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The Importance of Direct, Indirect and generalised reciprocity compared within children

Altruism can be defined as a behavior that is beneficial to the recipient but costly to the donor (Trivers, 1971). A key mechanism used to explain this idea is reciprocation; this is when the donor receives immediate costs and delayed benefits that are dependent on the future behaviour of the recipient whilst the recipient gains immediate benefits (Schino & Aureli, 2009). Via reciprocal altruism the costs and benefits of the act are balanced over time, resulting in an evolutionary stable strategy among non-genetically related individuals. 3 types of reciprocity are important and discussed for this research: Direct reciprocity states that an individual carries out altruistic behaviour as they know they are likely to have this behaviour directly reciprocated towards them by the recipient over time. This is based on a tit-for-tat trade and is the most common form of reciprocation. Direct reciprocity can only work however if the probability of individuals meeting again is beyond the cost-to-benefit ratio of the altruistic act (Nowak, 2006). A disadvantage of this form is that individuals need to remember and recognise their partner and the outcome of the previous encounter, which involves cognitive demands in order for it to work or the same partners need to interact for a long period of time (Dugatkin, 2002). Another disadvantage is the ability for the recipient to cheat and choose not to reciprocate the behaviour leaving the donor in a costly position. The final two types of reciprocity involve the reciprocal exchange network to increase to 3 or more. Indirect reciprocity relies on the idea that acting altruistically will enhance the individual's reputation and therefore increase the chance of receiving an altruistic act from an individual other than the recipient of the altruistic act. The donor and recipient therefore do not have to meet again unlike with direct reciprocation. Simple forms of this behaviour is seen to be found in animals (Bshary 2006) in comparison however Majolo et al (still under reviews) found no form of this behaviour within macaques. This can be explained by the substantial cognitive demands needed to carry out such behaviour therefore resulting in only humans being able to fully engage in it. Generalized reciprocity states that an individual who receives an altruistic behaviour will be more likely to carry out a altruistic act towards the former donor or a third party, there is limited evidence for generalized reciprocity however evidence of all these 3 types of reciprocity in humans exists.

Under indirect reciprocity support is given to individuals, who have helped other individuals, theorists have only recently shown that indirect reciprocity can evolve through image scoring. Nowak & Sigmund 1998 showed that the strategy of helping those who have helped others could evolve to fixation in the population. These predictions were tested by Wedekind and Milinski (2000) who used an image scoring task where participants were able to donate to and receive money from others. They carried this out anonymously however the players giving or not giving was displayed at each interaction. Results found that those who donated more to others in earlier interaction were significantly more frequent to gain donations, providing evidence of indirect reciprocation. A disadvantage of such research however is the lack of ecological validity; this could result in the findings not being a true representation of reciprocation within everyday lives. Alongside this disadvantage as participants were all sat within the same room conversations could occur individuals may portray their moves via their facial expression again reducing the validity of the results, to improve this each participant should have been placed in separate rooms to make sure no interactions were occurring. The robustness of Nowak and Sigmund's predictions were questioned by Leimar and Hammerstein 2001, although they agreed indirect reciprocity could evolve in principle they discussed serious problems with image scoring strategies. They argue if individuals followed the image scoring rule, refusing to help an individual with a low image score then they would suffer from not being helped themselves therefore resulting in lowering their own image score. Leimar and Hammerstein 2001 suggest that a more superior method than image scoring is Sugden's 1986 strategy of aiming for good standing, which is an evolutionary stable strategy. The research proposed however will be using a similar method to that of Wedekind and Milinski (2000) but instead of money toys will be used as the resource, and the study will be carried out within the Childs school which will be a more natural environment

Current Research was carried out into the use of direct, indirect and generalised reciprocity within human adults. The aims of this study were similar to above: to analyse and compare the importance of direct, indirect and generalised reciprocity within human adults and to compare this data against data gathered by Dr. Majolo on macaques to look into the importance of cognitive abilities. A computer programme was used, the resource used was minutes with participant being told the more minutes gained the quicker they can leave the experiment. Each experiment involved 4 participants, a donor a recipient and two other participants. 2 different conditions were used, condition 1 aimed to force participants to have to choose among direct indirect or generalised reciprocity and condition 2 aimed to see if participants

discriminated among these. Data gathered from each trial will consist of whether participant A, B and C gave any minutes to other participants, which participant and how many bases on the initial decision made by D. Results have not yet being analysed as further data is being gathered during a summer scientist week held at the university that is going to be added to this data. However we are predicting that due to humans having a greater cognitive ability they will take part in all of the three forms of reciprocity which would therefore contrast to the previous data gathered on macaques. Direct and indirect reciprocation would be expected to be occurring more than generalised. Some quick temporary analysis was however carried out showing that participants exchanged the resource according to direct and indirect reciprocity but not according to generalised reciprocity

The project ran for a total of 8 weeks however initial communication with the schools was made a few weeks prior to the beginning of this to make sure permission was in place from the Head of the school in order for the research to take place. Participants aged between the ages of 5 to 7 were used. Firstly modified consent forms used for the previous research on adults was handed out to the children's parents was carried out. A literature review and modification of Wedekind and Milinski (2000) design method was also carried out in order to make it suitable for the research here. Collection of data then occurred within the schools, using a special room that was set up for psychological research. The method used allowed testing of up to 15 children a day however we allowed for testing on average about 5 a day which would allow all data to be gathered within 12 days. Two schools were used Killingholme Primary school and Welton St Marys school in Lincoln. Stata version 10.0 will be used in order to carry out a variety of generalised mixed models for the data analysis stage. A write up of the research has now began to take place. Further data however was to be gathered from the summer scientist week by myself in order to gain more participants for broader results .

## References

- Dugatkin, L. A. (2002). Animal cooperation among unrelated individuals. *Die Naturwissenschaften*, 89(12), 533-541.
- Leimar, O., & Hammerstein, P. (2001). Evolution of cooperation through indirect reciprocity. *Proceedings Biological Sciences / the Royal Society*, 268(1468), 745-753.
- Majolo B, Aureli F. & Schino G. (2011) The relative importance of direct, indirect and generalized reciprocity. Under review
- Nowak, M. A., & Sigmund, K. (1998). Evolution of indirect reciprocity by image scoring. *Nature*, 393(6685), 573.
- Schino, G., & Aureli, F. (2009).  
Reciprocal altruism in primates: Partner choice, cognition, and emotions. *Advances in the Study of Behaviour*, 39, 45-69.
- Trivers, R. (1971). The evolution of reciprocal altruism. *The Quarterly Review of Biology*, 4(1), 35-57.
- Wedekind, C., & Milinski, M. (2000). Cooperation through image scoring in humans. *Science*, 288(5467), 850.