left-side is higher than the right-side. However this is not correlated with lack of spontaneity in the

Table 5. Nonverbal items, definitions and inter-observer reliabilities (all p's < 0.001).

Item	Definition	Reliability
Orbicularis oculi * - Originates at the medial wall of the orbit and follows a circular path around the eye. The muscle is used during the spontaneous smile (Ekman & Friesen,	6-point likert scale rating of *orbicularis oculi* activity (Ekman & Friesen, 1982). Cheeks raised and eyes narrowed. Raters were instructed to look for "crow's feet" around the eyes when assessing	0.83

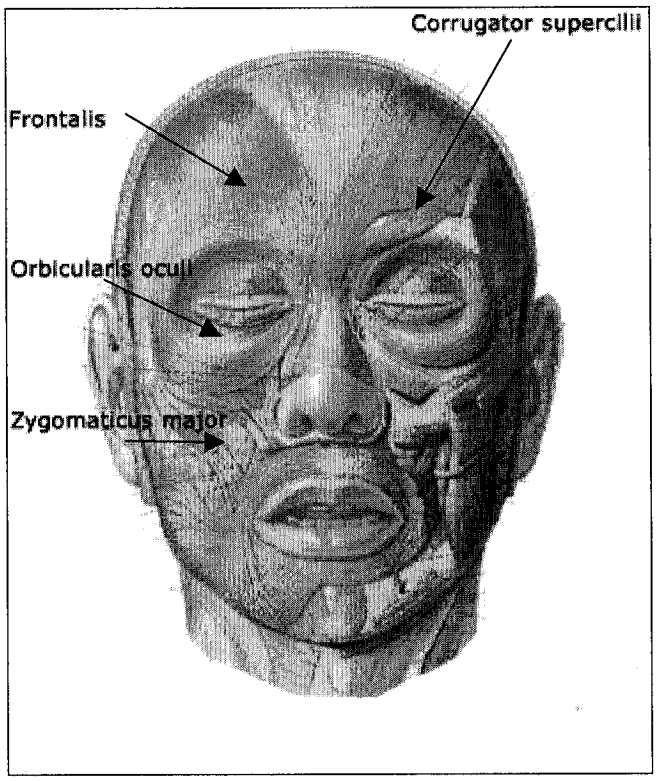
1982).	this muscle movement. Specifically, cheeks raised and eyes narrowed were the movements scrutinized.	
Eyebrow raises	Frequency of occurrence: An eyebrow raise is when the occipitofrontalis* elevates the eyebrows to form prominent, horizontal furrows in the forehead. Eyebrow flashes were also included under 'raises' despite the reduction in furrows on the forehead.	0.84
Concern furrows *	Frequency of occurrence: Each time there was movement of the corrugator supercilii*.	0.89
Head nods	Frequency of occurrence: A head nod was any movement up and down.	0.85
Open smiles	Frequency of occurrence: Open smiles are smiles that show the target's teeth. More specifically, open smiles defined by Zygomaticus major activity (Lip corners pulled up and laterally)	0.86
Time per smile *	Duration in seconds. Each smile was timed from beginning until the peak aperture began to decline. Specifically observers would begin timing as soon as the	0.92

	corners of the mouth began to rise and stop timing as soon as the corners of the mouth begin descending toward a resting state.	
Smile Symmetry *	6-point likert scale rating with 1 representing smile asymmetrical and 6 representing smile symmetrical. Reverse asymmetries were not coded (i.e. when the left side is higher than the right side of face). Left-sided oral asymmetries were coded. That is a smile was considered asymmetrical only when the right-corner of mouth was higher than the left-side of mouth.	0.83

* "I.C." represents nonverbal behaviour under involuntary control of the sender.

facial expression (Wylie & Goodale, 1988). The remaining nonverbal behaviours were in frequencies or duration (in seconds). As seen in Table 5 inter-observer agreement (calculated using Spearman correlations) for all items was greater than the .80 criteria for good reliability recommended by Martin and Bateson (1993). As indicated in Table 5 four of the coded nonverbal behaviours are involuntarily controlled (Ekman & Freisen, 1981; Frank, 1988; Gazzaniga et al.,1998).

Figure 3. Location of muscles involved in facial expression analysis. This diagram was given to observers before coding facial expressions so that they would know what areas to focus upon when decoding Orbicularis oculi activity, concern furrows etc.



Results – Study Four A

To test whether altruists and non-altruists express different nonverbal behaviours during a self-presentation, point biserial correlation coefficients were calculated. Altruism level (altruist vs. non-altruist) was entered as a dichotomous independent variable. Results are consistent with the altruism-signalling hypothesis. Specifically during a self-presentation altruists produced significantly greater *orbicularis oculi* activity, more concern furrows, more head nods, shorter

smiles and more symmetrical smiles than non-altruists (all *r*'s (20) > 0.26, all *p*'s < .05 -see Table 6).

Table 6 Correlations between target altruism level and target nonverbal behaviour (* Significant at < .05)

Nonverbal behaviour of target	Targets' altruism
Orbicularis oculi (I.C.)	0.30*
Eyebrow raises	0.12
Concern furrows (I.C.)	0.26*
Head nods	0.51*
Open smiles	0.14
Time per smile (I.C.)	-0.44*
Smile Symmetry (I.C.)	0.72*

Discussion – Study Four A

As expected there were significant nonverbal differences between altruists and non-altruists. Four nonverbal differences are of particular theoretical interest; *orbicularis oculi* activity, concern furrows, shorter smiles, and smile symmetry. These four nonverbal behaviours are particularly difficult to fake since they are linked to spontaneous emotional expression (Ekman & Freisen, 1982; Gazzaniga & Smylie, 1990). Perhaps altruists who are perceived as more concerned for others are expressing these facial expressions during social encounters.

Altruists produced a greater degree of smile symmetry than non-altruists. The effect size was large. Specifically 52 percent of variance in smile symmetry

was accounted for by altruism level. This result is consistent with the idea that altruists are genuinely interested in helping others and that one especially important way this interest is signaled is via smile symmetry. Research in neuroscience has shown that posed smiles (smiles without an underlying emotional basis) are less intense on the left-side (Gazzaniga & Smylie, 1990). If non-altruists are less emotionally concerned for helping non-kin, facial expressions (e.g. smile asymmetries) could reveal this aspect their intentions. Right-sided asymmetrical smiles when cooperating may be a reliable indicator of underlying intentions due to physiological constraints in neural architecture determining emotional expression (Wylie & Goodale, 1988; Gazzaniga & Smylie, 1990; Brown & Moore, 2002).

A weakness to Study Four A is that it is confined to one culture (i.e. Canadian). Based on Frank's (1988) nonverbal pathway to altruist detection it was predicted that nonverbal expressions would correlate with altruism level in the Dutch sample of altruist and non-altruist targets from Study Three. In particular it was expected that spontaneous nonverbal behaviours should vary with altruism level in the Dutch sample of targets. Increases in altruism level should correspond to the activity of facial expressions that are hard to fake.

Methods - Study Four B

Target Selection

Students from the University of Groningen participated in a study on first impressions (see Study Three). All 49 targets signed consent forms (Appendix

4). Targets completed the Altruism Scale (Appendix 5) designed by Johnson et al. (1989) and the helping orientation questionnaire (Appendix 6). Each target was asked to make a 1-minute self-presentation (i.e. stating name, likes and dislikes). This self-presentation methodology was identical to the one used Study Four A. Close-up head-shots of targets were video-taped.

Coding Nonverbal Expressions

Two Canadian observers blind with respect to the purpose of the study independently coded video targets. Observers coded nonverbal expressions with the audio portion of the tape turned off. Facial expressions were coded using items gathered from several non-verbal behaviour studies based on applicability to involuntary signalling hypothesis and conceptual links to affiliative behaviour (Grant, 1969; Rime et al., 1978; Shrout and Fiske, 1981; Ekman & Friesen, 1982; Noller & Gallois, 1986; Simpson, Gangestad & Biek, 1993). Items, definitions and inter-observer reliabilities can be seen in Table 7.

Degree of *orbicularis oculi* muscle activity and smile symmetry were assessed using 80 mm ruler scales. For example the observer would draw a vertical line anywhere along the ruler scale representing "extremely asymmetrical" to "extremely symmetrical". Smile asymmetry was defined as the left-side of the mouth being lower than the right-side. The remaining nonverbal behaviours were in frequencies or duration (in seconds). As seen in Table 7 inter-observer agreement for all items was greater than the .80 criteria for good

reliability recommended by Martin and Bateson (1993). Inter-observer reliability was calculated using a Spearman correlation.

Table 7 Nonverbal items, definitions and inter-observer reliabilities (all p's < 0.001). "I.C." represents involuntarily controlled nonverbal behaviour.

Item	Definition	Inter-observer reliability
Orbicularis oculi (I.C.)	Ruler-scale rating of *orbicularis oculi* activity	0.81
Eyebrow raises	Frequency of occurrence	0.89
Concern furrows (I.C.)	Frequency of occurrence	0.82
Head nods	Frequency of occurrence	0.84
Open smiles	Frequency of occurrence	0.81
Time per smile (I.C.)	Duration in seconds	0.98
Smile Symmetry (I.C.)	Ruler-scale rating	0.80

Results – Study Four B

To test whether altruism correlates with different nonverbal behaviours during a self-presentation, Spearman correlation coefficients were calculated (see Table 8). Altruism level was entered as a continuous variable. Results are consistent with the altruism-signalling hypothesis. Specifically increases in self-

Table 8 Correlations between target altruism level (i.e. self-reported and actual) and target nonverbal behaviour (* Significant at < .05)

Nonverbal behaviour	Self-reported altruism	Actual altruism
Orbicularis oculi (I.C.)	0.53*	0.22*
Eyebrow flashes/raises	0.12	0.10
Concern furrows	0.35*	0.40*
Head nods	0.15	0.18
Open smiles	-0.24*	-0.20*
Time per smile	-0.30*	-0.30*
Smile Symmetry	0.64*	0.42*

reported and actual altruism for Dutch students corresponded to significantly greater *orbicularis oculi* activity, more concern furrows, shorter smiles, fewer open smiles and more symmetrical smiles during a self-presentation (all r's (48) > 0.20, all p's < .05 – see Table 8).

Discussion – Study Four B

As hypothesized there were correlations between nonverbal behaviours and altruism level (self-reported and actual altruism) in the Dutch sample. Four nonverbal differences are of particular theoretical interest: orbicularis oculi activity, concern furrows, shorter and symmetrical smiles. These four behaviours are difficult to fake since they are linked to spontaneous emotional expression (Ekman & Freisen, 1982; Gazzaniga et al., 1998) and possibly determined by

physiologically constrained neural machinery (e.g. smile symmetries – Ekman et al., 1981; Gazzaniga & Smylie, 1990; Gazzaniga et al., 1998).

Increases in self-reported and actual altruism correlated with increases in smile symmetry in the Dutch sample. This relationship replicates the result found in Study Four A with Canadian targets. In the Dutch study target altruism was a continuous variable in contrast to the Canadian study where target altruism was a discontinuous variable (i.e., targets were either High or Low in altruism level). The effect sizes were mid to large-sized. Forty-one percent and 18 percent of variance in smile symmetry was accounted for by self-reported and actual altruism level respectively. Results are consistent with Frank's (1988) nonverbal pathway to altruist detection. Furthermore, since smile symmetry was a factor strongly associated with altruism level in Canadian and Dutch samples, this feature of facial expression may be a particularly salient cue to perceivers' assessments of altruism in others.

Canadian and Dutch altruists produce similar facial expressions that appear to be under involuntary control as predicted. Specifically, increases in altruism level appears to be associated with increased *Orbicularis oculi* movement, concern furrows, short and symmetrical smiles. However, differences were found between Canadian and Dutch altruists. Specifically, Canadian (but not Dutch altruists) produced more head nods than non-altruists. Indeed there was no significant relationship between head nods and altruism level in the Dutch sample. Another cultural difference is the number of open smiles. It appears that non-altruists produce significantly more open smiles than altruists. This

relationship was not found in the Canadian sample. However, this could be due to a TYPE II error in the Canadian study as the sample size was smaller relative to the Dutch study. Future research needs to determine if these differences are culturally based.

An open question is whether altruist detection influences resource allocations. It may be that once an altruist is detected perceivers exploit them. Frank's (1988) model of the evolution of cooperation predicts that individuals with altruistic reputations or a prosocial demeanor should receive more resources from non-kin. The following study utilizes an experimental economics approach to test whether facial displays (e.g. smile symmetry) and an altruistic reputation influence resource accrual.

CHAPTER VI

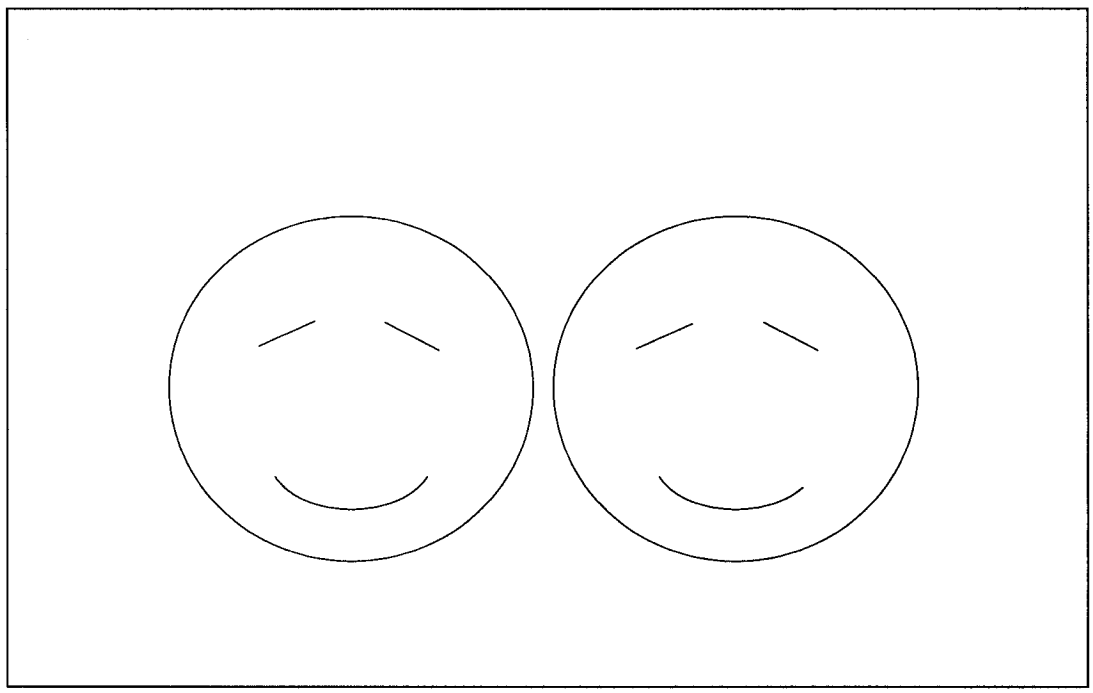
Study Five – Manipulating Smile Asymmetry and Reputation

There have been few studies on what aspects of facial expression may cue others to an individual's level of altruism. Based on theoretical work discussed in Chapter I it was expected that smile asymmetries and reputation would be reliable cues to altruistic intent. Chapters II and III reported studies consistent with the hypothesis that humans assess altruistic reputations. Specifically individuals who help others but do not demand a tangible benefit are trusted (e.g. for a good friend and for a baby-sitter). Chapters IV and V report studies indicating that altruism can be detected from nonverbal behaviour even without semantic cues. Furthermore it appears that smile symmetry positively correlates with altruism level in Canadian and Dutch samples.

To explore the idea that humans assess smile asymmetry and reputation in cooperative contexts, these properties were varied in an experiment in which participants played resource allocation games. Cartoon icons exhibiting different types of smiles (asymmetrical smile vs. symmetrical smile) were presented to participants along with information regarding the intentions of the icons (e.g. selfish vs. altruistic). Cartoon icons representing particular stylized emotions have been used in numerous psychology experiments (Hansen & Hansen, 1988; Hoptman & Levy, 1988; Yeo et al., 1997). Icons are an effective way to control for extraneous features of the human face that are unrelated to the emotion under investigation. In order to stylistically represent the emotion of prosocial concern two aspects of the cartoon face (i.e. eyebrow concern furrows and

smiles) were selected due the evidence suggesting that these expressions are cross-cultural signals of affiliation (Grant, 1969; Tidd & Lockard, 1978; Eibl-Eibesfeldt, 1989). The symmetrically smiling icon was used to represent a genuine, involuntary smile. An asymmetrically smiling icon was used to represent a posed, voluntary smile (see Figure 4 depicting icons with asymmetrical and symmetrical smiles).

Figure 4. Benevolent icons with a symmetrical and asymmetrical smile.



The dictator game was selected as a measure of participants' resource allocations because it is widely used in experimental economics as a test of cooperative tendencies in humans (Eckel & Grossman, 1996; Bolton, Katok, & Zwick, 1998; Andreoni & Vesterlund, 2001). The dictator game is an unilateral

resource allocation game that requires participants to divide a valued resource between themselves and an opponent (Eckel & Grossman, 1996). In dictator games the experimenter asks participants to divide up a resource (e.g. money) between themselves and another individual. It was predicted that participants would deliver fewer resources in dictator games to selfishly motivated icons (relative to altruistically motivated icons) and icons with asymmetrical smiles (relative to icons with symmetrical smiles).

Methods – Study Five

Participants

Thirty-eight (female n = 22; male n = 16) Introductory Psychology students (mean age = 20.08; SD = 4.10) participated for 1% credit toward class grade. Participants signed a consent form and received a debriefing form after participation (Appendix 10).

Procedure

After signing consent forms, participants played dictator games for a valued resource against cartoon icons. The valued resources in this experiment were lottery tickets for a cash draw (total value of prizes = $120). Specifically participants divided 20 tickets between themselves and a cartoon icon. In addition, participants were asked to predict how many tickets they believed the icon would give them. This was the order of decisions made by participants. Each participant viewed two icons; one described as a self-interested cooperator

and one described as an altruistic cooperator. Finally, half of the sample (n = 19) were presented with a symmetrically smiling icons and the other half (n = 19) viewed an asymmetrically smiling icons. Participants were naive with respect to this between-participants manipulation.

Manipulation of Smile Asymmetry

Smile symmetry was a between-participants independent variable. Smile symmetry was manipulated only on the left-side of the face in accordance with the neuropsychological literature that suggests this is one difference between posed and spontaneous smiles (Meihlke, 1973; Myers, 1976; Ekman, Hage & Friesen, 1981; Wylie & Goodale, 1988; Gazanniga & Smylie, 1990; Smith, Smith, & Ellgring, 1996; Gazzaniga, Ivry, & Mangun, 1998). Figure 2 depicts an example of the cartoon icons used in Study Five (symmetrical smile vs. asymmetrical smile). The asymmetrical smile represents the false smile, while the symmetrical smile is designed to represent a genuine smile.

Manipulation of reputation

Reputation was a within-participants independent variable. Each icon had either a reputation for altruism or self-interest. The descriptions were taken from Study 2's altruist-detection Wason task (see Appendix 3). Their altruist-detection tasks were based on the reputation pathway to altruist detection. Specifically the idea that natural selection should have designed perceiver psychological mechanisms to scrutinize whether motives of generosity accompany the altruistic

act, since such forms of altruism would be more likely to occur in the future. Therefore the altruistic motive for the helping condition stated, "Gave blood and refused cash reward" while the self-interested motives for helping condition stated, "Gave blood and demanded cash reward."

Results - Study Five

As hypothesized, the number of tickets players thought they would receive was significantly and positively correlated with the number of tickets they gave to the icons: [R = .67, F (1, 36) = 29.63, p = .001]. This is what would be expected if the decision rules mediating human cooperation were based upon reciprocity (Trivers, 1971).

Effects of Smile Asymmetry and Reputation

The number of tickets perceivers predicted icons would allocate was analyzed using an analysis of variance (ANOVA) with smile symmetry (asymmetrical smile vs. symmetrical smile) as a between-participants factor and reputation (altruistic vs. self-interested) as a within-participants factor. Players predicted that symmetrically smiling icons would give more tickets (M = 10.80 / SD = 3.60) than asymmetrically smiling icons (M = 8.00 / SD = 3.60): F (1,36) = 5.05, $p < .05$. In addition players predicted that icons described as altruistic in the past would give more tickets (M = 13.60 / SD = 6.40) than icons described only as self-interested helpers (M = 5.60 / SD = 4.40): F (1, 36) = 19.30, $p < .001$. The interaction was not significant.

Number of tickets allocated was analyzed using an analysis of variance (ANOVA) with smile symmetry (asymmetrical smile vs. symmetrical smile) as a between-participants factor and reputation (altruistic vs. self-interested) as a within-participants factor. Symmetrically smiling icons received a mean of 9.60 tickets (*SD* = 4.40) while asymmetrically smiling icons received a mean of 6.80 tickets (*SD* = 2.48). This mean difference was significant: F (1, 36) = 5.05, $p < .05$. Icons with altruistic reputations received more tickets (*M* = 10.00 / *SD* = 5.20) compared to icons with reputations for pseudo-altruism (*M* = 6.00 / *SD* = 4.00): F (1, 34) = 39.60, $p < .001$. The interaction was not significant.

Discussion - Study Five

Consistent with predictions, smile symmetry and a reputation for altruistically motivated helping influenced game players' assessments of icons and resource allocations to icons. Icons representing symmetrical smiles received more resources than icons representing asymmetrical smiles. An altruistic reputation influenced participants' resource allocations. Icons with altruistic motives received more resources than icons described as self-interested helpers. It appears that smile asymmetry and reputation are scrutinized when deciding how to allocate resources. Results were consistent with Frank's (1988) Commitment Theory. In addition, findings were consistent with reciprocal altruism theory (Trivers, 1971). That is, the more lottery tickets participants thought they would receive from an icon the more lottery tickets they gave.

The Importance of Reputation

Icons with information suggesting they were benevolent helpers in the past received more resources than icons described as being self-interested helpers. This result is consistent with the idea that a reputation for other-interested helping may have been beneficial in evolutionary environments. An altruistic reputation accounted for a substantial proportion of the variance in resource allocations (35 percent of the variance). Indeed this is more than smile asymmetry's influence upon resource allocations (14 percent of the variance). However, it should be pointed out that the smile asymmetry manipulation was implemented using a between-participants rather than within-participants design. Furthermore the asymmetry manipulation was much more subtle (slight decrease in left-side of icon's smile) than the changing the motives for helping behaviour (i.e. the reputation pathway). Removing variance due to differences between participants from the error variance greatly increases the power of within-participants significance tests. Therefore, within-participants designs are almost always more powerful than between-subject designs. Also, there may have been demand characteristics in the within-participants manipulation of reputation increasing the putative effect size. Specifically, all participants received icons with a description of an altruistic and selfish cooperator. Thus participants may have 'realized' what the experimenter was hypothesizing. Nevertheless, it appears that an altruistic reputation influences participants' resource allocations. If this result holds in more naturalistic conditions then one may assume that it would pay for altruists to cultivate a prosocial image.

Evolutionarily it is interesting to ask how difficult it is for a con artist to cultivate a reputation for honesty. Con artists' evolutionary success at manipulating others may depend upon gossip. That is, the con must keep ahead of social transmission (Dugatkin, 1992). The critical factor appears to be the speed with which a con can infiltrate a group before his or her reputation. Research is needed to measure the speed of between-group information exchange relative to the speed of which a con artist can garner the interests of strangers between groups. It would be predicted that the relative difference should correlate with the frequency of con artists in a population.

In Dugatkin's (1992) model of the evolution of the con artist, deceivers prosper when they move from community to community faster than cultural transmission (i.e. gossip). Signaling false trustworthiness nonverbally can benefit the con temporarily but eventually gossip may travel faster than they are able to migrate. Perhaps the best strategy for Machiavellian con artists is to move from patch to patch quickly before cultural transmission can reveal their identity Cultural transmission of information regarding trust could travel particularly fast considering that humans appear to pay special attention to the motives underlying altruism (Brown & Moore, 2000). According to Alexander (1987) and Nowak and Sigmund (1998) humans assess the altruistic behaviour performed for the benefit of a third party. If the third party observer returns the benefits, cooperation could have evolved via indirect return payment. This is known as indirect reciprocity (Alexander, 1987). If perceivers assess nonverbal signals of prosocial emotions and rely on gossip between- and within-groups, exploiters

could be at a disadvantage. Con artists most likely have evolved counter-strategies to avoid detection. Costs of scrutiny and frequency-dependent selection may be one route for the evolutionary maintenance of deception (Frank, 1988). Perceivers may not bother scrutinizing nonverbal behaviours (which takes effort) when the frequency of altruists is high in population. Under these conditions con artists may prosper.

Smiles as Index Cues

Previous research suggests that smiling individuals are trusted and receive more resources compared to non-smiling individuals (Tidd & Lockard, 1978; Otto et al., 1994; LaFrance & Hecht, 1995; Scharlemann et al., 2001). Cross-cultural ethological research by Eibl-Eibesfeldt (1989) suggests that smiles are affiliative signals. Simply trusting smiles regardless of type (i.e. genuine versus false) could have been detrimental in ancestral environments. Therefore aspects of smiles indicating truthfulness may be scrutinized by others.

Since resource allocations by game players were influenced by smile asymmetry it may be that the smile is a reliable index cue to altruistic intentions. This result should be viewed as preliminary. For instance the smile symmetry findings were based on cartoon icons that are not ecologically valid faces. Humans evolved to assess actual human faces, three dimensionally and in real time. In addition, perhaps any facial asymmetry (e.g. in the eyes, nostrils etc.) would elicit fewer resources allocated. Future research needs to use photographic quality stimuli with several facial features morphed asymmetrically

to ensure that smile asymmetry per se is a cue to underlying self-interested intentions.

Conclusions – Study Five

Several evolutionary models have suggested that social network formation may be a pathway to the evolution and stability of cooperation (Frank, 1988; Peck, 1995; Wilson & Dugatkin, 1997). The research here suggests that humans assess altruism and preferentially deliver resources to altruists. Indeed, these assessments of altruism may be involved with the formation of social support networks. This is what an evolutionary approach would predict considering the ancestral fitness costs associated with unreciprocated altruism.

Honest signals with a reliable emotional basis may be needed to guarantee perceivers that the target is not a con artist. The burgeoning literature on animal signalling (Espmark, Amundsen & Rosenqvist, 2000) may help clarify the evolutionary maintenance of altruism signals in humans by exploring the costs associated with encoding. This chapter has focused mostly on sender-dependent encoding costs (i.e. index signals), however there are multiple pathways to signal reliability that do not depend on sender-dependent costs (e.g. receivers may exploit or punish signalers – see Vehrencamp, 2000). If an altruistic character is detectable, then encoding costs and the sensory systems involved in decoding need more empirical elucidation.

CHAPTER VII

General Discussion - Triangulation of a Phenomenon

"I don't feel guilty for anything I've done."
(Ted Bundy)

"If we worry too much about ourselves, we won't have time for others." (Mother Teresa)

In five independent studies evidence has been presented consistent with the altruist-detection assumption of Frank's (1988) commitment model. What is unique about these findings is that they were attained using different methodological paradigms from different disciplines. Study One and Two's methodology was borrowed from cognitive psychology and suggests that humans have decision rules designed for detecting altruists. Study Three uses standard social psychology (i.e. the zero-acquaintance video-presentation paradigm) in a cultural psychology context. Specifically in zero-acquaintance video encounters with students speaking Dutch, Canadian students can detect altruism level. Study Four (A & B) departs from an experimental approach slightly by exploring the naturally occurring facial expressions of altruists and non-altruists in two cultures. Findings corroborate the altruism signalling hypothesis in that hard-to-fake facial expressions varied with altruism level in Dutch and Canadian samples. Finally, Study Five uses an experimental economics approach to test whether cues to altruism (e.g. smile asymmetry and/or reputation for genuine altruism) influence resource allocations. As predicted participants delivered more resources to cartoon icons with an altruistic

reputation and cartoon icons with symmetrical smiles. The following synopses discuss the five studies in more detail.

Study One and Two Synopsis

In Studies One and Two North American students could solve Wason selection tasks that were worded in such a way as the correct answer resulted in detecting an altruist. Altruist-detection in Wason tasks did not depend on the familiar wording and/or the facilitation of logical reasoning. That is, participants performed poorly on familiar control Wason tasks and switched versions of the altruist-detection Wason task. The results from the switched versions of the altruist detection Wason task parallel the findings of Cosmides (1989). That is participants exposed to switched Wason tasks detected altruists (i.e., choosing the cards "Helped" and "did not demand credit") rather than reasoning according to formal conditional logic (i.e., choosing the "P" and "not-Q" cards). When Cosmides (1989) found that switched versions elicited cheater detection (i.e., choosing the cards "Took Benefit" and "Did Not Pay Costs") but not formal logical reasoning (i.e., choosing the "P" and "not-Q" cards) it was concluded that natural selection must have designed cheater detection cognitive machinery in humans.

The findings that participants can detect altruists in Wason tasks are consistent with Frank's (1988) "reputation pathway". Specifically, verbal information denoting proximate mechanisms of genuine altruism are scrutinized and may reflect an underlying cognitive adaptation designed to assess trustworthiness.

Study Three Synopsis

Study One and Two supported the hypothesis that there are evolved altruist-detection capacities in humans (in the Wason selection task). However, one criticism is that these studies presumably demonstrating a universal cognitive adaptation for altruist-detection are confined to one culture (which reduces one's ability to generalize to all humans). Evolutionary psychologists (Cosmides & Tooby, 1992) often argue that human psychological mechanisms are species-typical and should be exhibited by all humans regardless of culture (for an alternative approach see Wilson, 1995 who suggests that adaptive phenotypic plasticity is common within taxa and should be found in humans). Despite the validity of this criticism, it would be empirically beneficial to know if language (i.e. semantic information) or even culture-specific facial expressions are *solely* responsible for altruist-detection. Findings from Study Three contradict this hypothesis. Canadian students could detect altruism from nonverbal information provided in 1-minute video-segments of students speaking Dutch during a self-presentation. Specifically, self-reported altruism and actual altruism in dictator games was detectable from nonverbal and/or paralinguistic cues. Study Three did not assess whether participants can detect altruism based on linguistic information. However, even if linguistic content is important for altruist detection, nonverbal cues appear to be important as well. This is the first evidence that semantic and/or culture-specific facial expressions are not solely responsible for altruist-detection capacities in humans. Involuntary index signals

(e.g. smile symmetry) could be responsible for the altruist-detection effect in zero-acquaintance video-presentation paradigm (see Study Four B).

Study Four A/B Synopsis

It is difficult to know for certain if smile asymmetries influence altruist-detection. Study Four (A & B) was designed as a replication and extension of Brown (1998) with a larger sample size of video-targets performing a different task (i.e. a self-presentation). Video-targets were pre-assessed for altruism level. Two observers coded facial expressions (blind to hypothesis and altruism level). Results replicated Brown (1998) who found that asymmetries in smiling behaviour during a cooperative game are associated with altruism level. That is self-reported altruists displayed more symmetrical smiles than self-reported non-altruists. In addition further nonverbal differences were found in the self-presentations of altruists and non-altruists. Altruists produced more genuine (i.e. Duchenne) smiles, had shorter smile durations, more head movements, and more concern furrows than non-altruists. However, eyebrow flashes and raises were not related to altruism level. This is consistent with Frank's (1988) commitment model. Specifically, altruists were more likely to display hard-to-fake index cues (e.g. orbicularis oculi movement, short and symmetrical smiles) than non-altruists. The reason that these nonverbal cues may be thought of as indices is that they are not particularly costly for the honest signaler (in contrast to the Peacock's tail or roar of a red deer). If these cues are indices it is predicted that

there are physiological constraints mediating these emotional expressions that prevent signal mimicry.

Study Four B (i.e. nonverbal expressions of Dutch targets) found similar results to Study Four A (i.e. nonverbal expressions of Canadian targets) using a similar method. This suggests that altruists may signal their underlying cooperative intentions with involuntary facial expressions (e.g. orbicularis oculi movement, short and symmetrical smiles). This result appears to be consistent across two cultures (i.e. Canadian and Dutch). Involuntary signalling of spontaneous emotions may assist perceivers in the reliable detection of altruism.

Study Five Synopsis

Study Five suggested that in a dictator game requiring the delivery of resource allocations (i.e. lottery tickets) participants delivered more lottery tickets to icons described as altruistic (compared to non-altruistic) and icons with symmetrical smiles (compared to asymmetrical smiles). These findings are consistent with Frank's (1988) model that predicts that altruist detection occurs based on nonverbal and/or reputation information. The reputation information provided under the icons contained the statement (e.g. "Gave blood and refused payment" vs. "Gave blood and demanded payment") used in Wason selection studies (Study One & Two) and facilitated the delivery of more lottery tickets. The smile asymmetry findings were produced using a between-participants manipulation in smiles. Different groups of participants viewed icons with a

slightly asymmetrical or a perfectly symmetrical smile. The latter icons received more resources.

Limitations

Each study has its own unique limitations. For example Study One tested the altruist-detection hypothesis with a 'loaded deck' in the sense that the control task was a traditional Wason problem (e.g. "If the card has an A on one side, it has a 5 on the other"). Participants in a variety of cultures do poorly on this task (1-25 percent accurate). Study Two remedied this potential confound of an abstract control by constructing a familiar control ("If a student lives in Halifax, then that student must be assigned to Halifax High School'). Indeed this procedure helps to alleviate the concern that altruist-detection in the Wason task was simply a by-product of participants being able to reason more clearly when exposed to familiar versus abstract problems.

Study Three reported preliminary evidence consistent with cross-cultural encoding and decoding of altruism. However Study Three in itself cannot have much bearing on this hypothesis because Canadian targets were not presented to Dutch perceivers. In addition, there is no evidence in Study Three to discount that Canadian students did not base their judgments on socially acquired information that is culture-specific. It can be easily imagined that Dutch targets could have developed similar pitch and timbre as English targets due to the degree of similarity between the two cultures. Indeed Dutch and English cultures are very similar to one another (despite having different languages). Study Three

suggests that perceivers based their judgments upon nonverbal information; however the specific cues were not investigated until Study Four B.

Study Four A has clear limitations despite the data being consistent with the smile asymmetry result found in Study Five. For example it cannot be generalized based on a sample size of 20 (i.e. 10 altruists and 10 non-altruists) that the nonverbal differences found are universal indicators of cooperative intent. Also, it is difficult to investigate the possibility of gender differences with this small sample of targets. However, it should be pointed out that gender differences have not been found in displays of altruism and no evolutionary hypothesis has been suggested that would predict one. Study Four A was not designed with this hypothesis in mind and therefore cannot address gender differences in altruistic displays. Study Four B attempted to investigate gender differences and cultural specificity in hypothesized displays associated with altruism. A weakness to Study Four B is that the Dutch are not necessarily that much different from Canadians (despite speaking different languages). Indeed both are western societies.

Study Five haspotential design problems. Specifically, cartoon icons are artificial and only smile asymmetry was manipulated. Maybe any subtle asymmetry (e.g. eye) would lead to decreased resource allocations. A second criticism is that the effect of reputation (despite being a large effect size) could simply have been a by-product of demand characteristics as all participants received icons with both descriptions (i.e. selfish and altruistic). Study Five also suffers from an appropriate control icon manipulating facial expression intensity.

It could be that more intense smiles (regardless of symmetry) are viewed as more altruistic and thus receive more resources. For example it is predicted that a left-sided oral asymmetry (the left-corner of the mouth higher than the right-corner) in a smile would be rated as more altruistic and receive more resources. However since this type of icon was not presented to perceivers it is unknown whether or not symmetry or smile intensity is responsible for the perceivers' resource allocations.

General Contributions

Despite methodological limitations inherent to each of the studies, taken together they provide moderate support for the altruist-detection hypothesis. Recall altruist-detection capacities are an integral assumption of partner-preference mathematical models (e.g. Frank, 1988; Wilson & Dugatkin, 1997). Effect sizes were moderate to large and indicate that an important biological phenomenon (i.e. altruistic displays) may be operating on perceiver's judgments. These studies provide the first (albeit tentative) support for a number of hypotheses generated from Frank's (1988) commitment model. In particular it appears that reputation and nonverbal displays are important for assessments of altruism.

Index cues

Index cues are reliable because they are physiologically constrained (Brown & Moore, 2002). Studies Four and Five indirectly support the hypothesis that

there are index cues to human altruism. Specifically smile asymmetries influenced perceivers' assessments of altruism (Studies 4&5). In Study Four A hard-to-fake cues correlated with self-reported altruism. That is, Duchenne smiling, concern furrows, and a smile of short duration are difficult to manifest unless the sender actually experiences positive emotion (Frank, 1988). Despite the consistency of the findings (across cultures – Study Four B) it must be pointed out that metabolic costs were not measured. It is predicted for these facial expressions to be index cues there must be no association with metabolic costs to a truthful sender.

Resource accrual

Ultimately altruistic displays must lead to tangible benefits for truthful senders if the displays evolved by individual selection. Study Five found that altruistic displays correlated with increased number of lottery tickets received in a dictator game. Reputation and smiles have been previously shown to facilitate resource accrual. For example individuals who were known as altruistic (based on computer feedback in which a participant was made aware of the 'reputation score' of their opponent) received a larger share of resources (Nowak & Sigmund, 1998). As for smiling there is consistent evidence that smiles influence resource accrual. For example Tidd and Lockhart (1978) found that waitresses who smiled more often received higher tips from customers. Furthermore, LaFrance and Hecht (1995) found that smiles generate leniency in punishment. A recent study (similar to Study Three) has found that smiling individuals are

cooperated with more often than non-smiling individuals (Scharlemann et al., 2001). Taken together these results point to the importance of the human smile in resource allocation. Study Five extends this general finding into the domain of smile type. Ekman and Freisen (1981) suggested as did Darwin (1873) that there are different types of smiles. Study Five manipulated smile asymmetry and found that this between-subject manipulation influenced the acquisition of resources.

Reputation

Frank (1988) and others (e.g. Alexander, 1987; Nowak & Sigmund, 1998) have suggested that indirect reciprocity (i.e. third party reciprocation) can evolve when reputation of recipient is taken into consideration. That is individuals with a socially acquired reputation of altruism may be preferred partners for social dilemmas requiring trust. Studies One, Two and Five support this social transmission hypothesis. That is, Wason tasks provide linguistic information regarding the motivation behind apparent acts of altruism and participants solved these problems more proficiently than control Wason tasks. Participants were not significantly better at solving cheater detection versus altruist detection Wason tasks. These findings suggest that humans pay special attention and are willing to scrutinize the reputation of apparent altruists. In Study Five individuals characterized as having selfish motives for helping received less resources in a dictator game than individuals described as having other-interested motives for helping. It appears that reputation is an important factor in the decision rules regarding altruist-detection.

Individual selection?

At first glance the results support the hypothesis that altruistic displays evolved solely by selection at the individual level as modeled by Frank (1988). It may be premature to assume this was the case. Indeed Studies One, Two, Three, and Four (A&B) support predictions generated from individual selectionist (i.e. within-group natural selection) *and* multilevel selectionist accounts (between-group natural selection - see Wilson & Dugatkin,1997). These alternative perspectives are not alternative theories as both suggest that altruistic phenotypes benefit genes in evolutionary games (David Sloan Wilson personal communication). However the level of biological organization responsible for the evolution of non-kin altruism is open to debate (Thompson, 2000). Wilson and Dugatkin (1997) predict that humans may prefer altruists as social partners. Altruistic partner preferences necessarily influence the between-group fitness component of natural selection (Wilson & Dugatkin, 1997). Specifically if altruists assortate based on nonverbal cues this changes the selection dynamics at a higher level of selection due to different frequencies of altruists between demes (Michod, 1999). Groups with higher proportions of altruists produce more offspring due to advantages in resource output. Assume that a group with 75 percent altruists produce or acquire more reproductively relevant resources (e.g. food) than a group with 50 percent altruists due to enhanced coordination in the former deme. One prediction integral to this multilevel model is that group output is high due to higher levels of cooperation. According to Wilson and Dugatkin (1997) altruists may lose slightly in within-group contests relative to non-altruists.

That is non-altruists may hoard a larger proportion of the share at a within-group cost to altruists. As long as this difference is small and the between-group benefit of having a higher proportion of altruists in the group is relatively large then altruism could theoretically evolve by multilevel selection.

Study Five appears to contradict the multilevel approach however (i.e. altruists are doing well within the group). Recall Study Five found that altruistic displays resulted in more resources accrued compared to displays of selfishness. This is consistent with an indirect reciprocity approach (e.g. Frank's 1988 commitment model). It cannot be ruled out that altruists deliver more resources to altruists within a group which in turn reduces the within-group costs of unreciprocated altruism (in other domains). Wilson and Dugatkin (1997) would likely not dispute this speculation. What becomes novel in this prediction is that the between- and within-group components of natural selection may have shaped human decision-making abilities differently depending upon the trait in question (i.e. whether one is a cheater or an altruist). Cheating behaviour within groups can increase the forces selecting against altruistic behaviour while indirect reciprocity may decrease the costs so that between-group natural selection can operate effectively. The Darwinian dynamics appear analogous to suppressor genes designed to thwart the costs of short-term sex-ratio distortion genes in some plants and insects (Stearns & Hoekstra, 2000).

Future studies

There are a number of potentially fruitful theoretical and empirical avenues of future research that could be generated from these findings. Theoretically it appears that prosocial emotions are evolved devices mediating altruism and altruistic displays. However mimicry and selfish mutants are a potential threat to the stability of all altruistic signaling systems. Signal mimicry can be kept at low frequency in a number of ways (e.g. general and quality handicaps). However phylogenetically what were the ancestral states and pre-adaptations? It can be imagined that a frequency-dependent arms race ensued between senders and receivers. If this were true we should expect to find vestigial cues that lost their reliability during the course of evolution.

Determining vestigal facial expressions to altruism may be difficult in practice. However the co-adapted nature of facial physiognomy and facial expressions of emotion may provide a window to empirical inquiry. It is surprising that psychologists in the 20th century have kept facial expressions separate from the facial structure that produces them. It is imaginable that these two attributes are not orthogonal and have coevolved. This does not necessarily mean that facial shape is a reliable predictor of intentions, however ancestrally it may have been. Indeed Penton-Volk et al (1999) have shown cross-culturally that more 'feminized' faces are trusted more than masculinized faces. Hormones may have influenced secondary sexual characters and personality in ancestral environments. In modern environments this relationship may be more tenuous.

Empirical research could attempt to investigate methodological concerns. For example, one of the limitations to Study Five was that artificial icons were used to represent false and genuine smiles. Photographs of human faces that have morphed smiles could be a better research paradigm. However, photos must be directly straight on to the perceivers as head angle could be a potential confound.

Advanced technology for deciphering altruistic facial expressions is needed. The number of muscles in the human face surpasses all areas of the body which makes it extremely difficult to perform facial expression analyses. Software is now being designed to analyze facial expressions, but its availability and accuracy is questionable.

Brain imaging may be a useful method for isolating the condition-dependent nature of altruist-detection capacities. For example, when the number of altruists is low in a population Frank (1988) predicted that perceivers should pay the costs of scrutiny. However when altruists are at high frequency decoding costs should be avoided (since the chances of interacting with altruist are high). Finally brain imaging could help locate the computational areas involved in altruist detection. Recent imaging data shows that prefrontal cortical activation is more common in cooperators than non-cooperators (McCabe et al., 2002).

Another aspect of Frank's (1988) theory that has not been tested in naturalistic environments is the altruism and social support connection. I know of one study that found a longitudinal positive correlation between altruism level and received social support (Brown & Palameta, 1995). However a more fruitful

approach may be an ethnographic fieldwork approach (David Sloan Wilson personal communication). For example Machiviallianism and altruism questionnaires could be given to friends within a rural community. It is predicted that friendship dyads will have similar scores on these personality instruments if assortative interactions between altruists are occurring in humans.

Deception

Deception may have been a powerful selective force on early hominid cognition (Trivers, 1985; 2000). Indeed if a particular pattern of facial expression while helping others was believed by others to be signal of altruism one may expect natural selection to favour deceivers that could manifest the signal. Selection would most likely not favour deceivers who practiced putting involuntary neural machinery and facial musculature under conscious control, since there may be high costs for being caught. However, a reversal in cerebral lateralization could accomplish a similar end product without the time, effort and risks associated with practice. If over the course of hominid evolution there was a mutation reversing hemispheric involvement in posed smiles, deceivers could prosper. For example, left-handers manifest posed smiles that have the characteristic left-sided oral asymmetry characteristic of a right-handers genuine or spontaneous smile (Wylie & Goodale, 1988). Deceivers may benefit from left-handedness since their posed facial expressions when helping could be misperceived as trustworthy. If this were true it would be expected that exploitative individuals would be more likely to be left-handed than right-handed

since perceivers would have a difficult time detecting self-interest from the smile. In fact, criminal behaviour appears to vary with handedness. Specifically, more left-handers than right-handers have been involved in criminal acts (Coren, 1998). Interestingly in another study left-handers report themselves as being more manipulative and Machiavellian (Coren, 1994). Finally, there appears to be a correlation between psychopathy and handedness (Hare & Forth, 1985). Further research needs to explore the connection between cerebral asymmetries, facial expression and deception. Finally, it should be noted that there are numerous candidates for reliable signals associated with altruism in human facial expression besides smile asymmetries. For example the orbicularis oculi (i.e. periocular muscle region) and the zygomaticus major or cheek muscle regions (Ekman & Freisen, 1982; Surakka & Hietanen, 1998) are also involved in the involuntary expression of emotions. Evolutionarily one may expect that if a deceiver entered the population with a genuine-looking phony smile, perceivers may be selected to scrutinize the eye region to make more reliable judgments regarding intentions. Viewing facial expression as a step-wise co-evolutionary arms race between signalers and perceivers may be a fruitful way to formulate hypotheses. Selection may adjust one region of facial expression in favour of deception, but this will create counter-selection pressures for perceivers to assess another uncorrelated region to ensure reliable detection.

General Conclusions

Triangulation is an approach to behavioural science in which the researcher uses multiple methods of testing a hypothesis or proposed phenomenon. In the case of this thesis the phenomenon was 'altruist-detection' and methods were used from cognitive psychology (Study 1 & 2), social psychology (Study 3), ethology (Study 4 A/B), and experimental economics (Study 5). It would be premature to suggest that altruist-detection has been adequately demonstrated. However it can be safely argued that an empirical groundwork has been laid.

The debate regarding whether psychological altruism exists has raged for centuries and cannot be easily resolved (however see Sober & Wilson, 1998). The emotions committing altruistic behaviour may be a cue if signalled nonverbally. If altruists form mutually supportive alliances (based on these putative cues) the within group costs to cooperation may be alleviated. Only through rigorous investigations of the psychological machinery mediating altruistic displays, altruist-detection, and the neural underpinnings of these capacities can the evolutionary models (beginning with Sewell Wright in 1932) hypothesizing assortative interactions be reasonably assessed for their empirical worth.

APPENDIX 1

INFORMED CONSENT FORM (FOR WASON STUDIES)

TITLE: Investigating of problem-solving
LOCAL PRINCIPAL INVESTIGATOR: William M. Brown Department of Psychology Dalhousie University
SUPERVISOR: Chris Moore Department of Psychology Dalhousie University
CONTACT PERSON: Chris Moore Department of Psychology Dalhousie University

We invite you to take part in a research study. Taking part in this study is voluntary and you may withdraw from this study at any time and you will still receive compensation. The Office of Human Research Ethics and Integrity of Dalhousie University, which has approved this project, requires that researchers using human participants conform with ethical guidelines currently suggested by most professional and research granting agencies. These guidelines require:

(1)That the character of the task required be explained to you.
(2)That you be made aware that participation is voluntary and that you may decline to continue as a participant at any point during the course of the research project, without loss of expected compensation.
(3)That you be assured that all information assembled from the questionnaires is entirely confidential and anonymous and will be stored securely by the primary investigators (i.e. William M. Brown and Chris Moore).

Please read the following, which provides these details about the research project.

Purpose of the research project : To study problem-solving abilities. More information will be provided to you upon completion of the study on a debriefing form (e.g. why the study was done and how to find articles regarding this line of research).

Task requirements: You will be asked to complete three problem-solving tasks. For compensation for your participation will provide you with a credit point toward class grade. Participation will take approximately 30 minutes. You may be contacted by the experimenter (William M. Brown) for a follow-up study. If you do not wish to be contacted please do no leave your phone number.

Hazards, risks, inconveniences, or benefits associated with participation: One inconvenience is that you may be contacted at home by the experimenter for a follow-up study. You do not have to participate in the follow-up if you do not want to. Benefits include experiencing the process of research, contributing to the objectives of the study and learning more about the purpose of the research at the end of the study. Please sign below to confirm that you understand the information provided above, and that you are aware that your self-report scale scores are kept entirely confidential, and that you may discontinue participation at any point in the study and still receive your credit point. Furthermore if you

wish to participate as an observer you may and still receive a credit point. Specifically if you want to observe (but not participate as a subject) to view how I conduct an experiment please feel free to do so for 1 credit point. Please make inquiries to address any question you may wish to the investigator either now or after you have participated. Individuals with specific ethical concerns should contact either the staff member responsible or a member of the Office of Human Research Ethics and Integrity of Dalhousie University (902-494-1462).

Participant's signature:_____ **Researcher's signature:**_____
PHONE#: _____
Date:_____

DEBRIEFING FORM (FOR WASON STUDIES)

Thank you for your participation in this research. This study attempted to determine if people scrutinize social emotions (e.g. concern for others) in Wason selection tasks. Wason tasks have previously been used to show that people are especially good at reasoning about cheaters. We wanted to know if people are especially good at reasoning about motives for altruism. If people can detect presence of prosocial emotions they may base future interactions with altruists upon this identification. This study attempted to investigate this question.

Chris Moore and William M. Brown will keep all information you provided strictly confidential. I would like to thank you again for participating in this study and should you wish to know the results of this research or have any questions or concerns, please do not hesitate to contact me (William Brown) or Chris Moore at the Department of Psychology at Dalhousie Univeristy. Should you wish to learn more about altruism, selfishness and nonverbal behaviour here are some references:

Hoffman, M.L. (1981). Is altruism, part of human nature? Journal of Personality and Social Psychology, 40, 121-137.

Wilson, D.S., Near, D., & Miller, RR (1996). Machiavellianism: A synthesis of the evolutionary and psychological literatures. Psychological Bulletin, 119, 285—299.

APPENDIX 2

Abstract Control Version of the Wason Selection Task

On each card below, there is a number on one of its sides and a letter on the other. Your task is to decide which if any of these four cards you *must* turn to decide if the rule is true of these four cards. Don't turn unnecessary cards.

Rule: "*If there is an A on one side, then there must be a 5 on the other side.*"

Cards:

A	K	8	5
P	**not-P**	**not-Q**	**Q**

Altruist-Detection Wason Selection Task – Version 1

Imagine that you have had a newborn baby within the past year and you decided to go back to work. You are now in need of a trustworthy babysitter. Because there have been recent media reports of baby-sitters who have abused children, you have to be extra careful to select a sitter who will genuinely care for your child. But you do not want to hire someone simply because they have babysat before. Instead, you wish to base your decision on how genuinely concerned the person is for the welfare of others. This quality often can be demonstrated when people volunteer within the community without receiving material rewards of any kind. Therefore, you decide to hire someone who volunteers to help sick children on his or her days off for the sake of helping rather than for self-gain or academic credit (for example: volunteering for extra school credit or volunteering just to improve his or her resume).

As a result, those candidates who observe the following rule are considered unacceptable to care for child:

"If they volunteer, then they seek credit." (standard version)
OR
"If they seek credit, then they volunteer." (switched version)

The cards below have information about four potential candidates. One side of each card tells you whether or not a candidate volunteers and the other side of each card tells you whether or not they seek credit. Choose only the card(s) you definitely need to turn over to determine whether a candidate is acceptable to you as a babysitter.

sought credit	did not seek credit	did not volunteer	volunteered
"Q"	*"not-Q"*	*"not-P"*	*"P" (standard)*
"P"	*"not-P"*	*"not-Q"*	*"Q" (switched)*

Altruist Detection Wason Selection Task – Version 2

You have been offered an excellent job in your field in New York City. Although you are excited about this great career opportunity, you are worried about finding friends who can help you deal with the transitional adjustments of living in a new city. Coupled with the fact that recent studies have shown that there are many people who cannot be trusted in New York City, your worries are justified. You would like to have close friends who will not take advantage of you in the workplace, or in personal life. You wish to base your friend choice on how genuinely concerned they are for others. Thus, you decide to befriend anyone who gives to others and does not ask for anything in return.

In the same building where you work, a health clinic has set up temporary facilities for giving blood. Many people from your office plan to give blood, and you consider this a good opportunity to meet potential friends. The clinic is desperately in need of blood supplies and is willing to offer a small cash payment to each person who gives their blood. Of course, the idea of accepting payment for such a good deed is not something you would do. Similarly, you consider anyone who does accept payment for giving blood to not be as selfless as they appear, and thus not someone you wish to befriend.

Therefore, those co-workers who follow the rule below are not considered to be an acceptable friend:

"If they give blood, then they accept payment." (Standard version)
OR
"If they accept payment, then they give blood." (Switched version)

The four cards below have information about four co-workers. One side of each card has information about whether or not they gave blood, and the other side of each card has information about whether or not they accepted payment. Indicate only the card(s) that you definitely need to turn over to determine if any of your co-workers are potential friends.

accepted payment	did not accept payment	did not give blood	gave blood
"Q"	*"not-Q"*	*"not-P"*	*"P" (standard)*
"P"	*"not-P"*	*"not-Q"*	*"Q" (switched)*

APPENDIX 3

School Assignment Control Wason Selection Task

The secretary you replaced at the local school board may have made some mistakes when she processed student documents. It is important that certain rules are followed for assigning students from various areas to the appropriate school. This is because the population statistics that are provided allow the school board to decide how many teachers need to be assigned to each school. If these rules are not followed, some schools could end up with too many teachers, and other schools with too few.

Students are to be assigned to Halifax High School or Dartmouth High School. Some students live in Halifax and some live in Dartmouth. There are rules that determine which school a student is to be assigned; the most important of these rules is:

"If a student is to be assigned to Halifax High School, then that student must live in Halifax" (Standard)

OR

"If a student lives in Halifax, then that student must be assigned to Halifax High School" (Switched)

Shortly before she retired, the secretary you replaced was supposed to sort through the documents that specify what area the students' live in, and make school assignments according to this rule. She was a sweet little old lady who had become rather absent-minded, and often made mistakes when categorizing student documents.

The cards below have information about the documents of four students. Each card represents one student. One side of the card tells what school the retired secretary assigned the student to, and the other side of the card tells what area that student lives in.

You suspect the retired secretary may have inadvertently categorized some of the students' documents incorrectly, so you decide to see for yourself whether she ever violated the rule. Indicate only those card (s) you definitely need to turn over to see if the documents of any of these students violate the rule.

Halifax	Dartmouth	Dartmouth High School	Halifax High School
"Q"	*"Not-Q"*	*"not-P"*	*"P" (standard)*
"P"	*"Not-P"*	*"not-Q"*	*"Q" (switched)*

Cheater Detection Wason Selection Task

In its crackdown against drunk drivers, Nova Scotia law enforcement officials are revoking liquor licenses left and right. You are a bouncer in a bar, and you'll lose your job unless you enforce the following law:

"If a person is drinking beer, then they must be over 18 years old" (standard)

OR

"If a person is over 18 years old, then they may drink beer" (switched)

The cards below have information about four people sitting at a table in your bar. Each card represents one person. One side of a card tells what a person is drinking and the other side of the card tells that person's age. Indicate only those card (s) you definitely need to turn over to see if any of these people are breaking this law.

25 years old	16 years old	Drinking coke	Drinking beer
"Q"	*"Not-Q"*	*"Not-P"*	*"P" (standard)*
"P"	*"Not-P"*	*"Not-Q"*	*"Q" (switched)*

Altruist Detection Wason Selection Task – Version 2

You have been offered an excellent job in your field in New York City. Although you are excited about this great career opportunity, you are worried about finding friends who can help you deal with the transitional adjustments of living in a new city. Coupled with the fact that recent studies have shown that there are many people who cannot be trusted in New York City, your worries are justified. You would like to have close friends who will not take advantage of you in the workplace, or in personal life. You wish to base your friend choice on how genuinely concerned they are for others. Thus, you decide to befriend anyone who gives to others and does not ask for anything in return.

In the same building where you work, a health clinic has set up temporary facilities for giving blood. Many people from your office plan to give blood, and you consider this a good opportunity to meet potential friends. The clinic is desperately in need of blood supplies and is willing to offer a small cash payment to each person who gives their blood. Of course, the idea of accepting payment for such a good deed is not something you would do. Similarly, you consider anyone who does accept payment for giving blood to not be as selfless as they appear, and thus not someone you wish to befriend.

Therefore, those co-workers who follow the rule below are not considered to be an acceptable friend:

"If they give blood, then they accept payment." (Standard version)
OR
"If they accept payment, then they give blood." (Switched version)

The four cards below have information about four co-workers. One side of each card has information about whether or not they gave blood, and the other side of each card has information about whether or not they accepted payment. Indicate only the card(s) that you definitely need to turn over to determine if any of your co-workers are potential friends.

accepted payment	did not accept payment	did not give blood	gave blood
"Q"	*"not-Q"*	*"not-P"*	*"P" (standard)*
"P"	*"not-P"*	*"not-Q"*	*"Q" (switched)*

APPENDIX 4

University of Groningen Faculty of Behavioral and Social Sciences

Social and Organisational Psychology

William M. Brown
Department of Psychology
Life Sciences Centre
Dalhousie University
1355 Oxford Street
Halifax, Nova Scotia
B3H 4J1 CANADA

Grote Kruisstraat 2/1
9712 TS Groningen
The Netherlands
Telephone + 31 50 363 63 80
Telefax + 31 50 363 63 04
E-mail:

Date April 22, 2002 | Telephone | Your reference | Our reference

Subject

Dear Mr. Brown,

As requested I send you some information about how I made the videos that you want to show to Canadian students at your university.

Within lectures and the local university newspaper we advertised that we were searching for people who would be willing to introduce themselves on a video for about one minute.

Participants were told that these videos were going to be shown to Canadian students and that these Canadian students would be asked about their "first impressions" of the persons they would see on these videos.

All participants signed a written consent form that their videos would be shown to students of another university.

Besides some other variables, we also measured the prosociality/antisociality of the participants. We did this by using some validated personality scales and by asking the participants how they divide a certain amount of money between themselves and another person in a number of game theoretical paradigms (e.g., dictator games, ultimatum games).

I hope that this information about how we gathered the video-material is sufficient for you4 purpose.

Kind regards,

Detlef Fetchenhauer

Detlef Fetchenhauer

Enclosure(s)

RuG

APPENDIX 5

Directions: Indicate how often you have performed each act described in the statement. Circle one number for each.

1. I have helped push or restart a stranger's car when it was stalled.
Never Once More than once Often Very often

2. I have given directions to a stranger.
Never Once More than once Often Very often

3. I have made change for a stranger.
Never Once More than once Often Very often

4. I have given money to a charity.
Never Once More than once Often Very often

5. I have given money to a stranger that needed it (or asked me for it)
Never Once More than once Often Very often

6. I have donated goods or clothes to a charity.
Never Once More than once Often Very often

7. I have done volunteer work for a charity.
Never Once More than once Often Very often

8. I have donated blood.
Never Once More than once Often Very often

9. I have helped carry a stranger's belongings (books, parcels, etc.).
Never Once More than once Often Very often

10. I have delayed an elevator and the door open for a stranger.
Never Once More than once Often Very often

11. I have allowed someone to go ahead of me in a line or queue.
Never Once More than once Often Very often

12. I have given a stranger a lift in my car.
Never Once More than once Often Very often

13. I have pointed out a clerk's error (in a bank, at a market) in undercharging me for an item.
Never Once More than once Often Very often

14. I have let a neighbour whom I didn't know too well borrow an item of some value to me (e.g. a dish, tools, etc.).
Never Once More than once Often Very often

15. I have paid a little more to buy an item from a merchant who I felt deserved my support.
Never Once More than once Often Very often

16. I have helped a classmate who I did not know that well with a homework assignment when my knowledge was greater than his or hers.
Never Once More than once Often Very often

17. I have looked after a neighbour's pets without being asked and without being paid for it.
Never Once More than once Often Very often

18. I have offered to help a handicapped or elderly stranger across the street.
Never Once More than once Often Very often

19. I have offered my seat on a bus or tram to a stranger who was standing.
Never Once More than once Often Very often

20. I have helped an acquaintance to move households.
Never Once More than once Often Very often

21. I have helped a neighbour whom I didn't know that well work on his or her house.
Never Once More than once Often Very often

22. I have absorbed the blame for the mistake(s) of a work-mate when he or she needed the help.
Never Once More than once Often Very often

23. I have done something I honestly felt was wrong in order to help someone I didn't know that well out of trouble.
Never Once More than once Often Very often

24. I have helped someone I didn't know get up when (s)he slipped or tripped and fell down.
Never Once More than once Often Very often

25. I have helped an acquaintance obtain something important that he or she needed (eg. a job, a place to live, etc.)
Never Once More than once Often Very often

26. I have worked past my shift to help someone make a productive quota.
Never **Once** **More than once** **Often** **Very often**

27. I have called the police after witnessing a crime and identified myself.
Never **Once** **More than once** **Often** **Very often**

28. I have shared credit for an accomplishment when I could easily have taken it all.
Never **Once** **More than once** **Often** **Very often**

29. I have 'bent the rules' to help someone I didn't know that well.
Never **Once** **More than once** **Often** **Very often**

30. I have helped a new fellow employee at work get settled on the job and learn the tasks involved, even though it was not part of my job.
Never **Once** **More than once** **Often** **Very often**

31. I have moved my car into a dangerous position to avoid hitting a pedestrian.
Never **Once** **More than once** **Often** **Very often**

32. I have helped an acquaintance out of a personally embarrassing situation and kept it confidential for his or her sake.
Never **Once** **More than once** **Often** **Very often**

33. I have volunteered to nurse an acquaintance who was ill.
Never **Once** **More than once** **Often** **Very often**

34. I have helped a neighbour who needed it to harvest his or her crops.
Never **Once** **More than once** **Often** **Very often**

35. I have defended someone I didn't know from being physically harmed.
Never **Once** **More than once** **Often** **Very often**

36. I have deceived someone when I felt it was for their own good.
Never **Once** **More than once** **Often** **Very often**

37. I have voluntarily served as a witness in a court of law.
Never **Once** **More than once** **Often** **Very often**

38. I have loaned my car to friends or neighbours.
Never **Once** **More than once** **Often** **Very often**

39. I have calmed someone I didn't know who was behaving in a visibly disturbed or frightened manner in public.
Never **Once** **More than once** **Often** **Very often**

40. I have walked a stranger through a dangerous area (eg. neighbourhood, parking lot, etc.)
Never Once More than once Often Very often

41. I have sacrificed a parking space for a stranger.
Never Once More than once Often Very often

42. I have stuck my neck out to 'cover for' a work-mate.
Never Once More than once Often Very often

43. In heavy traffic, I have slowed to let someone coming toward me make a turn in front of me even though it meant having to wait through a red light.
Never Once More than once Often Very often

44. I have stopped on a highway to help a stranger fix a flat tire.
Never Once More than once Often Very often

45. When playing a team sport, I often sacrifice an opportunity to score when I see that another player has a better chance.
Never Once More than once Often Very often

46. I have 'picked up the slack' for another worker when he or she couldn't keep up the pace.
Never Once More than once Often Very often

47. As part of a group of people, I have done menial jobs that needed doing without being asked even though they were not part of my responsibilities.
Never Once More than once Often Very often

48. I have been offered responsibilities at work which I have declined in favour of a more qualified colleague.
Never Once More than once Often Very often

49. On occasion, I have 'stretched the truth' to help someone out of an embarrassing situation.
Never Once More than once Often Very often

50. I have taken a lost child to a store manager so its parents could be found.
Never Once More than once Often Very often

51. I have saved someone's life (eg. from drowning, a fire, etc.)
Never Once More than once Often Very often

52. I have answered the questions of someone doing a door-to-door or telephone survey
Never Once More than once Often Very often

53. I have volunteered to work in a hospital.
Never **Once** **More than once** **Often** **Very often**

54. I have contributed my time and labour to community improvement activities.
Never **Once** **More than once** **Often** **Very often**

55. I have attempted to calm someone who was behaving in a frighteningly strange or psychotic fashion.
Never **Once** **More than once** **Often** **Very often**

56. I have worked on a committee of a legal but unpopular minority organization.
Never **Once** **More than once** **Often** **Very often**

APPENDIX 6

The Helping Orientation Questionnaire

Instructions: This questionnaire contains a number of real-life situations with a set of responses that people often make. Please imagine yourself in these situations and choose the action that is most descriptive of what you would do. Circle the letter (A, B, C, or D) corresponding to the action you choose.

1. You have come across a lost wallet with a large sum of money in it as well as identification of the owner. You:
A. return the wallet without letting the owner know who you are.
B. return the wallet in hopes of receiving a reward.
C. keep the wallet and the money.
D. leave the wallet where you found it.

2. A child riding his or her tricycle past your house appears to be lost. You:
A. ignore the child so you avoid potential entanglements and misunderstanding.
B. figure the child can find his or her own way home.
C. ask the child where he or she lives and take him or her home.
D. take the child into your home and notify the police.

3. Which would you be most likely to do on a Saturday afternoon?
A. find someone to help you on a long overdue project
B. go to a movie alone
C. work on a part-time job
D. help a friend panel his or her basement

4. A man who confronts you in Chicago's Loop does not speak English but appears to need directions. You:
A. keep on walking so you won't be late.
B. pretend you don't hear him.
C. decide what to do on the basis of his appearance.
D. help him in any way you can.

5. The night before an important exam, a student shows you a stolen copy of the test. You:
A. inform the instructor that a copy has been stolen.
B. refuse to look at the stolen copy and say nothing to the instructor.
C. study the stolen exam and get a good grade.
D. leave an anonymous note informing the instructor the exam has been stolen.

6. When it comes to cooperating when I would rather not, I usually:
A. cooperate if it is helpful to others.
B. cooperate if it is helpful to me.
C. refuse to get involved.
D. avoid situations where I might be asked to cooperate.

7. A friend asks to borrow an article of clothing. You:
A. say you don't like to lend clothing.
B. say no.
C. lend the article if you may borrow something in return on another occasion.
D. lend the article if you know the person really wants it.

8. A person in one of your classes is having trouble at home and with school work. You:
A. help the person as much as you can.
B. tell the person not to bother you.
C. leave the person alone to work out his or her own problems.
D. agree to tutor the person for a reasonable fee.

9. You are on the second floor of a building and notice a man stumbling around and appearing to be in trouble. You:
A. ignore him.
B. call the police fearing possible danger.
C. go out and help only if you recognize him.
D. go out to assist him regardless of whether you know him.

10. You are approached by someone asking for a contribution to a well-known charity. You:
A. give if there is something received in return.
B. refuse to contribute.
C. give whatever amount you can.
D. pretend you are in a hurry.

11. A neighbor calls you and asks you for a ride to the store that is six blocks away. You:
A. refuse, thinking you will never need a favor from him.
B. explain that you are too busy at the moment.
C. immediately give the ride and wait while the neighbor shops.
D. consent if the neighbor is a good friend.

12. Alone in your home, you hear a woman outside calling for help. You:
A. go to her aid.
B. call the police and join them at the scene.
C. are afraid to intervene directly, so you take no action.
D. are sure someone else has heard her so you wait.

13. You are driving to school and notice a person of the same sex and about your age who appears to have car trouble. You:
A. stop because the person is in one of your classes.
B. stop to help even though the person is a stranger.
C. drive by.
D. do not stop because you know it can be dangerous.

14. When asked to volunteer for a task in which you will receive no pay, you:
A. avoid or put off answering.
B. explain that you don't agree with the objectives to be accomplished and therefore couldn't volunteer.
C. compromise and help if you will receive some recognition.
D. volunteer without questions.

15. An elderly lady standing on a street corner appears to be lost. You:
A. go and help her.
B. help her only if she is dressed nicely.
C. assume someone else will help her.
D. leave her alone, fearing she may think you are a purse snatcher.

16. Your religious group sponsors a pancake breakfast (all you can eat) to benefit a needy organization. You:
A. purchase a ticket, not intending to go.
B. purchase a ticket and go.
C. purchase a ticket and eat all you can.
D. don't purchase a ticket.

17. A hitchhiker is thumbing for a ride late in the evening. It is raining and few cars are on the road. You:
A. offer a ride if the person looks like someone you want to talk to.
B. drive by fearing for your safety.
C. drive by and avoid the person.
D. stop and offer a ride.

18. You are in a waiting room with another person. If you heard a scream in the adjoining room and the other person failed to respond, you would:
A. help the screaming person whether the other person helps or not.
B. help the screaming person only if the other person does too.
C. wait to see if the screaming continues.
D. leave the room.

19. Which type of group would you be most likely to join?
A. a club devoted to leisure activities
B. a club that provides help for others and also activities for yourself
C. a club devoted primarily to helping others
D. not join any

20. A poorly dressed person confronts you on a deserted street seeking a dime. You:
A. ignore him.
B. ask him what the money is for.
C. give him the dime, without asking any questions.
D. refuse him the dime because it's just too much trouble.

21. Which of the following would you be most likely to do?
A. I like to help my friends.
B. I like to deal with my problems on my own.
C. I like to help my friends if they are likely to help me.
D. I like it when other people help me.

22. When asked to volunteer for a needy cause for which you will receive pay, you:
A. volunteer but don't accept the pay.
B. volunteer and accept the pay.
C. do not volunteer.
D. volunteer if you are certain of getting paid and if the work is not demanding.

23. A friend from another college visits your roommate for the weekend. He wants to use your meal pass in order to eat in the cafeteria for free. You:
A. give him your meal pass if your roommate promises to do the same for you sometime.
B. pretend that you don't have a meal pass.
C. give him your meal pass if he will pay you something.
D. give him your meal pass without eating yourself.

APPENDIX 7

INFORMED CONSENT FORM

Title: Study of first impression accuracy when assessing videotaped images of Dutch students.

Local principal investigator
William M. Brown Department of Psychology Dalhousie University, 494-3417, wmbrown@is2.dal.ca, M.Sc. (98) and Ph.D. Candidate.

Supervisor
Chris Moore Department of Psychology Dalhousie University, 494-3417, moorec@is.dal.ca

Contact person
William M. Brown Department of Psychology Dalhousie University, 494-3417, wmbrown@is2.dal.ca, M.Sc. Ph.D. Candidate. Please feel free to contact William M. Brown anytime regarding this study or if you have questions regarding the Psychology program.

Introduction
We invite you to take part in a research study at Dalhousie University [which is being conducted as part of a Ph.D thesis of the principal investigator, William M. Brown]. Taking part in this study is voluntary and you may withdraw from this study at any time. Your performance does not impact evaluation in your classes even if you decide not to participate. The study is described below. This description tells you about what you will be asked to do, and any risks, inconvenience, or discomfort which you might experience. Participating in the study will not benefit you. You should discuss any questions you have about this study with William M. Brown.

Purpose of the research project
To study nonverbal behavior and the assessment of personality from videotapes of Dutch students. Furthermore we wish to determine if your personality, gender and/or handedness influence your assessments of the videotaped images.

Study design
You will be asked to rate aspects of 25 individuals' nonverbal behaviors and make personality assessments. Individuals in the videotape will not be speaking English. For your participation as a subject or observer we will provide you with a credit point toward class grade. Afterwards you will be asked to fill out a personality questionnaire and demographic information sheet. Participation will take approximately 30 minutes.

Who can participate in the study
Anyone interested.

Who will be conducting the research
William M. Brown

What you will be asked to do
You will be asked to view 25 short video-clips (approximately 1 minute in length) of individuals speaking Dutch in LSC 4258. After viewing each video-clip you will rate aspects of their personality. After making your assessments you will be asked to fill out a questionnaire measuring an aspect of your personality, your handedness, your age and your gender.

Possible risks and discomforts
A risk is that you will be annoyed at making personality assessments from limited information. Also you may not like answering questions about your personality, gender, age and handedness.

Possible benefits

No direct benefits from participating. However some students may enjoy learning about this sort of research.

Compensation/reimbursement
Compensation includes a credit point for participation (as subject or observer).

Confidentiality
You will not be identified in any reports or publications. The information you provide will be used in combination with the information provided from other students participating. Information will be stored by William M. Brown a minimum of 5 years (after the results are published) in line with Dalhousie University policy.

New information
Any new information that may influence your desire to participate in this study will be given to you immediately.

Problems or concerns
In the event that you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact Human Research Ethics / Integrity Coordinator at Dalhousie University's Office of Human Research Ethics and Integrity for assistance: ph. (902) 494-1462, email: patricia.lindley@dal.ca

Signature (for current study only)

I have read the explanation of this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in this study. However I realize that my participation is voluntary and that I am free to withdraw form the study at any time.

Date: _____ Participant's signature:_____

Researcher's signature:_____

Future use of information

Other researchers may use your information with Research Ethics Board (REB) approval. However, your confidentiality and anonymity will be guaranteed. If you do not object to your information (i.e. video-tape and questionnaire responses) being used in follow up studies please sign below.

Date: _____ Participant's signature:_____

Researcher's signature:_____

Would you like to be a participant or observer?

Based on the policy of the Department of Psychology you may wish to participate in this study or be an observer. An observer's information is not used for research purposes by the experimenter. However you can still learn about the process of research without having your information used in this study. Participants and observers receive the same compensation (i.e. 1 credit point). Please check whether you want to be a participant or an observer:

Participant: _____

Observer: _____

DEBRIEFING FORM (FOR DUTCH TARGET ASSESSMENT)

Thank you for your participation in this research. This study attempted to determine if social emotions (e.g. concern for others) that may influence an individual's level of helping behavior are detectable nonverbally. If people can detect nonverbal signals of the social emotions they may base future interactions with others upon this identification. This study attempted to investigate this question using videotaped images of Dutch students whose cooperative personality was assessed before you looked at and rated the videos. That is, you observed and assessed video-segments of individuals previously assessed to be cooperative and/or selfish. We pre-assessed cooperativeness of the Dutch students in two ways: 1) how cooperative they believe themselves to be using self-report questionnaires; and 2) how much they give to others anonymously and while being observed.

If you were accurate at detecting level of cooperative personality no one knows what you may have based your assessments upon. One possibility is the human smile. We also investigated whether your personality, gender or handedness influenced your detection accuracy. Some research suggests that left-handers and females may be better at detecting lies and emotional expressions. However no one knows whether or not these attributes (handedness and/or gender) influence the detection of cooperative personality.

Another influence on detection accuracy could be the perceiver's own personality. Perhaps individuals who have a lot to gain from detecting cooperative individuals would be better detectors. For example, Machiavellian individuals (i.e. people who are self-interested and socially manipulative) could be better detectors of cooperativeness in others. This study attempted to explore this possibility. The questionnaire you completed measured your degree of Machiavellianism.

Chris Moore and William M. Brown will keep all information you provided strictly confidential. I would like to thank you again for participating in this study and should you wish to know the results of this research or have any questions or concerns, please do not hesitate to contact me (William Brown 494-3417 or wmbrown@is2.dal.ca) at the Department of Psychology at Dalhousie University. Should you wish to learn more about altruism, selfishness and nonverbal behavior here are some references:

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Brown, W.M., & Moore, C. (2000). Is prospective altruist-detection an evolved solution to the adaptive problem of subtle cheating in cooperative ventures? Supportive evidence using the Wason selection task. *Evolution and Human Behavior,* 21, 25-37.

Brown, W.M., & Moore, C. (2002). Smile asymmetries and reputation as reliable indicators of likelihood to cooperate: An evolutionary analysis. In S.P Shohov (Ed.) *Advances in Psychology Research*, 11, 59-78. Huntington, NY: Nova Science Publishers

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Question for participants during debriefing session

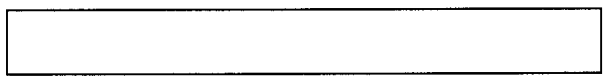
Why did the researchers feel that it was important to use videotapes of altruists speaking Dutch? (e.g. was it simply a convenience, by chance, or a control of some kind?). If you feel that it was a control procedure, what were we attempting to control? Think of this question in terms of the researcher's primary hypothesis.

APPENDIX 8

RATING SCALE USED FOR DUTCH TARGET ASSESSMENTS

This person would give how much money to a stranger anonymously?

Small amount of money



Large amount of money

APPENDIX 9

INFORMED CONSENT FORM (FOR NONVERBAL ANALYSIS STUDY)

TITLE: Investigating personality and person-perception
LOCAL PRINCIPAL INVESTIGATOR: William M. Brown Department of Psychology Dalhousie University
SUPERVISOR: Chris Moore Department of Psychology Dalhousie University
CONTACT PERSON: Chris Moore Department of Psychology Dalhousie University

We invite you to take part in a research study. Taking part in this study is voluntary and you may withdraw from this study at any time and you will still receive compensation. The Office of Human Research Ethics and Integrity of Dalhousie University, which has approved this project, requires that researchers using human participants conform with ethical guidelines currently suggested by most professional and research granting agencies. These guidelines require:

(1)That the character of the task required be explained to you.
(2)That you be made aware that participation is voluntary and that you may decline to continue as a participant at any point during the course of the research project, without loss of expected compensation.
(3)That you be assured that all information assembled from the questionnaires is entirely confidential and anonymous and will be stored securely by the primary investigators (ie. William M. Brown and Chris Moore).

Please read the following, which provides these details about the research project.

Purpose of the research project : To study personality and person perception. More information will be provided to you upon completion of the study on a debriefing form (e.g. why the study was done and how to find articles regarding this line of research).

Task requirements: You will be asked to state your like and dislikes to a camera for a follow-up study on person-perception. For compensation for your participation will provide you with a credit point toward class grade. Participation will take approximately 30 minutes. You may be contacted by the experimenter (William M. Brown) for a follow-up study. If you do not wish to be contacted please do no leave your phone number.

Hazards, risks, inconveniences, or benefits associated with participation: One inconvenience is that you may be contacted at home by the experimenter for a follow-up study. You do not have to participate in the follow-up if you do not want to. Benefits include experiencing the process of research, contributing to the objectives of the study and learning more about the purpose of the research at the end of the study. Please sign below to confirm that you understand the information provided above, and that you are aware that your self-report scale scores are kept entirely confidential, and that you may discontinue participation

at any point in the study and still receive your credit point. Furthermore if you wish to participate as an observer you may and still receive a credit point. Specifically if you want to observe (but not participate as a subject) to view how I conduct an experiment please feel free to do so for 1 credit point. Please make inquiries to address any question you may wish to the investigator either now or after you have participated. Individuals with specific ethical concerns should contact either the staff member responsible or a member of the Office of Human Research Ethics and Integrity of Dalhousie University (902-494-1462).

Participant's signature:_____ **Researcher's signature:**_____
PHONE#: _____
Date:_____

DEBRIEFING FORM (FOR NONVERBAL ANALYSIS STUDY)

Thank you for your participation in this research. This study attempted to determine if people scrutinize social emotions (e.g. concern for others) from video. Video has previously been used to show that people are especially good at detecting prosocial emotions. We wanted to know if altruists and non-altruists display different nonverbal behaviours. If people can detect presence of prosocial emotions they may base future interactions with altruists upon this identification. This study attempted to investigate this question.

Chris Moore and William M. Brown will keep all information you provided strictly confidential. I would like to thank you again for participating in this study and should you wish to know the results of this research or have any questions or concerns, please do not hesitate to contact me (William Brown) or Chris Moore at the Department of Psychology at Dalhousie Univeristy. Should you wish to learn more about altruism, selfishness and nonverbal behaviour here are some references:

Hoffman, M.L. (1981). Is altruism, part of human nature? Journal of Personality and Social Psychology, 40, 121-137.

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APPENDIX 10

INFORMED CONSENT FORM (FOR STUDY FIVE)

TITLE: Economic decision-making
LOCAL PRINCIPAL INVESTIGATOR: William M. Brown Department of Psychology Dalhousie University
SUPERVISOR: Chris Moore Department of Psychology Dalhousie University
CONTACT PERSON: Chris Moore Department of Psychology Dalhousie University

We invite you to take part in a research study. Taking part in this study is voluntary and you may withdraw from this study at any time and you will still receive compensation. The Office of Human Research Ethics and Integrity of Dalhousie University, which has approved this project, requires that researchers using human participants conform with ethical guidelines currently suggested by most professional and research granting agencies. These guidelines require:

(1)That the character of the task required be explained to you.
(2)That you be made aware that participation is voluntary and that you may decline to continue as a participant at any point during the course of the research project, without loss of expected compensation.
(3)That you be assured that all information assembled from the questionnaires is entirely confidential and anonymous and will be stored securely by the primary investigators (ie. William M. Brown and Chris Moore).

Please read the following, which provides these details about the research project.

Purpose of the research project : To study economic decision-making. More information will be provided to you upon completion of the study on a debriefing form (e.g. why the study was done and how to find articles regarding this line of research).

Task requirements: You will be asked to play experimental games. For compensation for your participation will provide you with a credit point toward class grade. In addition you may have an opportunity to win money in lottery. Participation will take approximately 30 minutes. You may be contacted by the experimenter (William M. Brown) for a follow-up study. If you do not wish to be contacted please do no leave your phone number.

Hazards, risks, inconveniences, or benefits associated with participation: One inconvenience is that you may be contacted at home by the experimenter for a follow-up study. You do not have to participate in the follow-up if you do not want to. Benefits include experiencing the process of research, contributing to the objectives of the study and learning more about the purpose of the research at the end of the study. Please sign below to confirm that you understand the information provided above, and that you are aware that your self-report scale scores are kept entirely confidential, and that you may discontinue participation

at any point in the study and still receive your credit point. Furthermore if you wish to participate as an observer you may and still receive a credit point. Specifically if you want to observe (but not participate as a subject) to view how I conduct an experiment please feel free to do so for 1 credit point. Please make inquiries to address any question you may wish to the investigator either now or after you have participated. Individuals with specific ethical concerns should contact either the staff member responsible or a member of the Office of Human Research Ethics and Integrity of Dalhousie University (902-494-1462).

Participant's signature:_____ **Researcher's signature:**_____
PHONE#: _____
Date:_____

DEBRIEFING FORM (FOR STUDY FIVE)

Thank you for your participation in this research. This study attempted to determine if people scrutinize social emotions (e.g. concern for others) in dictator games. Dictator games are a reource allocation game have previously been used to show that individuals differ with respect to altruism in one-shot situation. We wanted to know if players deliver more resources (in your case lottery tickets) to fictitious individuals who appear altruistic. In addition we wanted to know if asymmetrical smiles affect resource allocations. Half of you received icons with symmetrical smiles; while the other half received icons with asymmetrical smiles. Individuals with symmetrical smiles are more to be experiencing positive emotion. If people can detect presence of prosocial emotions they may base future interactions with altruists upon this identification. This study attempted to investigate this question.

Chris Moore and William M. Brown will keep all information you provided strictly confidential. I would like to thank you again for participating in this study and should you wish to know the results of this research or have any questions or concerns, please do not hesitate to contact me (William Brown) or Chris Moore at the Department of Psychology at Dalhousie Univeristy. Should you wish to learn more about altruism, selfishness and nonverbal behaviour here are some references:

Hoffman, M.L. (1981). Is altruism, part of human nature? Journal of Personality and Social Psychology, 40, 121-137.

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