Morality as Cooperation: A Problem-Centred Approach

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Introduction

Your country is under attack and you are preparing to join the fight to defend it. Just then, your mother calls and tells you she is seriously ill and needs your help. Do you take care of your mother, or do you abandon her to fight for your country? You are a member of a sports team that always loses to a rival team. You have an opportunity to join that rival team. Do you take it? You borrow £10 from a wealthy friend. The friend forgets all about it. Do you give him the £10 back? You and another friend are walking along the street when you spot a £20 note on the ground. You bend down and pick it up. Do you offer to share it with your friend?

In most people, these scenarios evoke a range of thoughts, feelings, emotions, and intuitions about what to do, what is the right thing to do, what one ought to do—what is the *moral* thing to do. What are these moral thoughts and feelings, where do they come from, how do they work, and what are they for? Scholars have struggled with these questions for millennia, and for many people the nature of morality is so baffling that they assume it must have a supernatural origin (Pew, 2014).

The good news is that we now have a scientific answer to these questions. Previous approaches have noticed that morality has *something* to do with cooperation (see Table 1). But now it is possible to use the mathematical theory of cooperation—the theory of nonzero-sum games—to transform this commonplace into a precise and comprehensive theory, capable of making specific testable predictions about the nature of morality.

In this chapter, I use game theory to identify the fundamental problems of human social life, and show how—in principle and in practice—they are solved. I argue

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Table 1 Some previous views of morality and cooperation

Aristotle	Justice is 'what is for the benefit of the whole community' or 'to the common advantage' (Aristotle, 1992, p. 207, 1160a10-14)
St. Augustine	Human law consists of 'an ordered concord of civic obedience and rule in order to secure a kind of co-operation of men's wills for the sake of attaining the things which belong to this mortal life' (Augustine, 1998, p. 945)
Thomas Aquinas	'If then a group of free men is directed by a rule to the common good of the group, his government will be right and just ...' (Aquinas, 1988, pp. 15–16)
David Hume	Moral passions promote the 'public interest', the 'public good', a 'common end', 'the general interests of society', and 'the good of mankind' (Hume, 1739/1985, p. 532, p. 580, p. 590, p. 620, p. 628)
Bishop Joseph Butler	'That mankind is a community, that we all stand in a relation to each other, that there is a public end and interest of society which each particular is obliged to promote, is the sum of morals' (Butler, 1856, IX)
Bertrand Russell	'[M]en's desires conflict, and 'good' is, to my mind, mainly a social concept, designed to find issue from this conflict' (Russell, 1927, p. 230)
Henry Hazlitt	'Social cooperation is the foremost means by which the majority of us attain most of our ends. It is on the implicit if not the explicit recognition of this that our codes of morals, our rules of conduct, are ultimately based. 'Justice' itself ... consists in observance of the rules or principles that do most, in the long run, to preserve and promote social cooperation' (Hazlitt, 1964)
John Rawls	'The circumstances of justice may be described as the normal conditions under which human cooperation is both possible and necessary' (Rawls, 1971, p. 126)
John Mackie	'Protagoras, Hobbes, Hume and Warnock are all at least broadly in agreement about the problem that morality is needed to solve: limited resources and limited sympathies together generate both competition leading to conflict and an absence of what would be mutually beneficial cooperation' (Mackie, 1977, p. 111)
David Wong	'Human beings have needs to resolve internal conflicts between requirements and to resolve interpersonal conflicts of interest. Morality is a social creation that evolved in response to these needs' (Wong, 1984, p. 175)
Daniel Hausman and Michael McPherson	'[T]he normative principles governing individual interactions are human contrivances to adjudicate conflicts of interest and to secure the benefits of cooperation' (Hausman & McPherson, 1996, p. 186)
Jonathan Haidt	'Moral systems are interlocking sets of values, virtues, norms, practices, identities, institutions, technologies, and evolved psychological mechanisms that work together to suppress or regulate selfishness and make cooperative social life possible' (Haidt & Kesebir, 2010)
Alan Fiske	'Morality functions to facilitate the generation and maintenance of long-term social-cooperative relationships with others' (Rai & Fiske, 2011)
Michael Tomasello	'Human morality arose evolutionarily as a set of skills and motives for cooperating with others' (Tomasello & Vaish, 2013)
Joshua Greene	'[T]he core function of morality is to promote and sustain cooperation' (Greene, 2015)

that it is the solutions to these problems that philosophers and others have called 'morality'. Thus, morality turns out to be a collection of biological and cultural solutions to the problems of cooperation and conflict recurrent in human social life. I show how this theory of 'morality as cooperation' incorporates the best elements of previous theories, and moves beyond them to create a principled taxonomy of moral values of unprecedented depth and breadth. I derive from this theory testable predictions about the structure and content of moral thought and outline how they differ from those of rival theories. And I conclude that, because the debate between these theories can be resolved using standard scientific method, the study of morality has at last become a branch of science. Let's get started.

A Natural History of Morality

Life begins when molecules start making copies of themselves. These 'replicators' are 'selfish' in the technical sense that they promote their own replication (Dawkins, 1976/2006). But they can promote their own replication at the expense of other replicators, or in concert with them (Dawkins, 1998). Game theory analyses these competitive and cooperative interactions as zero-sum and nonzero-sum, respectively (Maynard Smith, 1982; Von Neumann & Morgenstern, 1944). Competitive zero-sum interactions have a winner and a loser; one's gain is another's loss. But cooperative nonzero-sum interactions can have two winners; they can be win–win situations.

Natural selection for genes that employ cooperative strategies has driven several 'major transitions' in the evolution of life on Earth, including the formation of cells, chromosomes and multicellular organisms (Maynard Smith & Szathmáry, 1995). Natural selection has also favoured genes for cooperation between individuals, in a wide variety of species (Dugatkin, 1997), including humans. Humans descend from a long line of social primates; they have spent 50 million years living in social groups (Shultz, Opie, & Atkinson, 2011) and two million years making a living as intensely collaborative hunter–gatherers (Tooby & DeVore, 1987). This has equipped humans with a range of biological—including psychological—adaptations for cooperation. These adaptations can be seen as natural selection's attempts to solve the problems of cooperation. And ever since entering the 'cognitive niche' (Boyd, Richerson, & Henrich, 2011; Pinker, 2010), humans have attempted to improve upon natural selection's solutions by inventing evolutionarily novel cultural solutions—'tools and rules'—for further bolstering cooperation (Binmore, 1994a, 1994b; Nagel, 1991; Popper, 1945).

Together, these biological and cultural mechanisms provide both the motivation for social, cooperative and altruistic behaviour—leading individuals to value and pursue specific mutually beneficial outcomes—and the standards by which individuals evaluate the social behaviour of others. And it is precisely these mechanisms—these solutions to problems of cooperation this collection of instincts, intuitions, ideas, and institutions that constitute human morality (Curry, 2005).

This theory of morality as cooperation predicts that there will be not one but many domains of morality. This is because game theory tells us that there is not one problem of cooperation, but many, and many solutions. And the theory predicts what these problem-centred domains will be: (1) the allocation of resources to kin; (2) coordination to mutual advantage; (3) exchange; and (4) conflict resolution by means of (a) contests featuring displays of hawkish and dove-ish traits, (b) division, and (c) possession. Let's look at each of these problems, how natural selection and human ingenuity have attempted to solve them, and what predictions this problem-centred approach makes about human morality.

(1) Kinship

A gene has the potential to influence not only its own replication but also the replication of replicas of itself. In some situations, a gene in one individual can best promote its replication by diverting resources to copies of itself that reside in other individuals—that is, in genetic relatives or family members. Genes that benefit replicas will be favoured by natural selection if the cost of helping is outweighed by the benefit to the recipient gene(s) (Dawkins, 1979; Hamilton, 1964). So, evolutionary theory leads us to expect that organisms will possess adaptations for detecting and delivering benefits (or avoiding harm) to kin.

And, as expected, numerous species do indeed have adaptations for identifying (Hepper, 1991) and being altruistic to genetic relatives—with parental care and eusociality among insects being the most widespread and conspicuous examples (Clutton-Brock, 1991; Royle, Smiseth, & Kölliker, 2012).

Humans and their recent primate ancestors have always lived in groups composed mostly of genetic relatives, and so they have always faced the problem of allocating resources to kin (Chapais, 2014). Research into adaptations for kin altruism in humans has focussed on kin detection and incest aversion (Lieberman, Tooby, & Cosmides, 2003, 2007), paternal investment (Geary, 2000) and its absence (Daly & Wilson, 1996), and the effects of uncertainty of paternity on paternal and grandparental investment (Euler & Weitzel, 1996; Gaulin & Schlegel, 1980; Platek et al., 2003). Culturally, humans have invented institutions—such as naming conventions (Oates & Wilson, 2002) and inheritance rules (Smith, Kish, & Crawford, 1987)—to extend the reach of kin altruism. Behaviourally, kin altruism in humans is evident in the universality of family structure in human societies, patterns of alliance (Chagnon & Bugos, 1979), and homicide (Daly & Wilson, 1988). Humans have also invented a variety of rules for regulating inbreeding and avoiding incest (Thornhill, 1991).

Morality as cooperation predicts that solutions to the problem of efficiently allocating resources to kin—such as caring for offspring, helping family members, and avoiding inbreeding—are component parts of human morality and will be considered morally good. And there is evidence to suggest that they are.

For example, Edvard Westermarck's classic cross-cultural survey of ethics concluded: 'There is one duty so universal and obvious that it is seldom mentioned:

the mother's duty to rear her children…Another duty…is incumbent on the married man: the protection and support of his family' (Westermarck, 1906). The anthropologist May Edel and her philosopher husband Abraham Edel concurred: 'the moral obligation for a mother to take care of her children…is a universal imperative' (Edel & Edel, 1959/1968). And in Confucian ethics, 'Duty to the family trumped all other duties' (Fukuyama, 1996). Obligations to family—an ethic of care, an obligation to distribute goods on the basis of need and relationship, not abstract rules—also figure prominently in some feminist moral philosophy (Noddings, 1978; Ruddick, 1980). And 'the horror of incest is well nigh universal in the human race' (Westermarck, 1906).

(2) Mutualism

Situations in which individuals benefit more by working together than they do by working alone are referred to as mutualisms (Connor, 1995). Such mutualisms can provide economies of scale, efficient divisions of labour, and strength (or safety) in numbers. Darwin provides a typically charming example of the benefits of teamwork: 'Hamadryas baboons turn over stones to find insects, &c.; and when they come to a large one, as many as can stand round, turn it over together and share the booty' (Darwin, 1871). Because individuals must coordinate their behaviour in order to realise these benefits, these situations are modelled as coordination problems (Lewis, 1969; Schelling, 1960)—including 'stag hunts' (Skyrms, 2004) and soldier's dilemmas' (Clutton-Brock, 2009)—and the ensuing relationships are referred to as friendships, alliances, and coalitions (Tooby & Cosmides, 1996).

In principle, coordination problems can be solved by focal points and precedence ('return to the same breeding grounds each year'), simple decision rules ('follow the leader'; Van Vugt, Hogan, & Kaiser, 2008), signalling and communication ('I'm over here!'), as well as more sophisticated abilities to anticipate and predict others' behaviour (proto-theory of mind; Whiten, 1996). There has been relatively little empirical work on adaptations for coordination per se (but see Boos, Kolbe, Kappeler, & Ellwart, 2011). However, there is little doubt that many species are able to solve coordination problems, as evident in the ubiquity of herds, shoals, flocks, and collaborative hunting (Boinski & Garber, 2000; Clutton-Brock, 2009), as well as the formation of alliances and coalitions (Bissonnette et al., 2015; Harcourt & de Waal, 1992).

The problem of coordinating to mutual advantage has been a recurrent feature of the social lives of humans and their recent ancestors, especially with regard to collaborative hunting (Alvard, 2001; Alvard & Nolin, 2002) and forming coalitions to compete with rival coalitions (Wrangham, 1999). Research on adaptations for mutualism and coordination in humans has focussed on coalitionary psychology (Kurzban, Tooby, & Cosmides, 2001; Tooby & Cosmides, 2010), adaptations for representing common knowledge (Thomas, DeScioli, Haque, & Pinker, 2014), and 'theory of mind' (Curry & Jones Chesters, 2012; Tomasello, Carpenter, Call, Behne,

& Moll, 2005; Young, Camprodon, Hauser, Pascual-Leone, & Saxe, 2010). Theory of mind, in particular, seems to have taken human cooperation to new heights. This ability allows us to think about what others are thinking; to infer their desires, beliefs, and intentions; and to factor these into our judgments of their conduct— distinguishing, for example, between intentional and accidental harms. Theory of mind also seems to play a central role in the formation of conventions and other 'social constructions' that can be used to solve an indefinite array of novel coordination problems (Berger & Luckmann, 1966). Culturally, humans have enhanced their ability to coordinate their behaviour by means of maps, clocks, calendars and communication technology, and badges of membership. Behaviourally, mutualism is apparent in the widespread and spontaneous tendency of humans to form groups and to benefit those groups at the expense of others (Balliet, Wu, & De Dreu, 2014; Sherif, Harvey, White, Hood, & Sherif, 1954/1961; Tajfel, 1970).

Morality as cooperation predicts that solutions to the problems of mutualism— such as forming friendships, participating in collaborative endeavours, favouring your own group, and adopting local conventions—are component parts of human morality and will be considered morally good. There is evidence to suggest that they are.

Aristotle devoted two books of his *Nichomachean Ethics* to friendship (Aristotle, 1962); for Cicero, friendship was 'the noblest and most delightful of all the gifts the gods have given mankind' (Cicero, 1971); and G. E. Moore ranked friendship as one of 'the most valuable things that we can know or imagine' and the one that provides the only justification for 'performing any public or private duty' (Moore, 1903). Plato argued that life was a one big coordination problem, and that justice consisted of an efficient division of labour where everyone played their part (Plato, 1974). Loyalty—commitment to a common cause, such as the 'devotion of a patriot to his country'—has been described as 'the heart of all the virtues, the central duty amongst all duties' (Royce, 1908). More recently, many theorists have agreed that loyalty—'giving special consideration to a person or group of persons' (Gert, 2013, p. 18)—is a moral issue, even if they have not agreed on the reasons why (Levinson, Parker, & Woodruff, 2013). And the moral philosopher Allan Gibbard has argued that people possess 'biological adaptations for coordination' that enable them to identify and adopt norms and conventions and thereby coordinate individuals to mutual advantage: 'The key to human moral nature lies in coordination broadly construed' (Gibbard, 1990a, 1990b).

(3) Exchange

In some situations, the benefits of mutualism are uncertain, perhaps because the benefits are transferred at different times; here, individuals might be exploited by 'free riders', who accept a benefit, but neglect to return it. These situations are modelled as prisoner's dilemmas (social dilemmas, public goods games, and so on) (Ostrom & Walker, 2002)—games in which non-cooperation is the only viable

strategy. However, if individuals meet repeatedly, then the situation becomes an 'assurance game', and cooperation can be maintained by a strategy of conditional cooperation—such as 'tit for tat'—that begins by cooperating and then reciprocates the other individual's behaviour (returning a benefit or avenging an injury) (Axelrod, 1984; Trivers, 1971).

Surprisingly, few if any examples of full-blown 'reciprocal altruism' have been found in non-human species (Amici et al., 2014; Clutton-Brock, 2009), although some aspects of reciprocity have been identified in cleaner fish (Bshary & Grutter, 2006), vampire bats (Carter & Wilkinson, 2013), and primates (Mitani, 2009).

Social exchange may have been a recurrent feature of the social lives of humans since our last common ancestors with chimpanzees six million years ago (Jaeggi & Gurven, 2013); and there is some suggestive evidence for trade between groups from 82,000 years ago (Bouzouggar et al., 2007). Research on adaptations for exchange in humans has focussed on trust (Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005), gratitude (McCullough, Kimeldorf, & Cohen, 2008), cheater detection (Cosmides & Tooby, 2005), punishment (Price, Cosmides, & Tooby, 2002), revenge, and forgiveness (McCullough, Kurzban, & Tabak, 2013). Culturally, humans have extended the scope of exchange and reciprocity through such 'technologies of trust' as money, written contracts, 'mechanical cheater detectors' such as '[c]ash register tapes, punch clocks, train tickets, receipts, accounting ledgers', handcuffs, prisons, electric chairs, CCTV, branding of criminals, and criminal records (Pinker, 1997). Behaviourally, reciprocity emerges early in children's behaviour (Harbaugh, Krause, Liday, & Vesterlund, 2002) and is used as a strategy for social exchange cross-culturally (Henrich et al., 2005; Kocher, Cherry, Kroll, Netzer, & Sutter, 2008).

Morality as cooperation predicts that solutions to the problems of exchange—especially the mechanisms that implement reciprocity—are component parts of human morality and will be considered morally good. There is evidence to suggest that they are.

Reciprocity in general is the guiding principle of many moral philosophies. When asked for a single word that could sum up morality, Confucius answered: 'Reciprocity perhaps? Do not inflict on others what you yourself would not wish done to you' (Confucius, 1994). 'Social contract' theorists—from 'Glaucon' (Plato, 1974) to Hobbes (1651/1958) to Rawls (1971)—have viewed all of morality through the lens of reciprocity. The golden rule of 'do as you would be done by' is present in all major world religions (Chilton & Neusner, 2009). And in its negative form, reciprocity provides the guiding principle of theories of punishment and retribution—from the Code of Hammurabi's 'eye for an eye' onwards (Daly & Wilson, 1988). The specific subcomponents of reciprocity—trust (Baier, 1995), patience (Curry, Price, & Price, 2008), gratitude (Emmons, 2004), guilt (Gibbard, 1990b), apology (Ohtsubo & Watanabe, 2009), and forgiveness (Downie, 1965; Godfray, 1992; Richards, 1988)—have also been regarded as important facets of morality.

(4) Conflict Resolution

Organisms often come into conflict over resources such as food, territory, and mates (Huntingdon & Turner, 1987). Although such conflicts appear zero-sum, in fact there are costs involved in conflict—time, energy, and injury—that individuals have a common interest in avoiding. For this reason, animal conflicts are modelled not as zero-sum games, but as nonzero-sum hawk–dove games, in which the worst outcome occurs only if both players adopt a 'hawkish' strategy of all-out aggression (Maynard Smith & Price, 1973). Thus, conflict presents combatants with an opportunity to cooperate, by competing in less mutually destructive ways. There are three ways of achieving this: contests (featuring the display of hawkish and dove-ish traits), division, and possession.

(a) Contests

Instead of fighting, one option is for contestants to display reliable indicators of 'fighting ability' (or 'resource holding power' or 'formidability') and for the weaker party to cede the resource to the stronger. In this way, the stronger party still wins, but both avoid the costs of a real fight (Gintis, Smith, & Bowles, 2001; Maynard Smith & Price, 1973).

Animal contests in which contestants follow such 'display and defer' strategies are widespread in nature. Depending on the species, 'hawkish' displays of size, weight, age, or experience may carry the day (Hardy & Briffa, 2013; Riechert, 1998). Such displays may also involve costly acts that benefit others (Zahavi & Zahavi, 1997). Conversely, 'dove-ish' cues of submission involve exaggerated concealment of these same attributes, or conspicuous displays of their absence (Darwin, 1872/1998; Preuschoft & van Schaik, 2000). In stable social groups, in which relative 'power' is already known by reputation (through direct experience or third-party observation), individuals can dispense with the contest, and allocate disputed resources by 'rank'. Such 'dominance hierarchies' represent a further de-escalation of conflict, and are also widespread in nature (Preuschoft & van Schaik, 2000).

Humans and their recent ancestors have always faced the problem of conflict resolution, because such problems are inherent in group living (Shultz & Dunbar, 2007). Research into human adaptations for resolving conflicts via contests has focussed on cues of dominance and deference, including facial expressions, voice pitch, and height (Sell et al., 2010; Sell et al., 2009; Watkins et al., 2010), and testosterone—the hormonal system responsible for prompting competitive displays, elating winners, and deflating losers (Mazur, 2005). And experiments suggest that a tendency for the strong to display status by helping the weak—*noblesse oblige*—is present cross-culturally (Fiddick, Cummins, Janicki, Lee, & Erlich, 2013). Culturally, humans have invented numerous means of minimising the costs of

conflict through stylised contests—including single ('champion') combat (Cowan, 2007), duels, tournaments, rules of combat (Queensberry rules, Geneva Conventions), and competitive games and sports (Deaner & Smith, 2012). There has been relatively little research on human adaptations for navigating hierarchies, apart from the finding that human hierarchies are less pronounced than those of our nearest primate relatives (Boesch, 1999; Gavrilets, Duenez-Guzman, & Vose, 2008). But culturally, humans have invented countless ways of displaying status and regulating relationships accordingly, such as honorifics, etiquette, dress codes, medals, decorations and honours, and caste systems. Behaviourally, humans—especially males—commonly engage in costly and conspicuous displays of prowess, resources, and even altruism, especially in the context of mate competition (Hardy & Van Vugt, 2006; Hawkes, 1991; Hawkes, O'Connell, & Blurton Jones, 2001; Miller, 2000). Children spontaneously form dominance hierarchies relatively early in their development (Edelman & Omark, 1973), and status hierarchies are a ubiquitous feature of human societies (Boone, 1992; Rubin, 2000).

Morality as cooperation predicts that resolving conflicts by means of contests will give rise to two apparently opposing sets of moral values, reflecting the two branches of the 'display–defer' strategy—the virtues of the hawk and the virtues of the dove. The theory predicts that hawkish signals of prowess (strength, fortitude, bravery, heroism generosity, largesse) and also dove-ish displays of submission (humility, deference, respect, obedience) are component parts of human morality and will be considered morally good. There is evidence to suggest that they are.

Traits that establish status and forestall disputes have been celebrated as 'excellences' or 'virtues' throughout history (MacIntyre, 1981a, 1981b). The philosopher David Hume gives a particularly cogent account (Hume, 1739/1985). He recognised that many animals take pride in their 'beauty, strength, swiftness'; in addition, humans take pride in their 'imagination, judgment, memory or disposition; wit, good-sense, learning, courage, justice, [and] integrity', and differences in the ability give rise to hierarchies in which 'certain deferences and mutual submissions' are required 'of the different ranks of men towards each other'. High status then motivates altruistic acts by fostering the 'heroic virtues': '[c]ourage, intrepidity, ambition, love of glory, magnanimity, and all the other shining virtues'. Hume contrasted these 'heroic' virtues with the 'monkish' virtues of '[c]elibacy, fasting, penance, mortification, self-denial, humility, silence, solitude', and so on (Hume, 1757/1889). A monkish virtue such as humility—'a just sense of our weakness'—'is esteem'd virtuous, and procures the good-will of everyone' (Hume, 1757/1889). Aristotle, Machiavelli, Nietzsche, and Mill have celebrated similar virtues, for similar reasons (Curry, 2007). And, in keeping with the theory, the original meaning of 'respect' evoked 'an element of fear' directed towards 'dangerous things'. 'In olden days… the scale of respect was one with the scales of power and status'. Later, the term came to be applied not just to physical power, but to the power of ideas, 'not the ability to make demands backed up by force, but the ability to make claims backed up by reasons', and in this way, 'moral terms which in their original senses had to

do with power, pressure, force, coercion…come to be applied to 'moral' force, or power' (Feinberg, 1973).

Consistent with the theory, both hawkish and dove-ish traits tend to be seen as moral when there is an obvious power differential—as in Plato's Republic (workers ought to obey their 'virtuous' philosophical superiors), Aristotle's polis (slaves ought to obey their 'rational' masters), and feudal monarchies (subjects ought to obey their 'divine' sovereigns). Similarly, respect and obedience seem appropriate when arguing that children ought to obey their parents or soldiers ought to obey their superior officers. But, as the theory also predicts, in societies that are, or profess to be, more equal—such as Western, Educated, Industrialised, Rich Democracies (WEIRD) (Henrich, Heine, & Norenzayan, 2010)—deference and respect for power appear 'obsolete' (Berger, 1970).

(b) Division

If the contested resource is divisible (such as spoils from a hunt, or a disputed border between territories), then game theory models the situation as a 'bargaining problem' (Nash, 1950). Here, one solution is to divide the resource in proportion to the relative (bargaining) power of the protagonists (Skyrms, 1996). In the case of equally powerful individuals, this results in equal shares (Maynard Smith, 1982).

Among animals, indirect evidence for a 'sense of fairness' in non-human primates comes from reactions to unequal treatment in economic games (Brosnan, 2013).

There has been relatively little research on human adaptations for resolving conflicts using division. It has been found that males with elevated levels of testosterone make (Zak et al., 2009) and reject (Burnham, 2007) lower offers in ultimatum bargaining games. And there is also some evidence that individuals will exhibit deference to the preferences of more powerful individuals (de Kwaadsteniet & van Dijk, 2010). Nevertheless, rules such as 'I cut, you choose', 'meet in the middle', 'split the difference', and 'take turns' are ancient and widespread means of resolving disputes (Brams & Taylor, 1996). And behaviourally, it has been found that 'equal shares' is a spontaneous and cross-culturally prevalent decision rule in economic games (Güth, Schmittberger, & Schwarze, 1982; Henrich et al., 2005) and other situations (Messick, 1993).

Morality as cooperation predicts that resolving conflicts by means of division—negotiation, compromise, fairness—is a component part of human morality and will be considered morally good. There is evidence to suggest that it is.

Negotiating a compromise—whether directly between two individuals, or by means of a third party (arbitration, mediation)—has been described as a 'fair and rational way of reaching a reasonable agreement' (Pennock & Chapman, 1979). And fairness itself has been viewed as synonymous with morality, as in John Rawls' (1958) influential work 'Justice as Fairness'.

(c) Possession

Finally, game theory shows that conflicts over resources can also be resolved by deference to prior ownership (Gintis, 2007; Maynard Smith, 1982). The recognition of prior ownership is widespread in nature: 'in almost all territorial species, intruders respect territory ownership'—'The space that a territory owner defends is functionally equivalent to his property, and an intruder's respect reveals his acknowledgment of ownership and property rights' (Hauser, 2001, p. 303; see also Strassmann & Queller, 2014).

There has been relatively little research on human adaptations for ownership—although some have interpreted the 'endowment effect' (Gintis, 2007; Kahneman & Tversky, 1979) and international disputes over territory (Johnson & Toft, 2014) in this light. Culturally, humans have invented a range of institutions—title and land registries—to keep track of who owns what (No Title, 2001), and 'first possession' is the basis of much property law (Rose, 1985). Behaviourally, the notion that objects can be 'owned' emerges early in child development (Friedman & Neary, 2008; Ross & Friedman, 2011) and (in various forms) is cross-culturally universal: 'in all groups personal ownership of some goods and rights exists…private property, in this sense, is known everywhere' (Herskovits, 1952, p. 372); 'the phenomenon is a universal one, since there is no group who live so precariously that there is not some tool, some weapon, some bit of ornament or clothing that is not regarded as indisputably the possession of its maker, its user, its wearer' (Herskovits, 1952, p. 327).

Morality as cooperation predicts that resolving conflicts by deferring to prior ownership—respecting others' property and territory and not stealing—is a component part of human morality and will be considered morally good. There is evidence to suggest that it is.

In another astute analysis, David Hume noted that property rights are acquired primarily through 'first possession' or 'occupation', and he argued that such rights serve 'to cut off all occasions of discord and contention' (Hume, 1739/1985). Many others have agreed that there can be a moral right to own property, even while disagreeing as to the reasons why (Becker, 1977; Locke, 2000; Pennock & Chapman, 1980). And Westermarck reports that 'When we examine the moral rules of uncivilised races…[i]n every savage community homicide is prohibited by custom, and so is theft' (Westermarck, 1906).

A Periodic Table of Ethics

Thus, morality as cooperation predicts that there will be multiple moral domains, and it predicts what these domains will be. It uses the game theory of cooperation to create a novel taxonomy of moral values—a 'Periodic Table of Ethics'—that incorporates a wide variety of moral phenomena: obligations to family, group loyalty, reciprocity, bravery, respect for hierarchy, fairness, and property rights (see Table 2).

Table 2 A periodic table of ethics: an overview of morality as cooperation

Problem	Theory	Animal examples	Human examples	Morals
Kinship	Kin selection (Dawkins, 1979; Hamilton, 1964)	Kin recognition (Hepper, 1991), parental care (Clutton-Brock, 1991; Royle et al., 2012)	Kin detection and incest aversion (Lieberman et al., 2003, 2007), paternal investment (Geary, 2000), patterns of homicide (Daly & Wilson, 1996). Rules against incest (Thornhill, 1991)	Obligations to kin (Fukuyama, 1996), duty of parental care (Edel & Edel, 1959/1968; Westermarck, 1906), prohibition of incest (Westermarck, 1906)
Mutualism	Mutualism (Connor, 1995), coordination (Lewis, 1969; Schelling, 1960), coalition formation (Tooby & Cosmides, 1996; Von Neumann & Morgenstern, 1944)	Mutualism (Clutton-Brock, 2009), coordination (Boinski & Garber, 2000; Boos et al., 2011), coalitions (Bissonnette et al., 2015; Harcourt & de Waal, 1992)	Coalitionary psychology (Kurzban et al., 2001), common knowledge (Thomas et al., 2014), 'theory of mind' (Tomasello et al., 2005). Ingroup favouritism (Balliet et al., 2014; Sherif et al., 1954/1961; Tajfel, 1970). Social construction (Berger & Luckmann, 1966)	Friendship (Aristotle, 1962), loyalty (Royce, 1908), conformity (Gibbard, 1990a, 1990b)
Exchange	Reciprocal altruism (Axelrod, 1984; Trivers, 1971)	Vampire bats? (Carter & Wilkinson, 2013)	Trust (Kosfeld et al., 2005), gratitude (McCullough et al., 2008), cheater detection (Cosmides & Tooby, 2005), punishment (Price et al., 2002), revenge and forgiveness (McCullough et al., 2013). Technologies of trust (Pinker, 1997). Ubiquity of reciprocity (Henrich et al., 2005; Kocher et al., 2008)	Reciprocity (Rawls, 1971), punishment (Daly & Wilson, 1988), trust (Baier, 1995), gratitude (Emmons, 2004), guilt (Gibbard, 1990b), apology (Ohtsubo & Watanabe, 2009), forgiveness (Downie, 1965; Godfray, 1992; Richards, 1988)

(continued)

Table 2 (continued)

Problem	Theory	Animal examples	Human examples	Morals
Conflict resolution: contests (hawk–dove)	Animal conflict and costly signals (Gintis et al., 2001; Maynard Smith & Price, 1973), dominance and deference (Mazur, 2005)	Animal contests (Hardy & Briffa, 2013; Riechert, 1998), dominance hierarchies (Preuschoft & van Schaik, 2000)	Formidability (Sell et al., 2010), costly signalling (Hawkes, 1991; Hawkes et al., 2001; Miller, 2000), *noblesse oblige* (Fiddick et al., 2013), dominance and deference (Mazur, 2005). Games and sports (Deaner & Smith, 2012). Ubiquity of status hierarchies (Boone, 1992; Rubin, 2000)	Virtues and excellences (Curry, 2007; MacIntyre, 1981b). Hawkish virtues (fortitude, bravery, skill, generosity, beauty) (Hume, 1739/1985), dove-ish virtues (humility, respect, deference, obedience) (Feinberg, 1973; Hume, 1757/1889)
Conflict resolution: division	Bargaining and fairness (Maynard Smith, 1982; Nash, 1950; Skyrms, 1996)	Primates? (Brosnan, 2013)	Ultimatum games (Güth et al., 1982; Henrich et al., 2005), equality (Messick, 1993). 'Cut the cake' (Brams & Taylor, 1996)	Fairness (Rawls, 1958), negotiation, and compromise (Pennock & Chapman, 1979)
Conflict resolution: possession	Prior ownership (Gintis, 2007; Maynard Smith, 1982)	Ownership and territoriality (Strassmann & Queller, 2014)	Endowment effect (Gintis, 2007; Kahneman & Tversky, 1979), territoriality (Johnson & Toft, 2014). Property law (Rose, 1985). Ubiquity of property (Herskovits, 1952)	Property rights (Becker, 1977; Hume, 1739/1985; Locke, 2000; Pennock & Chapman, 1980). Theft (Westermarck, 1906)

And, as we have just seen, this approach receives some support from the existing literature on morality. But morality as cooperation is also brimming with further novel testable predictions about the structure and content of moral thought. Developing this promising, principled, problem-centred approach will involve making these predictions explicit and putting them to the test.

First, the good, the bad, and the neutral. As we have seen, morality as cooperation predicts that people will regard specific types of cooperative behaviour—behaviour that solves some problem of cooperation—as morally good. Thus, people will regard helping your family, being loyal to your group, reciprocating favours, being brave, deferring to authority, dividing disputed resources, and respecting property, as morally good. And they will regard failing to cooperate—by neglecting your family, betraying your group, cheating, being cowardly, rebelling against

authority, being unfair, and stealing—as morally bad. The theory also predicts that behaviour that has nothing to do with cooperation—nonsocial behaviour or competition in zero-sum games ('all's fair in love and war')—will be regarded as morally neutral.

Second, universality and diversity. Morality as cooperation also predicts that—because these problems are universal features of human social life—these cooperative behaviours will be considered morally good in every human culture, at all times and in all places. There will be no cultures where morality is about something other than cooperation—say, aesthetics or nutrition. And there will be no cultures where helping your family, being loyal to your group, reciprocating favours, being brave, deferring to authority, dividing disputed resources, respecting property, and so on are considered morally bad. However, the theory does not predict that moral systems will everywhere be identical. On the contrary, the prediction is that, to the extent that different people and different societies face different portfolios of problems, different domains of morality will loom larger—different cultures will prioritise different moral values. For example, differences in family size, frequency of warfare, or degree of inequality may lead to differences in the importance attached to family values, bravery, and respect.

Third, uncharted territory. Morality as cooperation predicts that as yet poorly understood aspects of morality will also turn out to be about cooperation. For example, sexual morality will consist of a collection of solutions to the specific problems of cooperation and conflict that arise within and between the sexes. Political morality will regard leaders as morally good if they promote cooperation among their followers—by solving coordination problems (especially in the context of group defence), enforcing contracts, punishing cheats, resolving (violent) conflicts, displaying prestigious virtues (especially bravery and wisdom), maintaining hierarchies, impartially arbitrating disputes, redistributing the rewards of collective action equitably, and respecting their subjects' property. Conversely, morally bad leaders will be those who do none of the above and instead parasitise their followers' cooperation. Ethics in international relations—grand alliances, trade agreements, diplomacy, rules of war, and so on—will consist of solutions to the problems of cooperation that arise between groups, as opposed to individuals. Religious morality—ancestor worship, food taboos, karma, reverence, and so on—will turn out to be the product of mechanisms designed for mundane cooperation (McKay & Whitehouse, 2014).

Finally, extending the foundations. Morality as cooperation predicts that developments in game theory will expand the theory's explanatory power. Already, by drawing on all nonzero-sum games, the theory goes beyond most existing reviews of cooperation, which tend to focus on kin and reciprocal altruism, and overlook mutualism and conflict resolution (see Table 3). The discovery of new game-theoretical problems and solutions will open up new horizons for the explanation of further aspects of morality.

Table 3 Previous reviews of cooperation are incomplete

		Kin	Mutualism	Exchange	Contest (hawk)	Contest (dove)	Division	Possession	Other
Cooperation among animals	Dugatkin (1997)								
	Kinship	1							
	Reciprocity			1					
	Byproduct mutualism		1						
	Group selection								1
Cooperation and collective action in animal behaviour	Nunn and Lewis (2001)								
	Kinship	1							
	Prisoner's dilemma			1					
	Coordination/mutualism		1						
	Chicken/hawk–dove				1	1			
The evolution of cooperation	Sachs, Mueller, Wilcox, and Bull (2004)								
	Directed reciprocation			1					
	Shared genes	1							
	By-product benefits		1						
Five rules for the evolution of cooperation	Nowak (2006)								
	Kin selection	1							
	Direct reciprocity			1					
	Indirect reciprocity			1					
	Network reciprocity			1					
	Group selection								1
The evolution of cooperation and altruism	Lehmann and Keller (2006)								
	Direct benefits		1						
	Reciprocation			1					
	Kin selection	1							
	Greenbeard	1							
Evolutionary explanations for cooperation	West, Griffin, and Gardner (2007)								
	Direct benefits			1					
	Indirect benefits	1							
	By-product benefits		1						

Alternative Alchemies

Morality as cooperation is a naturalistic theory grounded in our understanding of the material world; it draws on the latest insights from empirical sciences such as ethology, psychology, and anthropology; it offers a unified, universal view of morality; and it uses the principles of game theory to identify specific problems of cooperation and their corresponding solutions and to make predictions about moral phenomena. As such, morality as cooperation differs from existing theories in a number of ways.

It differs from those theories that invoke the supernatural (it has no need of that hypothesis). It differs from those that attempt to explain morality using only pre-scientific folk ontologies—such as belief, desire, passion, reason, and the will (Jackson, Pettit, & Smith, 2004).

It differs from theories that maintain that there is nothing that unifies the diverse array of moral phenomena (Sinnott-Armstrong & Wheatley, 2013) and that we must therefore settle for a plethora of low-level generalisations about morality (Bartels, Bauman, Cushman, Pizarro, & McGraw, 2015).

It differs from theories that argue that the very definition of morality varies from culture to culture, that there are no universal moral values, and that morality varies radically or arbitrarily across cultures (Ladd, 1985).

It differs from theories that hold that morality is not about cooperation, but about fulfilling natural human functions or fully expressing human capacities (Arnhart, 1998; Casebeer, 2003). And it differs from theories that hold that morality is about maximising welfare, well-being or utility by any means, not necessarily cooperation (Mill & Bentham, 1987).

It differs from approaches that do not use game theory (or indeed any theory at all) to derive their taxonomies of morality and that consequently conflate, omit, and misconstrue different types of cooperation (see Table 4). For example, morality as cooperation suggests that Fiske's Relational Models (based on ethnographic field work and, oddly, the theory of measurement; Stevens, 1946), Shweder's CAD Triad (based on a small study in one culture), and Haidt's Moral Foundations (based on a literature review of five sources, including Fiske and Shweder) err in conflating kinship and mutualism, and exchange and division, and in omitting hawkish traits and possession. Further, morality as cooperation suggests that the Moral Foundations approach also errs by interpreting mutualism as group selection (Haidt, 2012) and including a category—purity, avoiding 'people with diseases, parasites [and] waste products'—that has no apparent connection to cooperation.

And, it differs from theories that, because they lack any underlying theory, cannot make principled predictions about the nature of morality (Haidt & Joseph, 2011).

Table 4 Previous moral taxonomies are incomplete

			Kin	Mutualism	Exchange	Contest (hawk)	Contest (dove)	Division	Possession	Other
Relational Models	Fiske (1992) and Rai and Fiske (2011)	Unity	1	1						
		Respect					1			
		Equality			1			1		
		Proportionality			1					
CAD Triad	Shweder, Much, Park, and Mahapatra (1997/2003)	Community	1	1			1			
		Autonomy			1			1		
		Divinity								1
Moral Foundations	Graham et al. (2011) and Haidt and Joseph (2004)	Care	~1							1
		Fairness			1			1		
		Ingroup	1	1						1
		Authority					1			
		Purity								1

Conclusion

Morality is no mystery. We have a theory. Morality is a collection of biological and cultural solutions to the problems of cooperation and conflict recurrent in human social life; and game theory reveals what those problems and solutions are. Morality as cooperation explains what morality is, where it comes from, how it works, and what it is for.

Crucially, because this theory makes predictions about morality—predictions that can be tested against those of rival theories using standard scientific method—it makes clear that the study of morality, theory driven and empirically tested, is simply another branch of science. And it is this realisation, more than any particular theory, that will set the study of morality on the firm scientific foundation that will finally allow it to flourish.

References

Alvard, M. (2001). Mutualistic hunting. In C. Stanford & H. Bunn (Eds.), *Meat-eating and human evolution* (pp. 261–278). New York: Oxford University Press.

Alvard, M., & Nolin, D. (2002). Rousseau's whale hunt? *Current Anthropology, 43*(4), 533–559.

Amici, F., Aureli, F., Mundry, R., Amaro, A., Barroso, A., Ferretti, J., et al. (2014). Calculated reciprocity? A comparative test with six primate species. *Primates, 55*(3), 447–457. doi:10.1007/s10329-014-0424-4.

Aquinas, T. (1988). *On politics and ethics*. New York, London: WW Norton & Company.

Aristotle. (1962). *Nichomachean ethics* (M. Oswald, Trans.). Englewood Cliffs, NJ: Prentice-Hall.

Aristotle. (1992). *The politics*. London: Penguin Books.

Arnhart, L. (1998). *Darwinian natural right: The biological ethics of human nature*. Albany, NY: SUNY Press.

Augustine. (1998). *The city of god against the pagans*. Cambridge, UK: Cambridge University Press.

Axelrod, R. (1984). *The evolution of cooperation*. New York: Basic Books.

Baier, A. (1995). *Moral prejudices: Essays on ethics*. Cambridge, MA: Harvard University Press.

Balliet, D., Wu, J., & De Dreu, C. K. W. (2014). Ingroup favoritism in cooperation: A meta-analysis. *Psychological Bulletin*, No Pagination Specified. doi:10.1037/a0037737.

Bartels, D. M., Bauman, C. W., Cushman, F. A., Pizarro, D. A., & McGraw, A. P. (2015). Moral judgment and decision making. In G. Keren & G. Wu (Eds.), *Blackwell reader of judgment and decision making*. Malden, MA: Blackwell.

Becker, L. C. (1977). *Property rights: Philosophic foundations*. London, Henley and Boston: Routledge & Kegan Paul.

Berger, P. L. (1970). On the obsolescence of the concept of honor. *European Journal of Sociology, 11*, 338–347.

Berger, P. L., & Luckmann, T. (1966). *The social construction of reality*. London: Allen Lane The Penguin Press.

Binmore, K. (1994a). *Game theory and the social contract, Vol 1: Playing fair?* (Vol. I). Cambridge, MA: MIT Press.

Binmore, K. (1994b). *Game theory and the social contract, Vol 2: Just playing* (Vol. II). Cambridge, MA: MIT Press.

Bissonnette, A., Perry, S., Barrett, L., Mitani, J. C., Flinn, M., Gavrilets, S., et al. (2015). Coalitions in theory and reality: A review of pertinent variables and processes. *Behaviour, 152*(1), 1–56. doi:10.1163/1568539X-00003241.

Boesch, C. (1999). *Hierarchy in the forest*. Cambridge, MA: Harvard University Press.

Boinski, S., & Garber, P. A. (Eds.). (2000). *On the move: How and why animals travel in groups*. Chicago: Chicago University Press.

Boone, J. (1992). Competition, cooperation and the development of social hierarchies. In E. A. Smith & B. Winterhalder (Eds.), *Ecology, evolution and social behavior* (pp. 301–337). New York: Aldine de Gruyter.

Boos, M., Kolbe, M., Kappeler, P. M., & Ellwart, T. (Eds.). (2011). *Coordination in human and primate groups*. Heidelberg, Germany: Springer.

Bouzouggar, A., Barton, N., Vanhaeren, M., d'Errico, F., Collcutt, S., Higham, T., et al. (2007). 82,000-year-old shell beads from North Africa and implications for the origins of modern human behavior. *Proceedings of the National Academy of Sciences of the United States of America, 104*(24), 9964–9969. doi:10.1073/pnas.0703877104.

Boyd, R., Richerson, P. J., & Henrich, J. (2011). The cultural niche: Why social learning is essential for human adaptation. *Proceedings of the National Academy of Sciences of the United States of America, 108*, 10918–10925. doi:10.1073/pnas.1100290108.

Brams, S. J., & Taylor, A. D. (1996). *Fair division: From cake-cutting to dispute resolution*. Cambridge, UK: Cambridge University Press.

Brosnan, S. F. (2013). Justice- and fairness-related behaviors in nonhuman primates. *Proceedings of the National Academy of Sciences of the United States of America, 110*(Suppl. 2), 10416–10423. doi:10.1073/pnas.1301194110.

Bshary, R., & Grutter, A. S. (2006). Image scoring and cooperation in a cleaner fish mutualism. *Nature, 441*(7096), 975–978. http://www.nature.com/nature/journal/v441/n7096/suppinfo/nature04755_S1.html.

Burnham, T. C. (2007). High-testosterone men reject low ultimatum game offers. *Proceedings of the Royal Society B: Biological Sciences, 274*(1623), 2327–2330.

Butler, J. (1856). *Fifteen sermons preached at the Rolls Chapel*. London: Longman.

Carter, G. G., & Wilkinson, G. S. (2013). Food sharing in vampire bats: reciprocal help predicts donations more than relatedness or harassment. *Proceedings of the Royal Society B: Biological Sciences, 280*(1753). doi:10.1098/rspb.2012.2573.

Casebeer, W. (2003). *Natural ethical facts: Evolution, connectionism, and moral cognition*. Cambridge, MA: MIT Press.

Centre, P. R. (2014). *Worldwide, many see belief in god as essential to morality*.

Chagnon, N. A., & Bugos, P. E. (1979). Kin selection and conflict: An analysis of a Yanomamö ax fight. In N. A. Chagnon & W. Irons (Eds.), *Evolutionary biology and human social behaviour: An anthropological perspective*. North Scituate, MA: Duxbury Press.

Chapais, B. (2014). Complex kinship patterns as evolutionary constructions, and the origins of sociocultural universals. *Current Anthropology, 55*(6), 751–783. doi:10.1086/678972.

Chilton, B. D., & Neusner, J. (Eds.). (2009). *The golden rule: The ethics of reciprocity in world religions*. Bloomsbury Academic.

Cicero, M. T. (1971). *On the good life*. London: Penguin Classics.

Clutton-Brock, T. H. (1991). *The evolution of parental care*. Princeton, NJ: Princeton University Press.

Clutton-Brock, T. H. (2009). Cooperation between non-kin in animal societies. *Nature, 462*, 51–57.

Confucius. (1994). A single word. In P. Singer (Ed.), *Ethics* (p. 76). Oxford, UK: Oxford University Press.

Connor, R. C. (1995). The benefits of mutualism: A conceptual framework. *Biological Reviews, 70*(3), 427–457.

Cosmides, L., & Tooby, J. (2005). Neurocognitive adaptations designed for social exchange. In D. M. Buss (Ed.), *The handbook of evolutionary psychology* (pp. 584–627). New York: Wiley.

Cowan, R. (2007). *For the glory of Rome: A history of warriors and warfare*. London: Greenhill Books.

Curry, O. S. (2005). *Morality as natural history: An adaptationist account of ethics.* PhD, London School of Economics, London. Retrieved from http://etheses.lse.ac.uk/2/

Curry, O. S. (2007). The conflict-resolution theory of virtue. In W. P. Sinnott-Armstrong (Ed.), *Moral psychology* (Vol. I, pp. 251–261). Cambridge, MA: MIT Press.

Curry, O. S., & Jones Chesters, M. (2012). 'Put yourself in the other fellow's shoes': The role of 'theory of mind' in solving coordination problems. *Journal of Cognition and Culture, 12*, 147–159.

Curry, O. S., Price, M. E., & Price, J. G. (2008). Patience is a virtue: Cooperative people have lower discount rates. *Personality and Individual Differences, 44*, 778–783.

Daly, M., & Wilson, M. (1988). *Homicide*. New York: Aldine de Gruyter.

Daly, M., & Wilson, M. (1996). Violence against stepchildren. *Current Directions in Psychological Science, 5*, 77–81.

Darwin, C. (1871). *The Descent of Man and Selection in Relation to Sex*. London, John Murray.

Darwin, C. (1872/1998). *The expression of the emotions in man and animals* (3rd ed.). London: John Murray/HarperCollins.

Dawkins, R. (1976/2006). *The selfish gene* (3rd ed.). Oxford, UK: Oxford University Press.

Dawkins, R. (1979). Twelve misunderstandings of kin selection. *Zeitschrift für Tierpsychologie, 51*(2), 184–200. doi:10.1111/j.1439-0310.1979.tb00682.x.

Dawkins, R. (1998). *Unweaving the rainbow: Science, delusion and the appetite for wonder*. London: Penguin Books.

de Kwaadsteneit, E. W., & van Dijk, E. (2010). Social status as a cue for tacit coordination. *Journal of Experimental Social Psychology, 46*, 515–524.

Deaner, R. O., & Smith, B. A. (2012). Sex differences in sports across 50 societies. *Cross-Cultural Research*. doi:10.1177/1069397112463687.

Downie, R. S. (1965). Forgiveness. *Philosophical Quarterly, 15*(59), 128–134.

Dugatkin, L. A. (1997). *Cooperation among animals: An evolutionary perspective*. New York: Oxford University Press.

Edel, M., & Edel, A. (1959/1968). *Anthropology and ethics: The quest for moral understanding*. Cleveland, OH: Case Western Reserve University Press.

Edelman, M. S., & Omark, D. R. (1973). Dominance hierarchies in young children. *Social Science Information, 12*(1), 103–110. doi:10.1177/053901847301200105.

Emmons, R. A. (Ed.). (2004). *The psychology of gratitude*. Oxford, UK: OUP.

Euler, H. A., & Weitzel, B. (1996). Discriminative grandparental solicitude as reproductive strategy. *Human Nature, 7*, 39–59.

Feinberg, J. (1973). Some conjectures about the concept of respect. *Journal of Social Philosophy, 4*(2), 1–3. doi:10.1111/j.1467-9833.1973.tb00163.x.

Fiddick, L., Cummins, D., Janicki, M., Lee, S., & Erlich, N. (2013). A cross-cultural study of noblesse oblige in economic decision-making. *Human Nature, 24*(3), 318–335. doi:10.1007/s12110-013-9169-9.

Fiske, A. P. (1992). The four elementary forms of sociality – Framework for a unified theory of social-relations. *Psychological Review, 99*(4), 689–723. doi:10.1037//0033-295X.99.4.689.

Friedman, O., & Neary, K. R. (2008). Determining who owns what: Do children infer ownership from first possession? *Cognition, 107*(3), 829–849. http://dx.doi.org/10.1016/j.cognition.2007.12.002.

Fukuyama, F. (1996). *Trust: The social virtues and the creation of prosperity*. London: Penguin Books.

Gaulin, S. J. C., & Schlegel, A. (1980). Paternal confidence and paternal investment: A cross cultural test of a sociobiological hypothesis. *Ethology and Sociobiology, 1*(4), 301–309. doi:10.1016/0162-3095(80)90015-1.

Gavrilets, S., Duenez-Guzman, E. A., & Vose, M. D. (2008). Dynamics of alliance formation and the egalitarian revolution. *PLoS One, 3*(10), e3293.

Geary, D. C. (2000). Evolution and proximate expression of human paternal investment. *Psychological Bulletin, 126*, 55–77.

Gert, B. (2013). Loyalty and morality. In S. Levinson, J. Parker, & P. Woodruff (Eds.), *Nomos* (Vol. LIV, pp. 3–21). New York & London: New York University Press.

Gibbard, A. (1990a). Norms, discussion, and ritual: Evolutionary puzzles. *Ethics, 100*(July), 787–802.

Gibbard, A. (1990b). *Wise choices, apt feelings*. Oxford, UK: Clarendon Press.

Gintis, H. (2007). The evolution of private property. *Journal of Economic Behavior & Organization, 64*(1), 1–16.

Gintis, H., Smith, E. A., & Bowles, S. (2001). Costly signaling and cooperation. *Journal of Theoretical Biology, 213*, 103–119. doi:10.1006/jtbi.2001.2406.

Godfray, H. C. J. (1992). The evolution of forgiveness. *Nature, 355*, 206–207.

Graham, J., Nosek, B. A., Haidt, J., Iyer, R., Koleva, S., & Ditto, P. H. (2011). Mapping the moral domain. *Journal of Personality and Social Psychology, 101*(2), 366–385. doi:10.1037/A0021847.

Greene, J. D. (2015). The rise of moral cognition. *Cognition, 135*, 39–42. http://dx.doi.org/10.1016/j.cognition.2014.11.018.

Güth, W., Schmittberger, R., & Schwarze, B. (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior & Organization, 3*(4), 367–388.

Haidt, J. (2012, June 18). To see group-selected traits, look at groupishness during intergroup competition. *Edge*.

Haidt, J., & Joseph, C. (2004). Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. *Daedalus, 133*(4), 55–66.

Haidt, J., & Joseph, C. (2011). How moral foundations theory succeeded in building on sand: A response to Suhler and Churchland. *Journal of Cognitive Neuroscience, 23*(9), 2117–2122.

Haidt, J., & Kesebir, S. (2010). Morality. In S. Fiske, G. Gilbert, & G. Lindzey (Eds.), *Handbook of social psychology* (5th ed., pp. 797–832). Hoboken, NJ: Wiley.

Hamilton, W. D. (1964). The genetical evolution of social behaviour. *Journal of Theoretical Biology, 7*, 1–16, 17–52. doi:10.1016/0022-5193(64)90039-6.

Harbaugh, W. T., Krause, K., Liday, S. G., & Vesterlund, L. (2002). Trust in children. In E. Ostrom & J. Walker (Eds.), *Trust, reciprocity and gains from association: Interdisciplinary lessons from experimental research* (pp. 302–322). New York: Russell Sage Foundation.

Harcourt, A., & de Waal, F. B. M. (Eds.). (1992). *Coalitions and alliances in humans and other animals*. Oxford: Oxford University Press.

Hardy, C. L., & Van Vugt, M. (2006). Nice guys finish first: The competitive altruism hypothesis. *Personality and Social Psychology Bulletin, 32*(10), 1402–1413. doi:10.1177/0146167206291006.

Hardy, C. W., & Briffa, M. (Eds.). (2013). *Animal contests*. Cambridge, UK: Cambridge University Press.

Hauser, M. (2001). *Wild minds: What animals really think*. London: Penguin.

Hausman, D. M., & McPherson, M. S. (1996). *Economic analysis and moral philosophy*. Cambridge, UK: Cambridge University Press.

Hawkes, K. (1991). Showing off: Tests of another hypothesis about men's foraging goals. *Ethology and Sociobiology, 12*(1), 29–54.

Hawkes, K., O'Connell, J. F., & Blurton Jones, N. G. (2001). Hadza meat sharing. *Evolution and Human Behavior, 22*(2), 113–142.

Hazlitt, H. (1964). *The foundations of morality*. Princeton, NJ: D. Van Nostrand Company Inc.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., et al. (2005). 'Economic Man' in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. *Behavioral and Brain Sciences, 28*(6), 795–855.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Beyond WEIRD: Towards a broad-based behavioral science. *Behavioral and Brain Sciences, 33*(2–3), 111–135. doi:10.1017/S0140525x10000725.

Hepper, P. G. (Ed.). (1991). *Kin recognition*. Cambridge, UK: Cambridge University Press.

Herskovits, M. J. (1952). *Economic anthropology: A study in comparative economics*. New York: Afred A. Knopf.

Hobbes, T. (1651/1958). *Leviathan*. New York: Macmillan.

Hume, D. (1739/1985). *A treatise of human nature*. London: Penguin Classics.

Hume, D. (1757/1889). *The natural history of religion*. London: Freethought.

Huntingdon, F. A., & Turner, A. K. (1987). *Animal conflict*. London & New York: Chapman and Hall.

Jackson, F., Pettit, P., & Smith, M. (2004). *Mind, morality, and explanation: Selected collaborations*. Oxford, UK: OUP.

Jaeggi, A. V., & Gurven, M. (2013). Reciprocity explains food sharing in humans and other primates independent of kin selection and tolerated scrounging: A phylogenetic meta-analysis. *Proceedings of the Royal Society of London B: Biological Sciences, 280*(1768).

Johnson, D. D. P., & Toft, M. D. (2014). Grounds for war: The evolution of territorial conflict. *International Security, 38*(3), 7–38. doi:10.1162/ISEC_a_00149.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica, 47*, 263–291.

Kocher, M. G., Cherry, T., Kroll, S., Netzer, R. J., & Sutter, M. (2008). Conditional cooperation on three continents. *Economics Letters, 101*, 175–178. doi:10.1016/j.econlet.2008.07.015.

Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature, 435*, 673–676.

Kurzban, R., Tooby, J., & Cosmides, L. (2001). Can race be erased? Coalitional computation and social categorization. *Proceedings of the National Academy of Sciences of the United States of America, 98*(26), 15387–15392.

Ladd, J. (Ed.). (1985). *Ethical relativism*. Lanham, MD: University Press of America.

Lehmann, L., & Keller, L. (2006). The evolution of cooperation and altruism – A general framework and a classification of models. *Journal of Evolutionary Biology, 19*(5), 1365–1376. doi:10.1111/j.1420-9101.2006.01119.x.

Levinson, S., Parker, J., & Woodruff, P. (Eds.). (2013). *Loyalty* (Vol. LIV). New York & London: New York University Press.

Lewis, D. K. (1969). *Convention: A philosophical study*. Cambridge, MA: Harvard University Press.

Lieberman, D., Tooby, J., & Cosmides, L. (2003). Does morality have a biological basis? An empirical test of the factors governing moral sentiments relating to incest. *Proceedings of the Royal Society of London Series B-Biological Sciences, 270*(1517), 819–826. doi:10.1098/Rspb.2002.2290.

Lieberman, D., Tooby, J., & Cosmides, L. (2007). The architecture of human kin detection. *Nature, 445*(7129), 727–731. doi:10.1038/Nature05510.

Locke, J. (2000). Labour as the basis of property. In M. Rosen, W. Wolff, & C. McKinnon (Eds.), *Political thought* (p. 73). Oxford, UK: Oxford University Press.

MacIntyre, A. C. (1981a). *After virtue*. London: Gerald Duckworth & Co. Ltd.

MacIntyre, A. C. (1981b). The nature of the virtues. *Hastings Center Report, 11*(2), 27–34.

Mackie, J. L. (1977). *Ethics: Inventing right and wrong*. London: Penguin.

Maynard Smith, J. (1982). *Evolution and the theory of games*. Cambridge, UK: Cambridge University Press.

Maynard Smith, J., & Price, G. R. (1973). The logic of animal conflict. *Nature, 246*, 15–18.

Maynard Smith, J., & Szathmáry, E. (1995). *The major transitions in evolution*. Oxford, UK: Oxford University Press.

Mazur, A. (2005). *Biosociology of dominance and deference*. Lanham, MD: Rowan & Littlefield.

McCullough, M. E., Kimeldorf, M. B., & Cohen, A. D. (2008). An adaptation for altruism? The social causes, social effects, and social evolution of gratitude. *Current Directions in Psychological Science, 17*(4), 281–285. doi:10.1111/j.1467-8721.2008.00590.x.

McCullough, M. E., Kurzban, R., & Tabak, B. A. (2013). Cognitive systems for revenge and for-giveness. *Behavioral and Brain Sciences, 36*(01), 1–15. doi:10.1017/S0140525X11002160.

McKay, R., & Whitehouse, H. (2014). Religion and morality. *Psychological Bulletin*.

Messick, D. M. (1993). Equality as a decision rule. In B. Mellers & J. Baron (Eds.), *Psychological perspectives on justice* (pp. 11–31). Cambridge, UK: Cambridge University Press.

Mill, J. S., & Bentham, J. (1987). *Utilitarianism and other essays*. London: Penguin.

Miller, G. F. (2000). *The mating mind*. London: William Heinemann.

Mitani, J. C. (2009). Cooperation and competition in chimpanzees: Current understanding and future challenges. *Evolutionary Anthropology, 18*(5), 215–227. doi:10.1002/Evan.20229.

Moore, G. E. (1903). *Principia ethica*. Cambridge, UK: Cambridge University Press.

Nagel, T. (1991). *Mortal questions*. London: Canto.

Nash, J. (1950). The bargaining problem. *Econometrica, 18*, 155–162.

No Title. (2001, March 29). *The Economist*.

Noddings, N. (1978). *Caring: A feminine approach to ethics and education*. Berkeley, CA: University of California Press.

Nowak, M. A. (2006). Five rules for the evolution of cooperation. *Science, 314*(5805), 1560–1563. doi:10.1126/science.1133755.

Nunn, C. L., & Lewis, R. J. (2001). Cooperation and collective action in animal behaviour. *Economics in nature: Social dilemmas, mate choice and biological markets* (pp. 42–66). Cambridge, UK: CUP.

Oates, K., & Wilson, M. (2002). Nominal kinship cues facilitate altruism. *Proceedings: Biological Sciences, 269*(1487), 105–109.

Ohtsubo, Y., & Watanabe, E. (2009). Do sincere apologies need to be costly? Test of a costly sig-naling model of apology. *Evolution and Human Behavior, 30*(2), 114–123.

Ostrom, L., & Walker, J. (Eds.). (2002). *Trust and reciprocity: Interdisciplinary lessons from experimental research*. New York: Russell Sage Foundation.

Pennock, J. R., & Chapman, J. W. (Eds.). (1979). *Compromise in ethics, law and politics* (Vol. XXI). New York: New York University Press.

Pennock, J. R., & Chapman, J. W. (Eds.). (1980). *Property* (Vol. XXII). New York: New York University Press.

Pinker, S. (2010). The cognitive niche: Coevolution of intelligence, sociality, and language. *Proceedings of the National Academy of Sciences of the United States of America, 107*, 8993–8999. doi:10.1073/pnas.0914630107.

Pinker, S. (1997). *How the mind works*. New York: W W Norton.

Platek, S. M., Critton, S. R., Burch, R. L., Frederick, D. A., Myers, T. E., & Gallup, G. G., Jr. (2003). How much resemblance is enough? Sex difference in reactions to resemblance, but not the ability to detect resemblance. *Evolution and Human Behavior, 24*(3), 81–87.

Plato. (1974). *The republic*. London: Penguin Books.

Popper, K. R. (1945). *The open society and its enemies*. London: Routledge.

Preuschoft, S., & van Schaik, C. P. (2000). Dominance and communication: Conflict management in various social settings. In F. Aureli & F. B. M. de Waal (Eds.), *Natural conflict resolution* (pp. 77–105). Berkeley, CA: University of California Press.

Price, M. E., Cosmides, L., & Tooby, J. (2002). Punitive sentiment as an anti-free rider psycho-logical device. *Evolution and Human Behavior, 23*(3), 203–231. doi:10.1016/j.evolhumbehav.2004.08.009.

Rai, T. S., & Fiske, A. P. (2011). Moral psychology is relationship regulation: Moral motives for unity, hierarchy, equality, and proportionality. *Psychological Review, 118*(1), 57–75. doi:10.1037/a0021867.

Rawls, J. (1958). Justice as fairness. *The Philosophical Review, 67*(2), 164–194.

Rawls, J. (1971). *A theory of justice*. Cambridge, MA: Harvard University Press.

Richards, N. (1988). Forgiveness. *Ethics, 99*(1), 77–97.

Riechert, S. E. (1998). Game theory and animal contests. In L. A. Dugatkin & H. K. Reeve (Eds.), *Game theory and animal behavior* (pp. 64–93). Oxford, UK: Oxford University Press.

Rose, C. M. (1985). Possession as the origin of property. *University of Chicago Law Review, 52*, 73–88.

Ross, H., & Friedman, O. (Eds.). (2011). *Origins of ownership of property: New directions for child and adolescent development*. Hoboken, NJ: John Wiley & Sons.

Royce, J. (1908). *The philosophy of loyalty*. New York: Macmillan.

Royle, N. J., Smiseth, P. T., & Kölliker, M. (Eds.). (2012). *The evolution of parental care*. Oxford, UK: OUP.

Rubin, P. H. (2000). Hierarchy. *Human Nature, 11*(3), 259–279.

Ruddick, S. (1980). Maternal thinking. *Feminist Studies, 6*, 342–367.

Russell, B. (1927). *Philosophy*. New York: Norton.

Sachs, J. L., Mueller, U. G., Wilcox, T. P., & Bull, J. J. (2004). The evolution of cooperation. *The Quarterly Review of Biology, 79*(2), 135–160. doi:10.1086/383541.

Schelling, T. C. (1960). *The strategy of conflict*. Cambridge, MA: Harvard University Press.

Sell, A., Bryant, G. A., Cosmides, L., Tooby, J., Sznycer, D., von Rueden, C., et al. (2010). Adaptations in humans for assessing physical strength from the voice. *Proceedings of the Royal Society B-Biological Sciences, 277*(1699), 3509–3518. doi:10.1098/Rspb.2010.0769.

Sell, A., Cosmides, L., Tooby, J., Sznycer, D., von Rueden, C., & Gurven, M. (2009). Human adaptations for the visual assessment of strength and fighting ability from the body and face. *Proceedings of the Royal Society B: Biological Sciences, 276*(1656), 575–584. doi:10.1098/Rspb.2008.1177.

Sherif, M., Harvey, O. J., White, B. J., Hood, W. R., & Sherif, C. W. (1954/1961). *Intergroup conflict and cooperation: The Robbers cave experiment*. Norman, OH: University of Oklahoma Book Exchange.

Shultz, S., & Dunbar, R. I. M. (2007). The evolution of the social brain: Anthropoid primates contrast with other vertebrates. *Proceedings of the Royal Society of London B: Biological Sciences, 274*(1624), 2429–2436.

Shultz, S., Opie, C., & Atkinson, Q. D. (2011). Stepwise evolution of stable sociality in primates. *Nature, 479*(7372), 219–222. http://www.nature.com/nature/journal/v479/n7372/abs/nature10601.html#supplementary-information.

Shweder, R. A., Much, N., Park, L., & Mahapatra, M. M. (1997/2003). The 'Big Three' of morality (autonomy, community, divinity) and the 'Big Three' explanations of suffering. In A. Brandt & P. Rozin (Eds.), *Morality and health*. New York: Routledge.

Sinnott-Armstrong, W., & Wheatley, T. (2013). Are moral judgments unified? *Philosophical Psychology, 27*(4), 451–474. doi:10.1080/09515089.2012.736075.

Skyrms, B. (1996). *Evolution of the social contract*. Cambridge, UK: Cambridge University Press.

Skyrms, B. (2004). *The stag hunt and the evolution of social structure*. Cambridge, UK: Cambridge University Press.

Smith, M. S., Kish, B. J., & Crawford, C. B. (1987). Inheritance of wealth as human kin investment. *Ethology and Sociobiology, 8*(3), 171–182. http://dx.doi.org/10.1016/0162-3095(87)90042-2.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science, 103*(2684), 677–680.

Strassmann, J. E., & Queller, D. C. (2014). Privatization and property in biology. *Animal Behaviour*. http://dx.doi.org/10.1016/j.anbehav.2014.02.011.

Tajfel, H. (1970). Experiments in intergroup discrimination. *Scientific American, 223*(5), 96–102.

Thomas, K. A., DeScioli, P., Haque, O. S., & Pinker, S. (2014). The psychology of coordination and common knowledge. *Journal of Personality and Social Psychology, 107*(4), 657–676. doi:10.1037/a0037037.

Thornhill, N. W. (1991). An evolutionary analysis of rules regulating human inbreeding and marriage. *Behavioral and Brain Sciences, 14*(02), 247–261. doi:10.1017/S0140525X00066449.

Tomasello, M., Carpenter, M., Call, J., Behne, T., & Moll, H. (2005). Understanding and sharing intentions: The origins of cultural cognition. *Behavioral and Brain Sciences, 28*(5), 675.

Tomasello, M., & Vaish, A. (2013). Origins of human cooperation and morality. *Annual Review of Psychology, 64*(1), 231–255. doi:10.1146/annurev-psych-113011-143812.

Tooby, J., & Cosmides, L. (1996). Friendship and the banker's paradox: Other pathways to the evolution of adaptations for altruism. In W. G. Runciman, J. Maynard Smith, & R. I. M. Dunbar

(Eds.), *Evolution of social behaviour patterns in primates and man* (pp. 119–143). Oxford, UK: British Academy/Oxford University Press.

Tooby, J., & DeVore, I. (1987). The reconstruction of hominid behavioral evolution through strategic modeling. In W. G. Kinzey (Ed.), *The evolution of human behavior: Primate models* (pp. 183–237). Albany, NY: SUNY Press.

Tooby, J., & Cosmides, L. (2010). *Groups in mind: The coalitional roots of war and morality* (pp. 191–234).

Trivers, R. L. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology, 46*(1), 35–57. doi:10.1086/406755.

Van Vugt, M., Hogan, R., & Kaiser, R. B. (2008). Leadership, followership, and evolution: Some lessons from the past. *American Psychologist, 63*(3), 182–196.

Von Neumann, J., & Morgenstern, O. (1944). *The theory of games and economic behavior*. Princeton, NJ: Princeton University Press.

Watkins, C. D., Fraccaro, P. J., Smith, F. G., Vukovic, J., Feinberg, D. R., DeBruine, L. M., et al. (2010). Taller men are less sensitive to cues of dominance in other men. *Behavioral Ecology*. doi:10.1093/beheco/arq091.

West, S. A., Griffin, A. S., & Gardner, A. (2007). Evolutionary explanations for cooperation. *Current Biology, 17*(16), R661–R672. doi:10.1016/j.cub.2007.06.004.

Westermarck, E. A. (1906). *The origin and development of the moral ideas*. London: Macmillan.

Whiten, A. (1996). When does smart behaviour-reading become mind-reading? In P. Carruthers & P. K. Smith (Eds.), *Theories of theories of mind*. Cambridge, UK: CUP.

Wong, D. (1984). *Moral relativity*. Berkeley, CA: UC California Press.

Wrangham, R. (1999). Evolution of coalitionary killing. *Yearbook of Physical Anthropology, 42*, 1–30.

Young, L., Camprodon, J. A., Hauser, M., Pascual-Leone, A., & Saxe, R. (2010). Disruption of the right temporoparietal junction with transcranial magnetic stimulation reduces the role of beliefs in moral judgments. *Proceedings of the National Academy of Sciences of the United States of America, 107*(15), 6753–6758.

Zahavi, A., & Zahavi, A. (1997). *The handicap principle: A missing piece of Darwin's puzzle*. Oxford, UK: Oxford University Press.

Zak, P. J., Kurzban, R., Ahmadi, S., Swerdloff, R. S., Park, J., Efremidze, L., et al. (2009). Testosterone administration decreases generosity in the ultimatum game. *PLoS One, 4*(12), e8330.