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An independent academic psychologist, based in England, who has written extensively on different areas of psychology with an emphasis on the critical stance towards traditional ideas.

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1. EVOLVING UNDERSTANDING OF EVOLUTION AND CO-OPERATION

1.1. CO-OPERATION

Taborsky et al (2016) stated: "If a co-operative behaviour results in net fitness benefits to the actor, irrespective of the behaviour of the interaction partner, ie: if the benefits of acting outweigh the costs, the behaviour will be selected irrespective of its potential fitness effects on the partner" (pp1-2) [1]. Where individuals interact in this way, it is called mutualism (ie: all parties benefit) [2], and it is distinct from altruism (or co-operation) (defined as "a behaviour by which an individual (actor) benefits some else (receiver(s)) at some immediate cost to itself"; Taborsky et al 2016). Mutualism is not a challenge to evolutionary theory, whereas altruism/co-operation is.

[1] Co-operation can also be with people in the future (appendix 1A).
[2] Bshary et al (2016) preferred to use mutualism to describe mutual helping between member of different species.

Altruism and co-operation could persist if there are "correlated pay-offs" (ie: "the fitness effects of actor and receiver are somehow positively correlated"; Taborsky et al 2016) [3], and this is seen in (Taborsky et al 2016):

a) Genealogy - shared genes of co-operators;

b) "Green-beard effect" (eg: Gardner and West 2010) - traits that identify the bearers of "altruism genes". However, this idea "has been questioned on theoretical grounds and its prevalence is currently unclear" (Taborsky et al 2016);

c) Reciprocity - help returned in the future [4]. Concurrent reciprocity (or co-action), as in an exchange of commodities, reduces the risk of cheating (appendix 1B), but where there is a time delay between giving help and receiving it, previous experience is important. There are three possibilities here (Taborsky et al 2016):

i) Generalised reciprocity - "help anyone if helped by someone". Also called "upstream tit-for-tat" [5], "upstream indirect reciprocity", "serial reciprocity", "upstream reciprocity", or "pay-it-forward reciprocity" (Taborsky et al 2016).

This behaviour has been reported in domestic dogs and capuchin monkeys, for example, and in relation to the behaviours of co-operative hunting and mutual vigilance (Taborsky et al 2016).

ii) Direct reciprocity - "help someone who has helped you before" [6]. For example, a meta-analysis of studies of social groups of fourteen species found that direct reciprocity had a stronger influence on allogrooming (social grooming) than kinship (Kokko et al

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[3] There is also "synergism", where "the total effect of individual actions is greater than the sum of the individual effects" (Taborsky et al 2016).

[4] Taborsky et al (2016) emphasised that reciprocity was not more important than the other two "mechanisms" in the evolution of co-operation, nor than mutualism.

[5] Tit-for-tat (Axelrod 1984) is where in situations of multiple interactions over time, mimicking the opponent's previous decision is rational. This tends to encourage co-operation because a person who defects knows that there will be retaliation (King 2015).

To cover more complex situations (as in real-life rather than in experimental games), Nowak (2011) referred to "generous tit-for-tat", which involves forgiving some defections in a long-term relationship, and this takes account of occasional mistakes as in the real world. He also proposed "win stay, lose shift" (ie: "if I am doing well then I'll repeat my move, and if I am doing badly, I'll change my move"; King 2015), which is effective except with continual defectors (King 2015).

[6] In an one-off situation with no knowledge of others and no future reputation to worry about, rational thinking promotes defection/non-co-operation. For example, in the "Wolf's Dilemma" (Hofstadter 1985), individuals are placed in separate rooms and told to wait twenty minutes when they will each gain £1000, say. But any player can press a button before the twenty minutes is up, and they will receive £900 and everybody else nothing (King 2015).

2001) [7].

iii) Indirect reciprocity - "help someone who is helpful". This requires the reputation for being helpful to be signalled publicly.

Experimental work has investigated the conditions for reciprocity - namely, the cost of helping is low, the benefits to the receiver are high, and the opportunity for reciprocity are frequent (Taborsky et al 2016).

- Cost of helping - eg: Schneeberger et al (2012) (appendix 1C) varied the effort involved for a Norway rat to help another rat obtain food, and in situations of high effort, "the rats distinguished much more precisely between prospective receivers that had helped them before from those that had not" (Taborsky et al 2016).

- Benefits to receiver - eg: Rutte and Taborsky (2008) found that Norway rats who shared attractive food received back more food than donors of unattractive food.

- Frequency of interactions - eg: allopreening (social preening) in buff-breasted wrens greater in stable social groups (Gill 2012).

Cognitive ability is an important constraint on reciprocity. "Indirect reciprocity requires individual recognition of social partners as well as a reputation mechanism based on the performance of social partners when interacting with others, and hence complex social memory" (Taborsky et al 2016 p8). Direct reciprocity requires the recognition of individuals, while generalised reciprocity the ability to remember if helped or not in the past by anybody (Taborsky et al 2016).

Reciprocity does not have to be for the same behaviour. For example, wild vervet monkeys who received food paid back by grooming the donor (Fruteau et al 2009).

Rodrigues and Kokko (2016) emphasised the importance

[7] A variation is "partnership" (Eshel and Shaked 2001), where two individuals help each other as it is in the best interests to do so over the longer term, because, "put simply, it is very difficult to behave reciprocally if one is dead" (Rodrigues and Kokko 2016). But this is influenced by the availability of new partners. "If finding partners is easy, then levels of cooperation fall: put bluntly, there is not much point in keeping a team mate alive, if a new one appears as soon as the previous one dies. This leads to a feedback where the effort spent to keep others alive can drop further precisely because it is no longer important to keep only moderately helpful partners alive and well (the relative benefit of being in a team, compared with being alone, having already decreased)" (Rodrigues and Kokko 2016 p7).

of two questions in understanding the models of the evolution of co-operation - who helps whom, and what does the recipient achieve with the help given (ie: "which life-history traits of the helped individual are improved")? Answers to the first question can be divided into peer-to-peer co-operation (two equal individuals), offspring helping their mother, subordinate helping a dominant, and offspring helping a sibling. Answers to the second question include the recipient's fecundity is increased, their survival is prolonged, and/or their fitness is increased. For Rodrigues and Kokko (2016), the increased survival of the recipient is often downplayed in favour of increased fecundity in models.

"Helpers feeding the dominant's young in the nest may simply enable the dominant to work less hard, which then can allow energetic reallocation towards self-maintenance or fewer risks taken during foraging. Either way, the dominant lives longer as a result of load-lightening" (Rodrigues and Kokko 2016 p4). This has been observed in red-cockaded woodpeckers (Khan and Walters 2002), for example, and it makes sense if the helper is related to the dominant.

1.2. KIN SELECTION AND RECIPROCITY

So generally, co-operative behaviour could evolve to help kin (ie: those who shared genes - kin selection or genetic assortment explanation) or through reciprocity (ie: response to the action of the other, including punishing free-riders/non-co-operators - reciprocal altruism or response strategy explanation) [8].

But Quinones et al (2016) noted that "the two mechanisms are not mutually exclusive and, in fact, often act simultaneously. Moreover, the co-existence and collaboration of both related and unrelated individuals within breeding groups is widespread in social animals" (p2).

The presence of both types of individuals can be a problem. For example, Marshall and Rowe (2003) argued that the presence of kin weakened the evolution of reciprocal altruism because retaliator punishment for non-co-operators could not exist. The risk of punishing kin would be too great.

Quinones et al (2016) used the example of the co-operative breeding daffodil cichlid (Neolamprologus pulcher), where a dominant breeding pair is helped by

[8] Schonmann and Boyd (2016) argued that human co-operation evolved as a result of contingent punishment (ie: punishing non-co-operators) rather than due to contingent or reciprocal co-operation. Punishment of non-co-operators is at a cost to the punishers, and it requires a certain number of individuals in the group to do it for co-operation to dominate.

related and unrelated subordinates. The "pay-to-stay" explanation (eg: Bergmuller and Taborsky 2005) proposed that the dominant pair allow an unrelated individual to stay in their territory in exchange for providing help, like nest maintenance. Survival is limited for "floaters" (ie: individuals who do not live on a territory).

Quinones et al (2016) summed up: "Selection thus favours the evolution of responsive negotiation strategies that enable helpers providing more help to avoid the cost of aggression by appeasing the breeder, while allowing breeders to profit from the help induced by the threat to impose costs through aggression. The appeasement of aggression leads to an evolutionarily stable equilibrium in the population at which the breeder enjoys a net benefit from the presence of a helper. Moreover, because the mere threat of aggression suffices to secure help, the realised level of aggression during interactions is low. Thus, the two partners reach a compromise that satisfies their mutual interests" (p6).

The only alternative evolutionary stable strategy would be highly related individuals who helped because of kin selection, according to mathematical models used by Quinones et al (2016).

1.3. THEORETICAL IDEAS

Public goods games offer an individual a trade-off between investing their limited success in a public good for all or in their own private good [9]. In other words, the amount of altruism versus selfishness. A real life example would be a communal living animal like a meerkat deciding how much time to watch for predators (public good) and how much time to forage for food (private good).

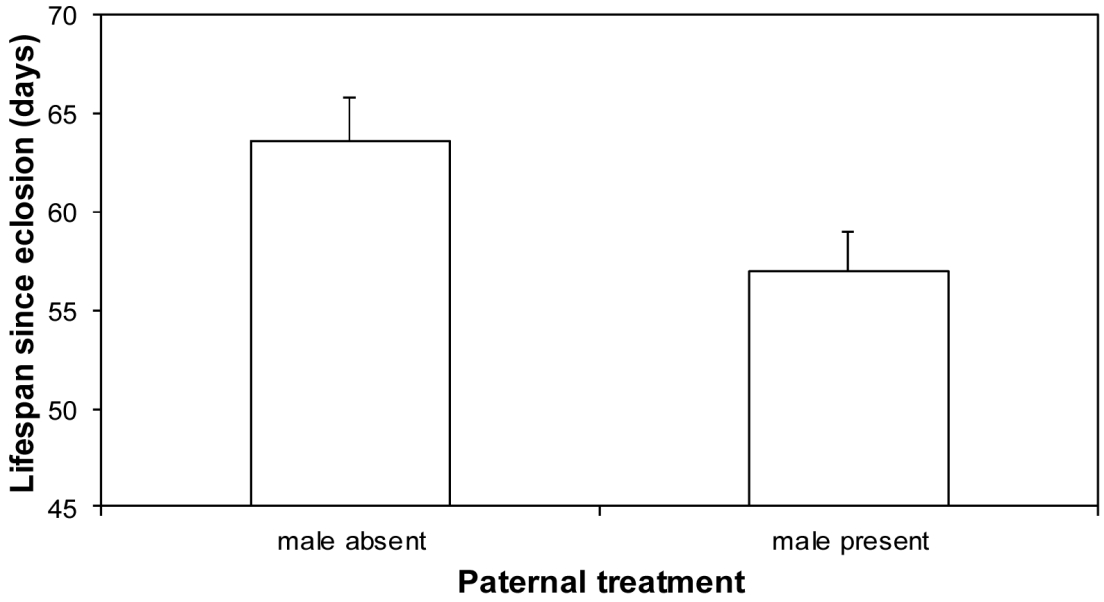
Fischer (1988) described the example of egg trading in the simultaneously hermaphroditic hamlet fish. Partners alternate between releasing an egg and fertilising an egg until all eggs of both partners are fertilised. This co-operation is inefficient, but the best strategy. If one partner released all their eggs in one go, the other partner could fertilise them and then leave to find another partner with eggs. But pairing occurs in the late afternoon, which limits the opportunities to find another partner, and so co-operation is the best self-serving strategy for both partners (Bshary et al 2016).

[9] Zak et al (2007) found that individuals were more generous in games like this after receiving oxytocin. But Wiseman (2016) questioned whether the oxytocin made the individuals more generous or more risk adverse (Keats 2016).

Biparental care is also an example - how much time to spend caring for joint young (public good) versus foraging for themselves or mating again (private good) (Johnstone and Rodrigues 2016).

Traditionally, it is assumed that in uniparental care, the parent who leaves benefits and "that the individual that remains does so because he or she has been caught in a 'cruel bind'. Departure, in other words, is interpreted as the 'selfish' or 'exploitative' option" (Johnstone and Rodrigues 2016 p8). But Johnstone and Rodrigues (2016) offered an alternative take with reference to resource competition - one parent leaving is beneficial to the caring parent because there are more resources available for themselves and the young (ie: the leaving parent is no longer competing for food, say) [10].

A study of burying beetles (Necrophorus vespilloides) (Boncoraglio and Kilner 2012) provides support for this idea. Female beetles lived longer if they were deserted by males during the period of care for offspring than if the males stayed (figure 1.1). The researchers manipulated the presence or absence of a male during the period of the female caring for the offspring.



(Source: Boncoraglio and Kilner 2012 figure 1)

Figure 1.1 - Mean lifespan of females (days) when a male present or absent during care [11].

[10] Developing statistical models of co-operation, Johnstone and Rodrigues (2016) used the terms "pseudo-reciprocity", where "one individual invests in another to acquire or enhance benefits that are a side-effect of behaviour by the latter that is of immediate, selfish benefit even in the short term" (p7), and "pseudo-relatedness" ("a measure of the extent to which a focal individual benefits from an increase in others' resources (compared with an increase in its own)" p7).

[11] Eclosion = time since larva.

It seems that the mother alone can "recoup the costs of care by feeding from the carcass themselves, whereas the presence of a male throughout the breeding attempt prevents this, perhaps through competition for food" (Johnstone and Rodrigues 2016 p8). Put another way, "females may have co-evolved to anticipate desertion by their partners so that they now benefit from the male's absence" (Boncoraglio and Kilner 2012).

Burying beetles lay eggs in a carcass and stay there for eight days during the caring period (ie: with limited food supply).

Bshary et al (2016) suggested that helping that is a by-product of an interaction could evolve into more structured co-operation where individuals "work" to be chosen as a partner (eg: showing that individual is a "good co-operator"). The growing importance of "partner monitoring" leads to greater co-operation as more has been invested in the interaction. Individual vying to be "good partners" is a "biological market" (appendix 1D). So, "any interaction that starts out as by-product benefits... has the potential to evolve into a system that involves specific investments with the sole purpose of being chosen as a partner, as soon as the system involves a biological market. Under such circumstances, stable investments can be achieved through the threat of partner switching,... individuals invest because it would otherwise be in the self-interest of the partner to stop the interaction and switch to a different individual" (Bshary et al 2016 p5).

1.3.1. Socially Imposed Monogamy

Many historically known small human societies were polygynous, whereas socially imposed monogamy (SIM) is the norm in larger residential groups today (ie: the recent millennia) (Bauch and McElreath 2016). SIM involves the punishment of individuals who violate the social norm (non-co-operators). This punishment could include not mating with them which is also costly to the punisher [12].

How to explain the transition from polygyny to SIM? The hypotheses include female choice, male power dynamics, technological impacts, cultural group selection (appendix 1E), and pathogen stress (Bauch and McElreath 2016). Though multiple explanations may be involved, Bauch and McElreath (2016) noted that "hypotheses stressing individual benefits face the obstacle of

[12] "However, costly punishment is susceptible to 'second-order free-riding', whereby non-punishers can reap the benefits created by punishers, without having to pay the costs of punishing" (Bauch and McElreath 2016 p2).

explaining costly social imposition, and hypotheses that stress group benefits must overcome individual incentives against costly punishment. The timing of the emergence of socially imposed monogamy — with the advent of agriculture and larger resident populations — also requires explanation" (p2).

Bauch and McElreath (2016) argued that bacterial sexually transmitted infections (STIs) were key in the emergence of SIM "by making costly punishment of non-monogamists advantageous to punishers at individual and group levels of selection" (p2). Prior to anti-biotics, for example, STIs could lead to infertility, and would be widespread in larger groups. So, "groups with individuals who enforce monogamous social norms and thus maintain low within-group STI prevalence may outcompete polygynous groups, who suffer reduced population size from STI health burdens. Such interaction between group size, disease dynamics and social norms may have contributed to the association of monogamy with large, integrated agricultural societies" (Bauch and McElreath 2016 p2).

1.3.2. Co-operation and Competition

Living in a group, a rapid decision is usually required by individuals as to whether to co-operate or compete with another person. This may include both of these simultaneously and with the same individuals, and involves recall of previous interactions. Platt et al (2016) believed that "natural selection has favoured individuals that are equipped with the cognitive architecture to navigate a social world in which they must make rapid decisions about when to compete and when to co-operate and when and whether to involve themselves in a given social interaction" (p1).

An experimental example shows both behaviours. A male rhesus macaque had the choice to give or withhold juice from another macaque. When the chooser could reward himself as well, he tended to be selfish (ie: withhold from other), but the chooser got nothing, he tended to co-operate (ie: give juice to other monkey) (Chang et al 2013).

Platt et al (2016) looked at studies with Old World monkeys in the context of co-operation and competition together. For example, a long-term study of baboons found that females with the best reproductive success (ie: offspring survival and longevity) were those with the strongest bonds to other females (Silk et al 2003). A similar idea has been reported for males in other primates (eg: Barbary macaques, chimpanzees) (Platt et al 2016).

What is the cognitive architecture supporting co-operation here? Memory is key, along with the ability to

make adaptive decisions. A small number of studies have been able to scan the brains of monkeys. Sallet et al (2011), for instance, used structural magnetic resonance imaging (MRI) with male rhesus macaques after they had lived in experimentally manipulated social groups of different sizes. There was an association between size of social group and the density of certain brain areas (including the rostral prefrontal cortex and the amygdala). Similar brain areas had been found to correlate with number of Facebook friends in a human study (Kanai et al 2011).

Overall, a variety of brain areas are involved in social perception and interactions, and many of them are distinct from general perception (Platt et al 2016).

The difference between monkeys and humans may also show how co-operation evolved. A key difference is the ability to attribute mental states to others and to understand them (ie: theory of mind). Monkeys show aspects of this, like gaze-following, but lack the amount seen in humans (Platt et al 2016).

Platt et al (2016) summed up: "non-human primates appear to be highly motivated to attend to each other's social interactions. They recognise not only other individuals' relative dominance ranks and social relationships, but also the nature and quality of recent interactions and the value of particular partners. These cognitive skills enable individuals to establish strategic social bonds that, in turn, enhance fitness. Evidence suggests that, early in the evolutionary history of primates (and perhaps many mammals), selection favoured the development of genetic, neural and hormonal mechanisms that promoted not only competitive, but also cooperative, behaviour" (p7).

The evolution of co-operation to aid social living makes sense because a social group "offers safety and security, supports offspring survival, reduces the need for energy expenditure, and provides a stage for social reward" (Matthews et al 2016 p617). The alternative is social isolation. Social animals are motivated to find and engage with others after a period of isolation. Matthews et al (2016) reported changes in dopamine neurons in the dorsal raphe nucleus in the brain of mice after 24 hours of social isolation and in subsequent social contact. These neurons appear to be "a neural substrate for a 'loneliness-like' state" (Matthews et al 2016).

1.4. INDIVIDUAL VARIATION

Co-operation between individuals is challenged by the presence of defectors or non-co-operators in a group,

and "a crucial aspect of the evolution of co-operation is how strong the assortment between co-operators is; in other words, how probable it is that co-operators interact exclusively with co-operators and defectors only with defectors" (Barta 2016 p1). A high level of assortment can occur with kin discrimination, limited dispersal, partner choice, and direct and indirect reciprocity, for example (Barta 2016). The "mechanisms" of assortment also evolve, so what is their relationship to the evolution of co-operation, asked Barta (2016)?

Variation between individuals is important as the "existence of variation in the social environment opens up new behavioural options for individuals which in turn may result in new selective forces. For instance, in a uniform population it is not worth choosing between possible partners because they are all the same. On the other hand, it may pay off to be choosy in a variable population because, for instance, it can be worth leaving a below-average partner as there is a good chance of finding a better one" (Barta 2016 p2).

Inter-individual variation can occur in different ways, including through (Bara 2016):

i) Random mutations.

ii) Differences in an individual's state (eg: parasite load, level of aggressiveness).

iii) Task specialisation (eg: males provide food and females protect nest).

McNamara et al (2004) computer modelled an infinite population following an "exit strategy" (Aktipis 2004) (ie: finish an interaction as soon as a partner defects) in Prisoner's Dilemma. In a population with low inter-individual variation, defection was likely to happen and so players pre=emptied this and defectors "evolved". But in a population with high variation, co-operation "evolved". Because individuals did not know the behaviour of the partner, they tended towards co-operation (ie: did not pre-emptively defect) (Barta 2016).

McNamara et al (2008) added partner choosiness to their model, and found that non-choosiness and defecting was the evolutionary stable system with low inter-individual variation, whereas co-operation and choosiness "evolved" in populations with high variation. This showed "how co-evolution between assortment (choosiness) and helping leads to the emergence of stable co-operation" (Barta 2016 p3).

Using the example of food sharing, Whitlock et al (2007) produced a model where individuals with a high level of resources give to individuals with a low level

of resources. Thus, "reciprocal food sharing can be evolutionarily stable if an individual's level of resources changes frequently and unpredictably" (Barta 2016 p4). But more than that, Barta (2016) stated: "Individuals share food if they have high reserves, but they can only have high reserves if they have previously received food; in other words, they only help if they have been helped previously. Under this strategy, it is not important who provides help and who is the recipient. The only important point is that high reserves signal a co-operative social environment. It follows that food sharing in this setting can be considered a form of generalised reciprocity, rather than direct reciprocity" (p4).

An individual's reputation (for co-operating) is another relevant individual variation (Barta 2016).

1.5. CO-OPERATIVE COURTSHIP

Co-operative courtship is a behaviour that makes sense with inclusive fitness (or kin selection) theory (Hamilton 1964). This theory focuses on the "gene's eye view" rather than the individual. For example, a mother who sacrifices herself for her three offspring means that 1.5 times her genes continue (ie: the offspring have half her genes, times three), which is better at the gene level that her survival at the expense of the offspring (individual level).

Male wild turkeys defend small territories which females visit to mate (lek-like mating system). Usually males are alone, but sometimes they work as pairs. The pair, though, often includes a dominant male who gets most or all the matings, and the subordinate who has a few or even no matings (Krakauer 2005). This is co-operative courtship, but what is the benefit for the subordinate male of the pair? If the pair are brothers, then some of the subordinate's genes are been passed into the next generation by their brother's mating. It has been mathematically calculated that being a subordinate to a successful dominant can be more evolutionarily beneficial than being alone (eg: 70% of single males did not reproduce; Krakauer 2005) (Akcay and Van Cleve 2016).

But in species with a strict dominance hierarchy or class structure, co-operative courtship could evolve between non-related males (Akcay and Van Cleve 2016). For example, in occelated wrasses (Symphodus ocellatus), satellite males help the territorial males defend their territory and attract females (Taborsky et al 1987). Satellite males are too small to have their own territory, so any possibility of mating is better than none (Akcay and Van Cleve 2016).

1.6. HUMAN CO-OPERATION

Silk and House (2016) compared three hypotheses for the evolution of human co-operation:

(i) Human co-operation is "built on the same evolutionary foundations as cooperation in other animal societies – kin selection, contingent reciprocity and mutualism – and that fundamental elements of the social preferences that shape our species' co-operative behaviour are also shared with other closely related primates" (Silk and House 2016 p1).

Silk and House (2016) summed up the evidence:

a) Primates generally - Co-operation is, firstly, between kin, then reciprocating partners, and, finally, coalitions between males, but "there is no evidence for co-operation among unfamiliar individuals from different groups that do not have a prior history of association" (Silk and House 2016 p2). There is also little evidence of "third party punishment" (appendix 1F) (ie: A punishes B for stealing food from C), which is a form of altruism (ie: it is costly to A and beneficial to C). "Second party punishment" is common (ie: A punishes B who has stolen food from them) (Silk and House 2016).

b) Chimpanzees specifically - The Pro-Social Test (Fehr et al 2008) was developed to test the concern for others. Chimpanzees have a choice between food for themselves and for a cage neighbour (1/1 option) or just food for themselves (1/0 option). If chimpanzees have concern for others, they will choose the 1/1 option when a neighbour is present and the 1/0 option when not. In a variety of experiments (with different chimpanzee populations and other primates) this is not the case. There is discussion about the methodology as too complex, for example.

Silk and House (2016) discussed this explanation of the evolution of human co-operative: "Both naturalistic observations of social behaviour and experimental investigations of social preferences suggest that there are important differences between humans and other primates in the form, scope and scale of co-operation, and the psychological mechanisms that motivate individuals to help others. In the wild, primates co-operate in a relatively limited number of contexts, do not incur high costs when they provide services to others, show strong biases in favour of kin and reciprocating partners, and limit co-operative activities to pairs or small groups of familiar group members. Chimpanzees and other great apes do not consistently provide benefits to others in the Pro-Social Test, suggesting that co-operation may not be motivated by

generalised preferences for outcomes that favour others" (p4).

(ii) Co-operative breeding hypothesis - General co-operation developed from the selective pressures favouring co-operative breeding. "Convergent evolution has produced a common set of behavioural dispositions and social preferences in co-operatively breeding primates and humans" (Silk and House 2016 p1).

It is suggested that hominin mothers needed the assistance of other group members in rearing their offspring because food needs are more complex and demanding than other apes, and the infant is slow-growing. Hrdy (eg: 2005) proposed that these pressures led to the evolution of empathy and "a more fully developed theory of mind" (Silk and House 2016).

Burkart et al (2014) compared fourteen non-human primate species and found a correlation between co-operative breeding/alloparental care and pro-sociality.

But Silk and House (2016) were not convinced: "the form of co-operative breeding that has evolved in callitrichid primates [eg: marmosets] and other co-operatively breeding mammals seems to be quite different than the form of cooperative breeding that has evolved in humans" (p5). They argued that co-operative breeding is associated with large litters, for one breeding pair in a group of highly related individuals. Hunter-gatherer societies are not like that (eg: in 32 such societies relatedness was low; Hill et al 2011).

(iii) Cultural group selection hypothesis - Collaboration, group-level co-operation and altruistic social preferences are "linked to our interdependence and capacity for culture" (Silk and House 2016).

Silk and House (2016) preferred this explanation, as humans rely on culturally transmitted information more than other animals. They stated: "Reliance on complex foraging techniques may have favoured economic interdependence within groups. If subsistence skills are difficult to master, it may be profitable for individuals to specialise in particular tasks, and to exchange the products of their efforts. Sexual division of labour is a universal feature of human foraging societies, as men mainly hunt and women mainly gather" (p6). Such complex techniques favour culturally transmitted information (ie: social learning), and the development of social norms. Hence, the punishment in groups of non-co-operators.

"Social learning may have enabled early hominins to acquire useful knowledge from skilled or prestigious

group members, make incremental improvements through trial and error or insight of their own, and pass their accumulated knowledge on to others. This kind of cumulative cultural change can give rise to complex habitat-specific adaptations much more rapidly than genetic evolution can, but it has the additional consequence of causing local populations to evolve toward different equilibria. It is likely that as cultural adaptation became more and more important, the amount of variation among human groups also increased" (Silk and House 2016 p6).

A key piece of evidence is that cultural variations in co-operation (ie: social norms) appear in middle childhood (6-8 years old), "a time when children seem to become sensitive to social norms within their communities" (Silk and House 2016). For example, House et al (2013) compared children aged three to 14 years old from six different societies in sharing games (like the Pro-Social Test or Dictator Game). In the latter case, one individual is given a sum of money, which they can share as they wish with another person. Those in middle childhood tend to share the amount similar to the cultural norms (ie: adults) of their society (Silk and House 2016).

West et al (2011) listed issues with studying the evolution of altruism and co-operation in humans, including:

- Definition of altruism - altruism has no fitness benefits to the donor, but some studies include behaviour that does benefit them.
- Co-operation is not automatically altruism as it can be mutually beneficial.
- The applicability of one-shot economic games to real life.

1.6.1. Reputation

Co-operation depends upon predicting the other person's behaviour, and thus trust. In the trust game, which involves two players, a "sender" is given an amount of money, say, £10. They are free to give as much as they want to the "receiver". The amount given will be tripled, say, and the receiver can then share as much as they want with the sender. A co-operation example would involve the sender giving all the £10 to the receiver, it becomes £30, and the receiver returns £15. Both parties share equally (Milinski 2016). But can the receiver be trusted to do something like that?

Key to answering this question is "a universal currency" of reputation, knowledge of which can be acquired in a direct interaction or indirectly (eg: through gossip) (Milinski 2016). In the latter case, A helps B, and C hearing of this, helps A. In experiments using games involving donations of small amounts of money, players with a reputation for giving received more than individuals without such a reputation (eg: Wedekind and Milinski 2000).

In experiments where the anonymity of players is varied, "knowledge of being recognised... motivated players to invest in their reputations" (Milinski 2016).

Milinski et al (2002) asked players if they wanted to give a donation to UNICEF before the experimental games started. Those who gave to the charity received donations from other players in the game whereas non-givers did not. But this was only the case if donation to UNICEF was made public knowledge.

The reputation or "standing" of an individual is not damaged by failing to help or donate to a player with a negative reputation (ie: for not helping or donating) (Milinksi 2016).

The "competitive helping" hypothesis (Barclay 2011) predicts that individuals compete to be seen as more generous, particularly in the presence of attractive potential partners. Raihani and Smith (2015) tested this idea using online giving. The researchers made use of a website asking for sponsorship for runners in the 2014 London Marathon. Runners posted photographs of themselves along with details of their charity, and the amount pledged to the runners and the donor were public.

Competitive helping was found for male but not female donors. Males were more likely to pledge a larger amount than a previous male donor to an attractive female than to an unattractive one or a male runner.

Using a sample of 1800 male donors and 1295 female donors, it was found that a male donation after another male to an attractive female runner was four times greater than in other situations (eg: male after female donation or to an unattractive female) [13]. Focusing on donations above £50 (which gave 668 gender-identifiable individuals - 420 male and 248 female), the average competitive donation was £9.61 more the previous one, but the average was £28.35 more by a male after another male for an attractive female runner ($p<0.001$).

[13] Attractiveness was rated by over 1000 individuals online.

1.7. ANIMAL CO-OPERATION

1.7.1. Bats

Bats show behaviours with non-kin like foraging together and huddling for warmth, which can be explained as "by-product mutualisms" (ie: the outcome of selfish individuals' actions) or as "co-operative investments" ("that require time or energy and can be exploited") (Wilkinson et al 2016). But which behaviours are which? Wilkinson et al (2016) summarised the research, and here are some examples:

i) Roosting together - Large groups dilute the individual's predation risk (mutualism), bit some species appear to share roost site discoveries with calls and active leading of other individuals (co-operation).

ii) Co-operative foraging - Some species forage together, particularly "when hunting for unpredictable but patchy prey", both in discovering food patches and in defending or exploiting them (eg: greater spear-nosed bats call groupmates to rich food sources). But echolocation can be overheard (ie: eavesdropping the "feeding buzz"), which is viewed as social parasitism.

iii) Food sharing - Regular food sharing among adults has been observed in the three species of blood-feeding vampire bats. Around one-fifth of individuals do not obtain blood in a 24-hour period, and the risk of starvation is high as they have a limited amount of stored energy, so well-fed individuals will regurgitate blood to the bats in need. "Regurgitated blood sharing likely evolved from extended maternal care" (Wilkinson et al 2016 p3).

The sharing is not indiscriminate, and experiments to induce food sharing in captivity only succeed when the individuals have been together for months. "Hence, food sharing is biased towards familiar partners, which are often, but not always, related" (Wilkinson et al 2016 p3).

Carter and Wilkinson (2013) reported that prior food received was over eight times more predictive of donation than kinship. Non-kin can provide a "safety net" for when kin are not available (Wilkinson et al 2016). For example, Carter and Wilkinson (2015) prevented females from receiving blood from kin, and those individuals who had previously shared food with non-kin received more food.

Studies have taken pairs of bats that shared food, and prevented them from doing so to see what would happen when the pair could share again. The findings were mixed with some pairs refusing to share and other sharing (Wilkinson et al 2016). "These divergent responses

suggest that vampire bats do not follow a simple tit-for-tat rule and may use alternative strategies for dealing with non-reciprocation" (Wilkinson et al 2016 p3).

iv) Co-operative care of young - For example, pups fed by non-maternal females could be a by-product of "milk dumping" during excess production by the females (Wilkinson et al 2016).

On the other hand, Wilkinson et al (2016) reported co-operative care from their observations of over 4000 greater spear-nosed bats in caves in Trinidad between 1990 and 2015. A female would usually stay with the "creche" (all young together) while others foraged, and this included defending the young from females of other social groups in the same cave. The low reproductive rate and high infant mortality could explain this "babysitting" behaviour by lactating females only.

Wilkinson et al (2016) speculated that protecting non-kin young improved social thermoregulation (ie: huddling together for warmth), and so the mother's own pup benefits. There is a high degree of birth synchrony in a social group (ie: within a few days) which would support this idea.

The non-kin female spear-nosed bats lived in stable groups, which allowed the opportunity for reciprocity. Establishing such behaviour exists requires long-term studies, argued Wilkinson et al (2016).

Wilkinson et al (2016) concluded that "evidence for costly co-operative investments among non-kin remains relatively rare among bats", but it is there for longer-term field studies to find.

1.7.2. Wasps

Eusocial insects, like ants or bees, co-operate together because the individuals are closely related. Some workers are sterile and so can only gain indirect benefits from rearing the young of the related queen. Occasionally non-relatives are involved, but only because of mutual benefits (eg: defending the nest [14]). There is also "worker drifting", "where workers from one colony enter an unrelated colony, either strategically [social parasitism] or because they are lost" (Field and Leadbeater 2016).

Field and Leadbeater (2016) quoted the example of the European paper wasp (Polistes dominula), found in Spain, for example, where unrelated female subordinates or helpers rear the offspring of the queen or dominant at

[14] Known as group augmentation - direct benefits of being in a large group (Field and Leadbeater 2016).

the expense of their reproduction. One explanation for the behaviour is the possibility of "inheritance" of the dominant position [15], though small in chance, the pay-off in number of offspring would be high. Another possibility is the opportunity for subordinates to lay occasional eggs (which is more productive than being alone) (Field and Leadbeater 2016).

1.8. EVOLUTIONARY BENEFITS OF RELIGION [16]

Using cross-cultural data, Purzycki et al (2016) found that religious individuals were more willing to give money to a stranger from the same religion if the religion involved a moralising, knowledgeable, and punishing god(s). Moralising refers to the god(s) being concerned about good and bad behaviour, and knowledgeable is "aware of one's thoughts and actions" (Johnson 2016a) [17]. Johnson (2016b) has argued that belief in supernatural punishment for violating social norms is an adaptive behaviour for the development of social co-operation. For example, a papyrus manuscript from Ancient Egypt's "Book of the Dead" included the heart of an individual being weighed by a goddess of truth and justice (Maat) to decide on entrance to the afterlife or banishment to the underworld (Johnson 2016a).

Purzycki et al (2016) stated: "People may trust in, co-operate with and interact fairly within wider social circles, partly because they believe that knowing gods will punish them if they do not. Additionally, through increased frequency and consistency in belief and behaviour sets, commitments to the same gods co-ordinate people's expectations about social interactions. Moreover, the social radius within which people are willing to engage in behaviours that benefit others at a cost to themselves may enlarge as gods' powers to monitor and punish increase" (p327) [18].

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[15] Gadagkar (2016) used the example of an eusocial wasp (Ropalidia marginata) found in India, and found that the workers appeared to know who would be the next queen when the current one was experimentally removed. There was a peaceful transition, which Gadagkar (2016) could not explain. Summing up, Gadagkar (2016) stated that "a full understanding of the evolution of the entire suite of characters that define the R. marginata society will require consideration of several kinds of evolutionary forces, including individual, kin and group selection" (p6).

Wynne-Edwards (1962) was a great advocate of group selection, which suggests that "selection acts on social groups as whole entities rather on the individual members" (Barnard 1983 p315). Generally, group selection has been heavily criticised (Barnard 1983).

[16] Religion is a term that can mean different things (appendix 1G).

[17] Sometimes referred to as the "supernatural monitoring hypothesis" (Rossano 2007).

[18] "As societies grow in size, individuals are more inclined to breach norms of pro-social conduct by virtue of the anonymity afforded by greater social complexity. As such, in order for large-scale co-operation to develop and stabilise, cultural evolution would have favoured a diverse suite of psychological traits, institutions, and traditions that promoted such co-operation. One such factor

But not following self-interest because of such beliefs reduces individual evolutionary fitness and the beliefs should be eliminated by natural selection. The adaptive benefit is that inhibiting self-interest in a group both avoids retaliation and gains from the group co-operation (Johnson 2016a).

Purzycki et al (2016) recruited nearly 600 participants from eight diverse communities (table 1.1) around the world to play a version of the random allocation game (table 1.2). Playing alone, an individual is presented with two cups, a die with two colours, and thirty coins. They are told to allocate in their head a colour for one cup and then roll the die for each coin. If the allocated colour appears, the coin goes in the appointed cup, if not, in the other cup. There is no way of checking if the player is following the rules in their head, but if they are doing so, fifteen coins should be each cup at the end. In the self condition, one cup was nominated for the self, and the other to "an anonymous co-religionist living in a geographically distant community that does not regularly interact with the player's community" (distant co-religionist). in the local co-religionist condition, one cup was nominated to a distant co-religionist and the other to a local co-religionist ("an unspecified anonymous co-religionist from their local community").

After the game, individuals were questioned about their religious beliefs. Characteristics of god or gods were determined in different ways:

- Moralising - A free-list task asking about the concerns of god or gods, and a rating scale about the importance of punishing theft, murder and deceit to supernatural being(s). Thirteen categories emerged from free-list task - eg: morality, ritual, food.

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predicted to co-evolve with religious cognition is the cultural clustering of gods' increased knowledge of human thoughts, feelings, and behaviours ..., punishment, and moral concern; gods believed to know what one is doing and explicitly care about how one treats other people perceived as belonging to one's moral community (that is, co-religionists) likely soften the threats to cooperation and coordination inherent in ecological pressures and social complexity" (Purzycki et al 2016 supplementary information pp3-4).

Community	Country	Religion
Tanna Island (coastal & inland)	Vanuatu	Christianity/traditional mix
Hadzaland	Tanzania	Traditional
Lovu	Fiji	Hindu
Yasawa	Fiji	Protestant Christian/ traditional mix
Pointe aux Piments	Mauritius	Hindu
Pesqueiro	Brazil	Catholic Christian
Kyzyl	Tyva Republic (Russian	Buddhism/traditional mix

Table 1.1 - Communities involved in study and religion.

- Step 1: Choose one of these two cups in your mind.
- Step 2: Roll the die once.
- Step 3: The die has 6 sides, each of which is coloured by one of two colours. If the die lands with a black side facing up, you will put one of the coins in the cup you chose in your mind in Step 1. If the die lands with a white side facing up, you will put one of the coins into the opposite cup from what you chose.

(Source: Purzycki et al 2016 supplementary information p4)

Table 1.2 - Rules of game.

- Knowledgeable - A two-item choice as to whether the god(s) were or not - eg: "Can [name of god] see into people's hearts and know their thoughts and feelings?".
- Punishing - A two-item choice as to whether the god(s) were or not - eg: "Does [name of god] ever punish people for their behaviour?".

These measures were combined into a "punishment-knowledge" index, scored as 0, 0.5, 1 or don't know.

In the local co-religionist condition and the self condition, individuals who reported that their god punishes (index score = 1) allocated more coins to the distant co-religionist than individuals who did not know or had a god that does not punish (figure 1.2).

Purzycki et al (2016) noted that the study was only correlational, but they were unsure about what third variable might account for the correlation. They stated:

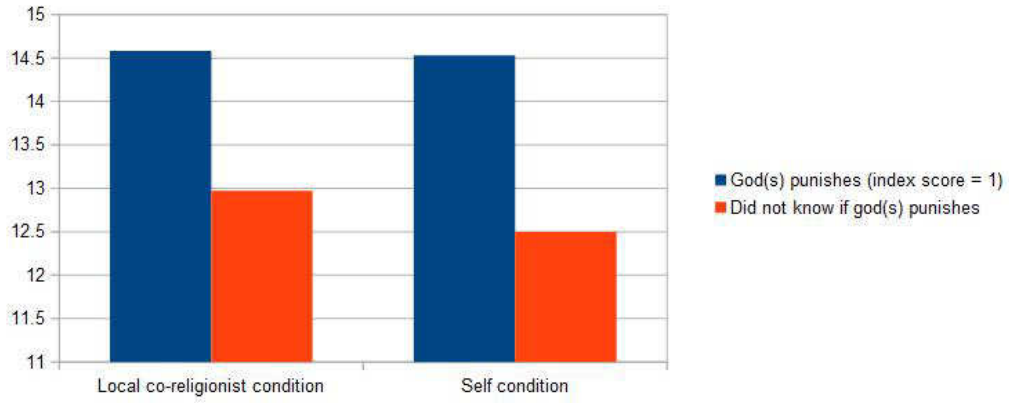

Figure 1.2 - Mean allocation of coins based on view as god(s) as punishing violation of social norms.

"A third variable, in addition to correlating with allocations, would have to correlate only with the punishing and knowing character of moralistic and knowledgeable gods, but not with those same attributes in local gods or with the tendency of either type of deity to reward people" (Purzycki et al 2016 p329).

Johnson (2016a) commented on Purzycki et al's (2016) experiments that they "did not conduct experiments to assess allocation to oneself versus a local co-religionist, nor experiments involving non-religious recipients, so we don't know whether local supernatural agents might promote co-operation between individuals within the local community..., or whether any kind of god promotes co-operation with strangers of another, or no religion" (Johnson 2016a p286).

Other studies support the findings with, for example, a correlation between beliefs in hell and divine punishment, and self-reported pro-social behaviours (eg: Shariff and Rhemtulla 2012; appendix 1H), or religion reminders (ie: "religious priming"; Shariff et al 2016; appendix 1I) beforehand [19] and increased generosity or decreased cheating (eg: Piazza et al 2011 - children; appendix 1J). College students who completed a

[19] For example, adults primed with religious words were more generous in an anonymous sharing game than individuals primed with neutral words (Shariff and Norenzayan 2007).

DeBono et al (2012 quoted in Shariff and Rhemtulla 2012) primed Christian participants by asking them to spend ten minutes before the experiment thinking about god's forgiving or punishing nature, or a forgiving or punishing human, or about a neutral topic. Participants were then given anagrams to solve, and asked to mark themselves. Thus they could claim more correct for a small monetary reward than they actually got right. Participants who had thought about the forgiving nature of god cheated significantly more.

competitive task in a room presented as inhabited by a ghost cheated less than controls (Bering et al 2005).

1.8.1. Religion and Cognition

Vishkin et al (2016) observed: "Perhaps more than any other cultural system, religion shapes the thoughts..., feelings... and behaviour... of followers. It does so, in part, by shaping the way people give meaning to the world around them..." (p252). It also influences the emotional reaction to events through, for example, cognitive reappraisal (CR), which is "changing the meaning of emotional events so that they lead to different emotional experiences" (Vishkin et al 2016 p253) [20].

Vishkin et al (2016) used the term "religiosity" (Rel) to describe "the extent to which religion plays an important role in one's life". These researchers investigated the links bet Rel and CR in four studies. They hypothesised, overall, that "more (versus less) religious individuals would use cognitive reappraisal more frequently and be more effective in doing so" (Vishkin et al 2016 p253).

Study 1 (Questionnaire study)

This study investigated the general association between Rel and CR in three different religions - a Muslim sample of 270 undergraduates in Turkey, an online Christian sample of 277 adults in the USA, and an online Jewish sample of 288 people in Israel. Rel was measured by a self-report questionnaire, which varied slightly between the religions. For example, the Christian sample answered from 1 (not at all) to 5 (absolutely) to the question, "Do you believe in God?", while the Muslim sample rated themselves from 1 (not at all religious) to 9 (very religious).

CR was measured by the Emotion Regulation Questionnaire (ERQ) (Gross and John 2003), which includes six items like, "When I want to feel less negative emotion, I change the way I'm thinking about the situation" (and scored 1-7 for agreement). As an alternative strategy, there are also four items covering expressive suppression (eg: "When I am feeling negative emotions, I make sure not to express them").

Overall, there was a significant positive relationship between level of Rel and use of CR [21].

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[20] CR has been linked to more positive emotions, and better well-being (Vishkin et al 2016).

[21] The correlations, which were all significant at least $p<0.05$, for each sample were +0.17 (Muslim), +0.15 (Christian) and +0.22 (Jewish).

Expressive suppression, however, had no relationship to Rel in the Muslim sample, a negative correlation in the Christian sample, and a positive correlation in the Jewish sample.

Study 2A and 2B (Questionnaire study)

Study 2A tested the relationship between positive reframing (which is changing the meaning of negative events to be less negative) and Rel in an online sample of 92 Israelis. Venting, which is the overt expression of negative emotions, was also measured. The COPE inventory (Carver 1997) measured both with items like, "I've been looking for something good in what is happening" (positive reframing), and "I've been expressing my negative feelings" (venting). More religious individuals used positive reframing significantly more frequently than less religious individuals, and there was no relationship for venting.

These findings were confirmed by Study 2B with 967 more online participants from Israel.

Study 3 (Laboratory experiment)

This study investigated the use of CR in response to experimentally produced negative stimuli among 119 Israeli undergraduates. The participants were shown pictures that created unpleasant feelings, like a cockroach on food, and either told or could choose to behave in one of three ways - reappraise (think about feelings differently), suppress (inhibit reaction), or passively watch (control condition). Then the participants rated their feelings. It was a repeated measures design.

Overall, there were significantly lower negative feelings reported after viewing a picture when CR used compared to the other two responses, and these findings were stronger for more religious individuals. The researchers took these findings to show that more religious people use CR more effectively.

Study 4 (Laboratory experiment)

This experiment concentrated on CR with sixty-five more Israeli undergraduates, who were shown an extract from a film involving a Nazi soldier and a Jewish woman in World War II. The participants were randomly allocated to use CR or not in response to the film. Thus, it was an independent participants design.

In the CR condition, more religious individuals reported less negative emotional experience than less

religious individuals, with the opposite in the control condition. This finding, for the researchers, was a confirmation that "individuals who are more religious use reappraisal more effectively than those who are less religious" (Vishkin et al 2016 p258).

Vishkin et al (2016) summed up the findings overall: "Religious people often transform the meaning of events in the world to fit their religious framework. We propose that this ability may serve them well when applied to the emotion domain, where one effective strategy involves changing the meaning of emotional events. In this investigation, we show that religious people are better, rather than worse, in flexibly changing the meaning of events to control their emotional impact" (p258).

However, the researchers were aware of the key limitation of their studies: "Although the findings supported our hypotheses, they do not allow us to conclude whether religiosity causally leads to more cognitive reappraisal. An alternative explanation may be that people who can flexibly change the meaning of events to regulate emotions are better equipped to handle theological challenges... and become more religious. Another alternative explanation may be that people who search for meaning are more likely to become religious and also more likely to engage in cognitive reappraisal, independently of each other" (Vishkin et al 2016 p259).

Other methodological limitations include:

- Self-report measure of Rel.
- Experiments used undergraduates only (though students were only about quarter of all participants, where details given).
- Three-quarters of the total participants were Jewish/Israeli.
- Monotheistic religions covered.
- Negative stimuli in experiments had limitations because of ethical concerns.
- Only "relatively small effect size. This suggests that although religiosity is consistently and positively linked to reappraisal, these links are not strong. It is likely that many other factors determine the frequency and efficacy of reappraisal, such as personality traits... and age..." (Vishkin et al 2016 p260).

1.9. APPENDIX 1A - CO-OPERATION WITH FUTURE GENERATIONS

The "capital stock" handed to future generations can be viewed as public goods, and co-operation is required in making sure that high-quality natural resources and infrastructure, for example, are passed on. In other words, what we do now has implications for others later.

What can the public-goods experiments tell us that is relevant here? In these experiments/games, one individual is given a sum of money that they can keep or spend to benefit the whole group. Many players show "other-regarding preferences" (Fehr-Duda and Fehr 2016) (ie: spend to benefit the whole group), but as long other players do as well (Fehr-Duda and Fehr 2016). These individuals are "conditional co-operators" (Fischbacher et al 2001).

They are often sensitive to social norms, and are willing to punish non-co-operators at their own expense (Fehr and Gachter 2000). Reputation is important to such individuals (ie: the fear of being publicly named as a non-co-operator) (Fehr-Duda and Fehr 2016). The power of social norms has been used by a US energy company, for instance, who wrote to its customers telling them how their energy use compared to their neighbours. There was found to be a 2% reduction in energy consumption, but the savings were less after the mailings stopped (Fehr-Duda and Fehr 2016).

In public-goods experiments, there will be players with "self-regarding preferences" (Fehr-Duda and Fehr 2016)(ie: do not spend on public goods and benefit from others doing so). Unless such individuals are punished, co-operation breaks down (Fehr-Duda and Fehr 2016).

But any willingness to invest in public-goods related to the future depends on how individuals perceive risk. Fehr-Duda and Epper (2012) referred to "delay-dependent risk tolerance" to explain how "people tend to be more tolerant of risk if their decision affects the future rather than the present" (Fehr-Duda and Fehr 2016 p414). For example, offered £10 for sure or a 50/50 gamble for £0 or £10, individuals tend to choose the former for rewards now, but the latter if the reward is in one year's time, say (Fehr-Duda and Fehr 2016).

Add to this, "feedback-dependent risk aversion" (Fehr-Duda and Fehr 2016). Individuals given more feedback about the performance of their shares, for example, make less risky investments (Fehr-Duda and Fehr 2016).

Despite the focus on now by individuals, and the difficulties in carrying out intentions, Fehr-Duda and Fehr (2016) were optimistic: "Self-interest is a powerful force in human behaviour. But it is also part of our nature to care for others, including people who have yet been born" (p415).

1.10. APPENDIX 1B - CHEATING

Riehl and Frederickson (2016) defined cheating as "an 'adaptive strategy' [Sachs et al 2010] that increases the cheater's fitness at the expense of its partner or social group", while Ghoul (2014) referred to "a trait that is beneficial to a cheat and costly to a co-operator in terms of inclusive fitness" (quoted in Riehl and Frederickson 2016).

So, "cheaters must prosper from cheating, and second, they must reduce the fitness of the individual being cheated. A failure to co-operate, therefore, does not always represent cheating; for example, individuals with few resources may invest little in co-operation but also generally have low fitness" (Riehl and Frederickson 2016 p2) [22].

Riehl and Frederickson (2016) offered four categories of unco-operative behaviour by animals:

i) "Lazy" group members in communal care groups - For example, among subordinate female meerkats, lazy helpers had lower body mass and poorer weight gain than hard-working carers (Clutton-Brock et al 2002).

"Laziness" may also be context-dependent. Baglione et al (2010) experimentally removed the dominant individuals from a carrion crow group, and the former lazy subordinates began providing food for the chicks "to fully compensate for the loss of a breeder, indicating that they may in fact represent a sort of 'insurance' workforce" (Riehl and Frederickson 2016 p4).

On the other hand, there is "false-feeding", where "helpers bring food to the brood but then consume the food themselves rather than delivering it" (Riehl and Frederickson 2016). But rather than a deception, it may be "a simple trade-off between the hunger of the helper and the needs of the nestlings: helpers that perform false-feeding are more likely to be young, inexperienced or in poor condition; and they are generally insensitive to the presence or absence of other group members" (Riehl and Frederickson 2016 p4).

ii) Subordinates that reproduce instead of caring for relatives - eg: eusocial insects. Riehl and Frederickson (2016) were unsure about the amount of such behaviour as experiments often manipulate workers to lay eggs.

iii) Defectors in reciprocal relationships - eg: food sharing by vampire bats. The ability to recognise individuals means that "cheating is not favoured because

[22] Such low-fitness partners are "defective, not defectors", according to Friesen (2012).

defectors should pay a large direct fitness cost in future losses" (Riehl and Frederickson 2016 p7).

iv) Free-riders who profit from collective action without participation - eg: co-operative hunting or defence. In the latter case, "laggards" who do not defend against invaders "decrease their own fitness as well as that of their group-mates, so 'free-riding' is in fact quite costly. Cheating is limited because the relative pay-offs of co-operating and defecting create a stable equilibrium: if other group members do their part, it is best for the laggard to do his as well" (Riehl and Frederickson 2016 p7). For example, white-faced monkeys (Cebus capuchinus) in inter-group fighting win or lose based on group size. Each additional group member was found to increase the odds of winning by 10% (Crofoot et al 2008).

Heinsohn and Packer (1995) observed four types of territorial defence behaviour by female lions:

- Unconditional co-operators - always led in defence.
- Conditional co-operators - participated when needed.
- Conditional laggards - participated less when needed.
- Unconditional laggards - never participated.

Laggards were more common in larger groups, and "individuals that hold back from collective actions do sometimes increase their own fitness at the expense of co-operative group-mates, though not as frequently as often supposed" (Riehl and Frederickson 2016 p8).

1.11. APPENDIX 1C - SCHNEEBERGER ET AL (2012)

A cage was divided into two compartments, each with a female rat. Beside the cage was a tray on ball bearings on a track containing food, and the rats learned that pulling a lever moved the tray closer, so the food could be reached by themselves or the other rat. The level of resistance of the lever was set at between 1-5 newtons and was shown by visual cues.

In the first experiment (direct reciprocity paradigm), fourteen rats were each partnered with a rat who had previously co-operated or not, and the level of resistance was varied. The frequency and latency to pull the lever within a seven-minute period was recorded.

The rats pulled the lever significantly more often for a co-operative partner to receive food than a non-co-operative one. When lever resistance was increased, the number of pulls significantly decreased for both partners, but the latency to pull significantly increased for the non-co-operative individual only.

The second experiment tested the generalised reciprocity paradigm. The focal rat received a co-operative experience or not from a third rat before being placed in the cage with a food-deprived or not stranger. The lever was kept at the least resistance throughout.

The rats provided more food to hungry partners who were in poor condition, "which might suggest empathy" (Schneeberger et al 2012), and pulled more, generally, after receiving help. When the partner was not hungry, the rats pulled more often for rats in good condition, "which was also the case when the focal rat had not received help before. This might suggest that unconditional help, in particular, is contingent on the relative status of a social partner, as in Norway rats body mass correlates with dominance. Helping a dominant partner might reduce the probability of punishment for defection. Alternatively, helping dominant individuals preferentially might be more effective in improving the social reputation of the donor than providing help to a subordinate partner" (Schneeberger et al 2012 p4).

Overall, the rats "seem to take effect of own costs and potential benefits to a receiver when deciding about helping a social partner, which confirms the predictions of reciprocal co-operation" (Schneeberger et al 2012).

Taking account of the cost of helping has been seen in an experiment with capuchin monkeys (van Wolkenten et al 2007), where the amount of effort was varied before a community reward.

1.12. APPENDIX 1D - BIOLOGICAL MARKET THEORY

Biological market theory (BMT) explains mutualism and co-operation as a trade between the two partners using the language of economics. For example, cleaner fish remove dead skin and ectoparasites from other fish. It gives a meal to the cleaner and the "client" gains from the removal (Bshary and Noe 2003) [23]. This is trade between different species. There is also trade between members of the same species, as in higher-ranking male chimpanzees who support lower-ranking males who have groomed them (Hammerstein and Noe 2016).

Spottiswoode et al (2016) reported a mutualistic foraging partnership between greater honeyguides (Indicator indicator) (figure 1.3) and human honey-hunters in Mozambique. The birds lead humans to the bees' nest and then eat the beeswax from the nest after the bees have been subdued by the hunters.

[23] However, occasionally the cleaner "cheats" and takes a "gentle bite" from the "client" (Hammerstein and Noe 2016).

(Source: Nicholas Huet le Jeune & Jean-Gabriel Pretre (1838) "Nouveau recueil de planches coloriees d'oiseaux"; in public domain)

Figure 1.3 - Drawing of greater honeyguide.

The researchers followed the hunters and found that three-quarters of guiding events by the birds led to a bees' nest. This showed that the birds behaviour of approaching humans, giving loud chattering calls, and flying in the appropriate direction was a reliable signal.

The local Yao people call the birds with a loud trill followed by a grunt ("brrrr-hm"). Spottiswoode et al (2016) checked that the honeyguides understood this call by playing it as well as two other calls (the local name for the bird and the call of another species of bird) in a playback field experiment with 72 trials. The birds were significantly more likely to respond to the

call and start to guide the caller (66.7% of times vs 25% for human words and 33.3% for bird calls).

"These results show that a wild animal correctly attaches meaning and responds appropriately to a human signal of recruitment toward co-operative foraging, a behaviour previously associated with only domestic animals, such as dogs. Although humans use many species as foraging partners, including falcons, dogs, and cormorants, these involve trained or domesticated individuals that are specifically taught to co-operate. The honeyguide-human relationship is notable in that it involves free-living wild animals whose interactions with humans have probably evolved through natural selection. To our knowledge, the only comparable relationship involves cooperation between artisanal fishermen and free-living dolphins" (Spottiswoode et al 2016 p389). This suggests that the honeyguide and the human behaviour have co-evolved in response to each (Pennisi 2016).

The researchers explained the honeyguides, thus: They are "brood-parasitic and reared by insectivorous hosts, which suggests that their propensity to locate bees' nests and guide humans to them is likely to be innate. However, the 'brrrr-hm' human signal studied here is confined to a specific geographical area, and a different cultural group living 1000 km away uses a different signal which is likely to have the same function. Local adaptation is unlikely to account for corresponding honeyguide specialisation, given a lack of obvious genetic structure across its range. This implies that local refinements to guiding behaviour are probably learned..." (Spottiswoode et al 2016 p389).

A different example of mutualism is seen in the songbird lazuli bunting (Passerina amoena) where a territorial male will allow an immature-looking male to be a "sub-tenant" in exchange for the opportunity to mate with the latter's female (Greene et al 2000). But there is the potential for "cheating" with the sub-tenant mating with the territorial male's female. This is called the "principal-agent problem" in economics (Hammerstein and Noe 2016). "The 'principal' (employer) is in the position to give the job to the 'agent' (employee) but has limited power to subsequently control that agent" (Hammerstein and Noe 2016 p6). The "boss" can exert control through "market selection" (Bshary and Noe 2003) - ie: careful selection of the "agent" [24]. In the case of

[24] Hammerstein and Noe (2016) noted that "competition among agents offering the same good or service and choice by the other party among these agents are crucial to the understanding of how co-operative partnerships are formed" (p2). Roberts (1998) used the term "competitive altruism" to describe "competition over the privilege to be chosen... Individuals are competing to obtain the reputation of not only a 'good Samaritan', but the 'best Samaritan' on the block in order to be preferred as co-operation partners..." (Hammerstein and Noe 2016 p2).

the lazuli bunting, the dullest looking males are chosen as sub-tenants as the territorial male's female will not be interested in them (Hammerstein and Noe 2016).

Along with market selection, there is a need for "book-keeping" (ie: a record of reciprocation and cheating). de Waal (2000) outlined three types for non-human primates:

i) Symmetry-based reciprocity - Equal level of reciprocation fairly immediate giving and receiving.

ii) Calculated reciprocity - A good memory to maintain information of deeds done and benefits received over a period of time (and the varying amounts of each).

iii) Attitudinal-based reciprocity (or "emotional book-keeping; Schino and Aureli 2009) - A "current account is kept by means of mechanisms such as neuro-hormone titres that are adjusted a little bit during each positive or negative interaction with the partner. The time frame over which this process takes place is long rather than short and a single run-of-the-mill interaction is unlikely to have a great effect on the agents' 'attitude'..." (Hammerstein and Noe 2016 p8).

1.13. APPENDIX 1E - CULTURAL GROUP SELECTION

Henrich et al (2012) proposed that "a set of processes termed cultural group selection" has produced norms that favour monogamous marriage over polygyny [25]. "The idea is that competition among communities — such as nations, polities or religious organisations — favours those norms, values, beliefs, practices and institutions [26] that most effectively harness, reinforce and shape our motivations and behaviour in ways that generate success in inter-group competition. Over centuries, these processes can lead to the spread of social norms and institutions (formal and informal) that create societal-level benefits and reduce aggregate societal costs, thereby giving an edge in inter-group competition" (Henrich et al 2012 p657).

The authors, using varied data sources, tested a number of predictions about imposing monogamous marriage in a society. Most prominently, it "reduces male

[25] "Marriage systems are distinct from mating strategies. Humans, unlike other species, are heavily reliant on cultural learning for acquiring all manner of behaviours and practices, including social behaviour. Because humans also acquire the standards by which they judge others as part of this process, cultural evolution gives rise to social norms. Failure to conform to norms results in reputational damage, loss of status and various forms of sanctioning" (Henrich et al 2012 p658).

[26] Powers et al (2016) proposed the "institutional-path hypothesis" to explain the evolution of human co-operation generally (appendix 1K).

reproductive competition and suppresses intra-sexual competition, which shrinks the size of the pool of low-status, risk-oriented, unmarried men" (Henrich et al 2012 p658). This leads to:

a) Lower rates of crime, personal abuse, intra-household conflict (eg: between females in a household), and fertility;

b) Greater parental investment, economic productivity, and female equality.

Henrich et al (2012) used a number of different data sets, including:

i) Mormon communities in the USA 1830-90 (Moorad et al 2011) - Comparing plural and monogamous marriages showed that intra-sexual competition declined with the move to monogamy.

ii) Longitudinal data on boys at a Massachusetts reform school (Sampson et al 2006) - Most individuals married and divorced several times, so comparing married and unmarried periods of their lives, the likelihood of committing a crime was reduced by 35% during marriage.

iii) Longitudinal data on inmates from Nebraska prisons (Horney et al 1995) - Less personal abuse, as seen in reduced binge drinking and use of marijuana, while married.

iv) Cross-cultural data from China and India, where the sex ratios (males to females) have risen and there are "surplus" men, crime rates have also increased.

v) Statistical comparisons of highly polygynous countries (where more than 10% of married men have multiple wives), low polygynous countries, and comparable monogamous countries - One model by Tertilt (2005) of imposing monogamy on all countries found that fertility rates dropped, brides became older and bride prices disappeared, saving rates and gross domestic product per capita increased. "The main cause of these effects is that men cannot invest in obtaining additional wives or selling daughters, so instead they have fewer children, invest in production, and both save and consume more" (Henrich et al 2012 p664).

vi) Data from twenty-two sub-Saharan African countries (Omariba and Boyle 2007) - Greater survival of children in monogamous than polygynous families.

1.14. APPENDIX 1F - THIRD-PARTY PUNISHMENT

Third-party punishment (TPP) is where an unaffected observer, often at a cost to themselves, punishes a selfish individual [27]. Though this behaviour is costly [28], Jordan et al (2016) argued that "it can be advantageous for individuals to punish selfishness in order to signal that they are not selfish themselves" (p473).

In economic game experiments third-party punishers were trusted more, and actually did behave in a more trustworthy way that non-punishers. TPP is, thus, an honest signal of trustworthiness. This was tested in the TPP game (Fehr and Fischbacher 2004), where one individual ("helper") is given money which they can share with another individual ("recipient"). An observer ("punisher") can pay to punish the helper if they are perceived as being selfish.

But in another situation where "potential punishers have the chance to help, they are less likely to punish, and punishment is perceived as, and actually is, a weaker signal of trustworthiness" (Jordan et al 2016 p473). This is the case when the TPP game allows the punisher to give money to the recipient instead of or as well as punishing the helper.

The trustworthiness of the punisher is shown in a subsequent trust game. An individual ("chooser") who has seen the TPP game is given money, which they can keep or share with the punisher. The money given is tripled and the punisher, who can decide how much to give back to the chooser. The amount returned is also a measure of the actual trustworthiness of the punisher.

1.15. APPENDIX 1G - RELIGION

Woodhead (2011) outlined five conceptualisations of religion:

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[27] Maintaining co-operation by punishment faces the "chicken-and-egg" problem (Cant and Johnstone 2006) - "did punishment give rise to co-operation, or did co-operation give rise to punishment? If punishment is necessary for co-operation to be favoured over cheating, then it had to be present before co-operation first evolved. But if punishment is an adaptation to cheating within social groups, then it is evolutionarily derived. Yet some mechanism that conditions an individual's fitness on its level of co-operation had to exist for co-operation to evolve, in which case co-operation was adaptive in the absence of punishment. And if co-operation is adaptive without punishment, then there should be little selection for cheaters and subsequently for punishment. So, which came first?" (Riehl and Frederickson 2016).

Riehl and Frederickson (2016) felt that "cheating occurs at low frequencies in some societies and that policing or physical aggression may help to maintain co-operation in others, but not that the latter has evolved in response to the former" (p8).

[28] Note that punishers may benefit from direct reciprocity from the victim of the punished individual, or from institutions seeking to promote co-operation (Jordan et al 2016).

1. As culture - This includes the idea that "being religious has to do with believing certain things" (ie: religion as belief and meaning), or "religion as an embracing system of meaning which covers the whole of life".

2. As identity - Religion is viewed as "a matter of the creation and maintenance of social bonds", and that distinguish one group from another.

3. As relationship - Though similar to the previous concept, there is more emphasis on the relationships between individuals, and between individuals and "supernatural" beings.

4. As practice - Focusing on ritual or "lived religion" (ie: "religious authorities only become real when embodied and lived out in actual social contexts and circumstances").

5. As power - "Religion indicates where power really lies (in forces of both good and evil), and allows people to enter into relation with it by understanding it, revering it, worshipping it, appeasing it, drawing upon it, manipulating it, railing against it, meditating upon it, making offerings to it, and falling in love with it... Religious institutions and elites, themselves empowered by virtue of an acknowledged relation to higher powers, also exercise significant this worldly power over their own followers and adherents, and within society more widely" (Woodhead 2011 p134).

Coleman (2011a) preferred to talk of belief because "although not without its difficulties, is less complex than either spirituality [29] or religion" (p1).

He argued that "life is unimaginable without belief", and beliefs underlie actions, goals and objectives in life (even if the beliefs are mistaken).

Dawkins (2006) argued that a set of beliefs should fulfil four basic functions (Wilkinson and Coleman 2011):

- Explanation (of the world in which we find ourselves);
- Exhortation ("moral compass");
- Consolation (eg: making sense of what happens after death);
- Inspiration (eg: fascination, awe, curiosity).

[29] Woodward (2008) felt that "the word spirituality runs the danger of becoming a vague and diffuse notion, functioning like 'intellectual Polyfilla', which changes shape and content conveniently to fill the space its user has devised for it" (quoted in Coleman 2011a). Individuals in surveys also find "spirituality" "a very sort of elastic concept ", and "like Humpty Dumpty. When I use the word it means what I choose it to mean, nothing more, nothing less" (Sadler 2009 quoted in Coleman 2011b).

A study of religious beliefs and practices in the Netherlands (Houtman and Mascini 2002) found "faith in both religion and scientific authority appears to have declined. What the evidence does support is an increase in forms of spiritual belief and non-religiosity in younger generations. This seems to reflect a move on the part of younger generations towards emphasising personal life experience as a touchstone of belief, and a distrust and dislike of external authority especially relating to moral rules and regulations" (Coleman 2011b p12). This has been described as the "individualisation" of religion or spirituality (eg: Heelas 1996).

1.15.1. Other Terms/Concepts

"Spiritual capital" (Spreadbury 2010 quoted in Spreadbury and Coleman 2011) is a term used to cover how the religious organisation, like the church, that the individual belongs to is a source of help (eg: performing jobs, sharing information, support).

"Fundamentalism" as a concept was originally linked to a "literal interpretation of text" in North American Protestantism in the early 20th century (Singh and Cowden 2011). So, in relation to other religions, Bhatt (2006) preferred to use "religious absolutism", which covers "a new form of militant piety and a general intolerance of liberal trends associated with freedom of thought and expression" (Singh and Cowden 2011 p355) [30].

Kepel (2004) emphasised that fundamentalist movements constructed a sense of "crisis" in society (usually "the godless nature of modernity"; Singh and Cowden 2011), which places them as victims, and through this they seek to impose "a single version of collective identity as the only true, authentic and valid one, and use it to impose their power and authority over 'their' constituency" (Imam et al 2004 quoted in Singh and Cowden 2011). There is an attempt to "purify" their religious tradition, which Singh and Cowden (2011) described as a part of the paradox of religious fundamentalism: "while on one hand they construct themselves through the language of a 'return to the past', they are in fact entirely products of the contemporary period" (p358) [31] [32].

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[30] Hirsi Ali (2015) described the "Muslim world" as in "the early stages of religious reformation" with three different groups involved - "Muslims who see the forcible imposition of sharia as their religious duty", the majority who are "not inclined to practice or preach violence", and "Muslim dissidents" or "reformist believers" (those who "realise that their religion must change if its followers are not to be condemned to an interminable cycle of political violence") (p40).

[31] Owen (2015) saw "Islamism" (or political Islam) as "an ideology and a plan for ordering common life that should be analysed alongside other ideologies", while "Islamists present their ideology not as an ism but as simply Islam".

Singh and Cowden (2011) attributed two key historical processes to the rise of such fundamentalism - the "collapse of secular visions of a better world", and economic globalisation with neo-liberal policies [33].

1.16. APPENDIX 1H - SHARIFF AND RHEMTULLA (2012)

The relationship between beliefs and behaviour is not always consistent. For example, university students believing in god (with the emphasis on the punishing nature) were less likely to cheat on an academic test [34], while students who emphasised the forgiving nature of their god were more likely (Shariff and Norenzayam 2011). This can be seen as the "anti-social effects of religious benevolence" - ie: "the idea that divine forgiveness offers individuals a way to cleanse their moral palate, and thereby feel more licensed to transgress again" (Shariff and Rhemtulla 2012). Shariff and Rhemtulla (2012) wondered "to what degree do these laboratory-based effects translate to large-scale societal effects?".

Shariff and Rhemtulla (2012) analysed international data on values and beliefs in society (eg: World Value Surveys) and crime rates in different countries. Belief in hell in a society significantly predicted lower crime rates (with the exception of kidnapping and human trafficking offences), but belief in heaven significantly predicted higher crime rates.

Shariff and Rhemtulla (2012) defended their findings: "First and foremost, these findings are correlational, and thus reverse-causation and third variable explanations need to be discounted before causal claims can be firmly endorsed. However, at least two reasons suggest that a causal effect of these religious beliefs on crime is a plausible explanation for the pattern of results. First, obvious third variable candidates such as differences between countries in national personality, wealth, wealth distribution, and general religiosity show no indication of driving the effects. Second, numerous lab studies have established direct causal effects for religious beliefs on both pro- and anti-social behaviours. The possibility remains that the lab effects and the international crime rate effects

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[32] "Islamic Scripture is constant... Some Muslims have cited Scripture to justify violence, and some have cited it to justify peace" (McCants 2015 p46).

[33] Morone (2015) noted the growth of the "prosperity gospel" in US Christianity, which "mixes the Christian ideal of individual salvation with the bootstrapping ethos of Horatio Alger, then adds a touch of New Age blather" (p162).

[34] "Unlike humans, divine punishers can be omniscient, omnipotent, infallible, and untouchable - and therefore able to effectively deter transgressors who may for whatever reason be undeterred by earthly policing systems" (Shariff and Rhemtulla 2012).

are entirely unrelated, but parsimony suggests that both are, at least to some degree, a reflection of the same underlying causal story".

1.17. APPENDIX 1I - SHARIFF ET AL (2016)

Priming is achieved in different ways in different studies (Shariff et al 2016):

- Explicitly - no efforts are made to hide the religious nature of the priming stimulus.

- Implicitly - hiding the religious nature of the stimulus (eg: a sentence-unscrambling task including religious words).

- Subliminally - presenting the religious stimuli so that participants do not consciously recognise that they are exposed to them (eg: presenting religious words too fast to consciously perceive).

- Contextually - eg: performing the experiment in a religious building.

Shariff et al's (2016) meta-analysis of ninety-three studies on religious priming showed a robust effect on pro-social behaviour, in particular, but only for religious participants. "This finding is also consistent with the idea that primes are most effective when they are self-relevant... The religious primes appear to capitalise on the situational activation of existing beliefs, rather than on society-wide stereotypes about religion..." (Shariff et al 2016 p41).

Shariff et al (2016) raised concerns about questionable research practices (QRP) in the studies, like "p hacking" (ie: looking for any significant relationship rather than analysing data based on hypotheses framed before the study begun).

1.18. APPENDIX 1J - PIAZZA ET AL (2011)

This study is sometimes called the "Princess Alice experiment", and involved thirty-eight 5 and 6 year-olds and 29 8 and 9 year-olds in Belfast, Northern Ireland. They were offered the chance to win prizes by playing a game of throwing Velcro balls at a target six-feet away while facing away. Getting a ball to stick to the target within a three-minute period earned a prize.

The children played the game either in a room alone (control), in the presence of an unfamiliar non-interacting adult female, or in the presence of "Princess

Alice" (who was an invisible "magical princess").

"Princess Alice" was described to the children thus: "Before we begin the game, I would like to introduce you to someone very special. Her name is Princess Alice. Have you ever heard of Princess Alice?... Well, let me tell you about her. Princess Alice is a friendly magical princess with a special ability... Do you think you know what her special ability is?... Well, let me tell you. Princess Alice can make herself invisible. Do you know what invisible means?... That's right – it means that you cannot see her even though she's there! And guess what? Princess Alice is in the room with us right now and she is sitting in that chair" (Piazza et al 2011 p313).

The children were covertly video-recorded while playing the game, and "full cheating" was scored as manually placing a ball on the target [35].

Children who professed belief in "Princess Alice" in the invisible agent condition (48% of them) resisted cheating significantly more than the other children in that condition (ie: disbelief or unsure).

1.19 APPENDIX 1K - INSTITUTIONAL-PATH HYPOTHESIS

Powers et al (2016) argued that "institutional rules" were key in moving from individuals in the "'game of life', determined by physical/environmental constraints, into self-created rules of social organisation where co-operation can be individually advantageous even in large groups of unrelated individuals" (p1). For them, language was key in negotiation between individuals in small hunter-gatherer groups, and it facilitated cultural evolution which led to modern states. "From an economic point of view, the major transition is from an initial state of autarky in which group members do not typically exchange resources with each other, to one of catallaxy where there is extreme division of labour and hence extreme interdependence between group members" (Powers et al 2016 p2).

The formation of "institutions" (ie: "human-devised mechanisms for generating the rules of social interactions") allows the changing of the environment in a way that individuals and small groups could not do (Powers et al 2016).

Powers et al (2016) described the "hallmark of an institution" as the "active genesis of institutional rules through communication and bargaining by the

[35] Kochanska (2002) argued that children go through two main stages of compliance to adult commands to inhibit their impulses when left alone:i) "Situational compliance" - "half-hearted compliance that is contingent on sustained parental control" (Piazza et al 2011).ii) "Committed compliance" - "wholehearted self-regulated compliance with parental norms" (Piazza et al 2011).

individuals in a group", and "economic interactions whose outcomes are material, and which are affected by the institutional rules". What is important is that the rules are self-created and self-enforcing. Thus: "Under self-enforcing institutional rules, co-operation and monitoring and sanctioning are adaptive at the individual level" (Powers et al 2016 p8).

Powers et al (2016) outlined three alternative hypotheses for the evolutionary origin of large-scale human societies and states, and the co-operation between non-kin therein:

i) "Biased social learning hypothesis" - Individuals imitate the most frequent behaviours within their group, and the tendency to do this and conform become evolutionarily advantageous.

ii) Coercion - Individuals with "power" in a group can coerce others into co-operation for the benefits of society.

iii) "Interdependence hypothesis" - Co-operation began as mutualism, which in time became dependence.

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2. AN EXAMPLE OF MONEY AS MORE IMPORTANT THAN IDENTITY AT WORK

Identity is viewed as central in work organisations. This involves a "personal myth" or kind of "life story" (McAdams 1996) that combines the past, the present and the future.

Alvesson and Robertson (2016) defined self-identity as "a reflexively organised understanding of one's distinctiveness and valued key characteristics derived from engagement in and with competing discourses and multiple experiences, which produces a degree of existential continuity and security. Identity is a response to the question 'who am I?' and 'What is important for me?'" (p9). Seeking a positive sense of self/identity, individuals see themselves as "'this' or 'that' kind of person" (Knights and Willmott 1999).

"Identity work" refers to the identity construction process, as "much, if not all activity involves identity work: people are continuously engaged in forming, repairing, maintaining, strengthening or revising the constructions that are productive of a sense of coherence and distinctiveness" (Alvesson and Willmott 2002 quoted in Alvesson and Robertson 2016). This is particularly so in situations where the positive self-narrative is challenged. Alvesson et al (2008) talked of "the ways individuals cope with the interface among self-understandings, ideals, and a frequently imperfect and hostile world". The work organisation often presents such challenges - eg: "young professionals who believe they have found an ideal job, but then find it to be very tedious and demanding and as a result see themselves as corporate slaves" (Alvesson and Robertson 2016).

But Alvesson and Robertson (2016) challenged the importance of identity work with the idea of "identity minimalism" ("a form of sparseness and limited focus on identity concerns"), and the notion of "teflonic identity manoeuvring" (TIM). This is "circumventing issues around the deeper personal meaning of work experiences and invoking a sense of self as a source of existential stability. Instead individuals largely avoid relating identity to their work experiences and rarely reflect on 'who am I?' and 'What does this mean for me?' at work" (Alvesson and Robertson 2016 p8).

Alvesson and Robertson (2016) interviewed six individuals in the investment banking sector a number of times between 2005 and 2007 about their careers. The researchers drew out the following themes from the analysis:

i) "A lack of organisational identification" - "None

of the participants discussed identifying with their banks, in anything other than broad terms which centred on more or less 'fit'" (Alvesson and Robertson 2016 p18).

ii) "The untroubled self and inattentiveness to identity issues" - This is seen in the individuals' ability to fit into the organisation even if the organisation was not "them". For example, "John" referred to a new bank: "It was very masculine even by my standards, a lot of testosterone flying about. I remember being conscious of it because it was so apparent once you walked onto the floor but you just fit in with it pretty quickly, it's just the done thing and after a while you don't notice it" (p20).

iii) "Few challenges and disruptions to identity constructions" - Alvesson and Robertson (2016) observed that "situations that most researchers (including ourselves) would predict would create uncertainty and anxiety, and threaten to undermine identity narratives and a secure sense of self, appeared to have been dealt with in ways which triggered very little identity work, as it is commonly understood. Instead, typically an almost automatic reaffirmation of a sense of self for which monetary rewards are absolutely central was drawn upon. This, we suggest, effectively bypasses concerns and reflexive thinking about 'Who am I?' in these demanding situations" (p21).

For example, "Lee" talked of dealing with his boss when "sometimes he explodes": "I am kind of used to it now and it just washes over me. I've developed a lot thicker skin and that comes in part from dealing with clients. I just see it as my job and don't take anything personally" (p21).

This is TIM - ie: "not taking interactions personally or letting criticisms or situations 'stick'. In these situations identity is circumvented or avoided. TIM effectively means making such issues peripheral to one's deeper sense of self" (Alvesson and Robertson 2016 p21).

iv) "Concerns about a positive sense of self - what's all the fuss?" - "To summarise, participants did not appear to have a preoccupation with sustaining a positive sense of self. It was rare for any of them to refer to being upset, happy, humiliated, perturbed etc across repeated interviews. Even when apparently 'sensitive' issues arose, for example their accounts of what most would assume was sexual harassment..., participants seemed genuinely unconcerned. They therefore differed from those discussed in other studies of individuals working in highly qualified, time-consuming occupations such as management consultants..." (Alvesson and Robertson 2016 p22).

Three "resources" were noted in the "identity minimalism":

a) "The primacy of money" - "Making money was central but taken for granted and rarely referred to. Compared to other sectors where intrinsic motivation, meaning and identification with occupations/organisations may be more salient, and workers often face identity-invoking dilemmas, the centrality of money, coupled with an absence of any other obvious non-instrumental reasons for doing this work in a sector where workers were hyper-disposable, meant that it was their main, possibly their only, significant concern [...] The profit workers make for the banks is the only significant criterion used for assessing individual performance and... substitute for organisational identification. Hence we can only assume that in this context workers' huge salaries and bonuses are invoked (albeit implicitly) to affirm a positive sense of self and self-esteem, in the absence of the availability of more affective resources to draw upon" (Alvesson and Robertson 2016 p24, p28).

b) "The emphasis placed on dress code and demeanour" - There was a strict dress code (involving expensive, designer merchandise, and displays of wealth - eg: jewellery). "Sarah" described her "sell me your company suit", which was "a really high maintenance, wealthy woman kind of suit" (p25).

c) "Being 'professional' at all times" - "Professional" here referred to "the ability to be impassive and detached at all times" (Alvesson and Robertson 2016). The female interviewees described handling sexual advances "professionally". For example, "Rachel" said: "The Helsinki crayfish party! Yes I got three gropes out of that one this year (laughing). One colleague and two clients and thank god neither will remember. But yes it went well. I did my normal thing of staying sober throughout because a lot of business is done at these events" (p26).

Alvesson and Robertson (2016) summed up: "Making money rather than identity, characterised as an instrumental, almost mercenary attitude to self and work, provides the major source of (or a sort of) meaning and purpose. It can therefore be argued that this study demonstrates an 'instrumental orientation' or 'economic subjectivity', corresponding with a minimalist identity" (p30).

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