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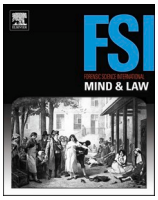

A case for evolutionary criminology: Introducing the retribution and reciprocity model

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ABSTRACT

We live in a reciprocating world – we smile when someone smiles at us, get angry when we perceive injustice, and support the social norm even when we cannot explain why. This paper sheds light on one of the most unlikely explanatory mechanisms of crime: cooperation. By combining knowledge from neuroscience, evolutionary biology, and behavioural economics, this theoretical paper presents the evidence that could help us understand crime and organises it into a Retribution and Reciprocity Model (RRM). RRM has the potential to help us take a step back and see how criminal acts may be an outcome of evolutionary mechanisms that the field of criminology should not overlook.

1. Introduction

Criminology is a multidisciplinary science, and as criminologists, we take pride in that fact despite the complexities it might cause in the field. That is to be expected, since crime is a complex behaviour embedded in many processes, from the genetic predisposition or B12 deficiencies (Domisse, 1991) to the more extensive societal processes and culture (Karstedt, 2001). In this paper, I make a case for looking at evolutionary criminology by bringing together the knowledge from neuroscience, evolutionary biology, and behavioural economics to shed light on one of the most unlikely explanatory mechanisms of crime: cooperation.

In aspiring to understand criminal behaviour, evolutionary science cannot be overlooked. Either implicitly or explicitly, every theory of criminology makes an assumption about the human nature, be in it that people are selfish (self-control theories), rule-guided (Situational action theory), or rational (rational choice theories). However, it is only by looking at the etiology can we test whether those assumptions are true. I posit that by looking at evolutionary psychology, we can not only design new criminological theories that are based in the evolutionary grounding, but we can also use evolution as a tool to advance our understanding on what theories are based on the correct assumptions about the human nature. In this paper, I posit that humans are retributive and reciprocal and present an overarching theory of evolutionary criminology, the Retribution and Reciprocity Model (RRM).

Humans are unique cooperators: we exchange resources, help one another at a time of need, and choose to enforce the rules. Most of these behaviours are so deeply embedded into us that we do not even think about them. Two of such behaviours are retribution and reciprocity. An eye for an eye is a belief shared amongst most cultures around the world and, as such, formed the basics of our criminal justice policy in the form of the Hammurabi code (Hogan & Henley, 1970). Reciprocal and retributive behaviours guide most human interaction and have a lot of explanatory power in evolutionary science. In this paper, I posit that looking at our society through the lens of retribution and reciprocity can help us understand why people commit crime. Therefore, this is a theoretical paper presenting evidence for cooperation and crime and aims to develop the Retribution and Reciprocity Model (RRM). Evolutionary criminology is a new field, and as such it lacks an overarching theory of why people commit crime - to the best of my knowledge, this paper presents the first attempt to introduce an evolutionary theory to the field of crime causation. In addition, I aim to explain why evolution is a useful tool to use if we are to explain criminal behaviour.

I begin by presenting the background information on retribution and reciprocity by explaining how it became such a fundamental part of society, starting with a description of the evolutionary processes that have led to cooperative tendencies. The subsequent section outlines the concepts of retribution and reciprocity, defines them, and explains their impact on cooperation. The fourth section brings that knowledge together to present RRM and its action framework as a testable theory. The concluding section of this chapter summarises the reasons for and

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benefits of studying RRM and introduces areas for future research.

2. Why study retribution and reciprocity

The ability to cooperate, communicate, and coordinate allowed humans to persist as a species despite being neither the strongest nor the fastest and having many other vulnerabilities. Through many years of evolution, our decision-making has adapted to a necessity to stay with a group (Van Vugt & Hart, 2004) by making us able to recognise the social norms of that group and abide by them (Fehr & Fischbacher, 2004). Even though human survival no longer directly depends on many of these behaviours, many are ingrained in us from birth. For example, we are capable of expressing empathy (Carr et al., 2003; Decety & Jackson, 2004), recognising facial expressions (Izard, 1994), following another person's gaze (Driver et al., 1999; Farroni et al., 2002), and following the majority as a means of social conformity (Berns et al., 2005). Cooperation is deeply etched in the human brain; every community creates social rules and punishes the violators, directly or indirectly.

As society evolved in its complexity, these rules were codified, and punishment systems emerged to form the basis of criminal justice systems as we know them today (Parekh, 2003). These criminal justice systems share remarkable similarities despite cultural differences between societies. In most places, offences like homicide and theft are generally unacceptable. But even more specifically, it is usually not acceptable for individuals to act in a wholly selfish manner, and members of society are expected to act in a way that contributes to the functioning of the whole group (Berthoz et al., 2002; Bowles & Gintis, 1998; Fehr et al., 2002). In other words, the expectation is to cooperate. For millions of years, society imposed harsh punishments for not following these expected norms of cooperation, such as ostracising some of their members from the group, thus rendering them unable to survive. As a result, natural selection in humans tended not to benefit the strongest or the fastest necessarily, but instead, those who were most able to work for the benefit of the entire group and hence be accepted by it (Axelrod & Hamilton, 1981). In practice, this instilled survival behaviours in humans that are, as a result, primarily hardwired into our brains, such as learning by imitation and feeling empathy (de Waal, 2008). These innate tendencies tell us to run when other individuals run even if they cannot see the predator, aid in learning which berries should not be eaten by simply trusting the other group members and imitating one another in learning how to use tools or behave towards our elders.

Features such as these facilitated the success of humans as a species, formed the basis of our society, and affected every aspect of our lives. They are etched into the genes and brains of every individual and play a role regardless of their environment and the situations they find themselves in (Curry et al., 2019). These evolutionary predispositions must be considered when explaining human behaviour, even when people show non-cooperative acts, such as committing a crime. As such, crime is not that different from other things that we do - most people commit a crime at some point in their lives (Farrington et al., 2014). Crime most certainly cannot be understood separately from all the other social processes that occur every minute of every day.

In this paper, I explain that the most fundamental human behaviour that helped us persevere as a species is cooperation. I also argue that the mechanism that supports cooperation is based on retribution and reciprocity, as proposed by Fehr and Gächter (2000a, 2000b). However, the main contribution of this paper is to explain why these mechanisms are relevant to criminology and how they can be arranged into a theory of crime. Reciprocity forms the basis of cooperation: without the certainty that something positive will follow good deeds, people would be unlikely to share and help one another. The expectation of reciprocity from others in the group means that all group members must cooperate to benefit from the cooperation of others. However, as in many social contracts, there is always a possibility to free-ride. The tendency to punish the violator of a social norm is a natural consequence of the need to cooperate, a tendency I call 'retribution'. Without the expectation of punishment from potential social norm violators, many more people would choose to free-ride. Even when punishing the violator of a social norm is costly, many people choose to do so for the potential benefit of cooperation that it would bring (Fehr & Gächter, 2002).

As such, I argue that crime is embedded in reciprocity and retribution. Sometimes crime itself may be an attempt by a person to punish a perceived injustice imposed on them by society or a specific person and serve as a retributive act. The evident example is the activity of vigilante groups that take justice into their own hands by punishing offenders without legal authority. In other cases, someone might be deterred from committing a crime by their positively reciprocal feelings, such as a reluctance to steal from a person who has been nice to them. Conversely, someone might be encouraged to commit a crime in response to a hostile act towards them, eliciting negatively reciprocal feelings, such as punching someone who has previously hit them. These tendencies (retribution and reciprocity) can be both motivating and constraining factors, and as such, they cannot be overlooked if we wish to understand crime.

3. Evolution of cooperation and punishment

Though scientists from many fields study "cooperation", the term is used to describe a range of different behaviours. For RRM, I define cooperation as a situation in which an individual incurs a cost to benefit another person or group. Therefore, cooperation comes in two forms: helping a group at a price and the costly punishment of defectors (non-cooperators). A cost can be paying money, enduring discomfort, or even simply investing time on a task. Cooperation is a fundamental part of human society. Examples include paying tuition fees for one's children, volunteering for social projects, deciding to put effort into recycling, or simply stopping to give lost strangers directions. It occurs between family members, friends, strangers, in pairs, small groups, or big groups. Since most interactions incur a cost to help another person, cooperation becomes an important concept when explaining human societies.

Creatures of every level of organisation cooperate to survive. From the earliest bacteria feeding their neighbours nitrogen (Brockhurst et al., 2010; Czárán & Hoekstra, 2009) and meerkats risking their lives to protect a communal nest (Clutton-Brock et al., 2001) to humans helping one another after natural disasters (De Alessi, 1975). However, the range and extent to which humans cooperate is rarely observed in the animal world (Johnson & Earle, 2000), apart from some highly cooperative groups like ants and bees. Humans' astonishing ability to collaborate has made them into "supreme cooperators" (Nowak & Highfield, 2011., p. xiv) and allowed them to flourish. However, many of our cooperative behaviours are so small and mundane that we do not even realise they are part of the exact mechanism. For example, we cooperate by keeping our voices down in libraries, standing in a queue in an orderly fashion, or putting our garbage into bins instead of throwing it on the streets.

Four main theories currently offer an explanation as to why cooperation was naturally selected for: kin selection (Hamilton, 1964); reciprocal altruism (Trivers, 1971); indirect reciprocity (Alexander, 1986; Nowak & Sigmund, 1998); and costly signalling (Gintis et al., 2001; Zahavi, 1975). Kin selection explains cooperation as helping individuals with similar genes and hence putting your genes forward to pass them on to the next generation. Reciprocal altruism describes cooperation as a way of ensuring that somebody will repay kindness with kindness, i.e., an investment for the future. Finally, indirect reciprocity and costly signalling assume that a person cooperating with others is building themselves a reputation to ensure that other group members cooperate with them in the future. All four of these theories work on the assumption that cooperation within the group was selected for because it benefitted group members allowing them to propagate.

Numerous Game Theory experiments (Bowles & Gintis, 2000; Boyd et al., 2003; Fehr & Henrich, 2003; 2004; Fehr et al., 2002; Fehr & Gächter, 2002; Fehr & Henrich, 2003; Fehr & Rockenbach, 2004; Gintis, 2000; Gintis et al., 2003) have tested cooperation in various conditions,

and in all settings participants show considerable degrees of cooperation. As there is much evidence that cooperation yielded advantageous results, evolution likely favoured people with strong innate tendencies to display such behaviour.

3.1. Evolutionary advantage of cooperation

Many moral behaviours and patterns of behaviour are thought hardwired (or innate) in humans from birth (Hauser, 2006; Hauser et al., 2007). It is believed that humans are predisposed to many of these tendencies because they offer a significant evolutionary advantage. Many of these behaviours are perceived as widespread solutions to prevalent problems of survival (Evans & Levinson, 2009). For example, most societies consider truth-telling a virtue, which is likely to be a consequence of humans relying on accurate information to survive, and hence needing to trust one another (Churchland, 2006, pp. 3–16). Similarly, humans are hardwired to trust one another by default, which was necessary to avoid predators (Churchland, 2011). Although not all the features we have are the most efficient mechanism for putting our genes forward (Galis et al., 2001); other features, primarily behavioural, are likely to have stayed with us because they provided an evolutionary advantage. In this paper, I posit that cooperation is one of those behaviours.

Nevertheless, cooperation has always been a puzzle. How, in the world of eat-or-be-eaten, did cooperation become evolutionarily advantageous? When a bacterium shares nutrients with its neighbours, it has less for itself. Similarly, when a person contributes money to a charity, they cannot spend it on themselves. When a starving wolf gives the last of her food to her cubs, she risks dying from starvation. Works on evolution are saturated with terms like “struggle”, “competition”, and “survival of the fittest”: how does cooperation come into this? The standard economic theory views humans as utility maximisers, choosing to behave in a way that helps them achieve their goals most quickly and cheaply. “Altruism”, or unconditional kindness, does not seem to have a place in that logic. However, these self-centred motives are precisely what allowed social cooperation to arise.

Axelrod (as described in 2012) tested the evolutionary principles by organising a complex tournament in which several computer programs played against one another in repeated Prisoner’s Dilemma environments. In these experiments, the programs had to share resources with one another and accumulate points. The most successful programs were rewarded with offspring (more versions of themselves), and those who did badly were killed off. Researchers worldwide submitted their programs that played in the tournament against one another tirelessly, and the one that got the most points won. Contrary to expectations, the winner of the computerised competition was a simple four-line program that used a tit-for-tat strategy. Put simply, it cooperated when it was cooperated with, and it defected in response to defection, or it continuously repeated the co-player’s previous move.

This simple experiment shows that a tit-for-tat strategy that allows for cooperation is the one that is likely to reap the most benefit. As such, it would be easy to conclude that it is expected that those that apply tit-for-tat strategies in real life would have an evolutionary advantage. However, humans are not utility maximisers with excellent skills for reading the environment: they make mistakes, suffer mood swings, misunderstand situations. In summary, humans produce a lot of noise. Even infrequent errors can have devastating consequences on the interaction between programs by triggering an endless cycle of retaliation.

As a result of these shortcomings, new computer models emerged, taking human error into account (Nowak & Sigmund, 2004). The new types of tournaments incorporated noise and forgiveness. In the past, thousands of generations of computer simulations have shown the triumph of tit-for-tat strategies, but in these noise-sensitive tournaments, the results were quite different. Every simulation started with a state of chaos, where programs were allocated strategies at random and, out of that, the Always Defect strategy always emerged with an early lead. For around a hundred generations, Always Defect dominated the tournament. At this point, a minority of Tit-for-Tat programs that previously barely clung to existence emerged and reversed direction. As soon as the Always Defect programs were left with nobody to exploit, they quickly died off against the reciprocal cooperators, Tit-for-Tats. In the end, the whole pool of programs consisted entirely of reciprocal cooperators. However, as the simulation progressed further, Tit-for-Tats lost to social programs that were more forgiving than the initial Tit-for-Tats. That program was the Generous Tit-for-Tat, which was programmed to never defect in response to cooperation, but sometimes cooperated in response to defection. That programming allowed them to prevail in the simulation in which mistakes happen. By the end, Generous programs wiped out Tit-for-Tat programs and managed to protect themselves against defectors. That created a population in which everyone uniformly cooperated and hence multiplied. However, as a result of mutations, Always Defect strategies emerged once more and conquered the population, but they never managed to wipe out all the other programs, and the cycle started once again (Nowak & Sigmund, 2004).

What does this mean? Tit-for-Tat strategies seem most successful in a world of rational point maximisers that make no mistakes. They also seem to be highly successful in a world where errors are considered but lose to the Generous Tit-for-Tat’s more forgiving strategy. Cooperation is more advantageous even in noisy environments; it makes sense that cooperative individuals would be more likely to pass on their genes and survive. However, perhaps the most exciting feature of these results is their cyclical nature; the chaos with which it starts, the prevalence of Always Defectors in the first stages, the emergence of Tit-for-Tats, then the victory of Generous Tit-for-Tat’s programmes, and the following re-emergence of the defectors. This cyclical nature could explain interpersonal differences - why some choose to cooperate more readily than others and why some choose to opt-out only for certain types of reciprocity. Evolution led to us having natural tendencies to cooperate due to the apparent evolutionary benefit that allowed cooperators to pass on their genes. However, it is also the hunt for resources that makes it possible for some people to remain non-cooperative since when everyone cooperates, it might be temporarily beneficial to defect. Nevertheless, there is a reason why most people remain cooperative: it increased their probability of surviving and passing their genes on (Eisler & Levine, 2002).

As a result of the survival benefits of cooperation, biological mechanisms likely developed that reward cooperation. There is a limited pool of neuroimaging evidence of the neurophysiology of cooperation, but some areas connected to cooperation have been identified. Participants playing cooperation games were found to have activation in their medial prefrontal cortex (McCabe et al., 2001), others in the ventromedial prefrontal cortex and the ventral striatum (Rilling et al., 2002) as well as the anterior cingulate cortex (Gallagher et al., 2002), all regions belonging to the prefrontal cortex. Generally, the prefrontal cortex is believed to mediate executive functions, i.e., planning, working memory, self-control. Hence, its activation may show that participants are rationally deliberating the relative benefits of cooperation versus defection. In addition, studies tend to show activation in regions specifically involved in reward processing: the nucleus accumbens, the caudate nucleus, ventromedial frontal/orbitofrontal cortex, and rostral anterior cingulate cortex (King-Casas et al., 2005; Rilling et al., 2002). The medial orbitofrontal cortex is specifically essential for situations where participants cooperate (Decety et al., 2004), and it is known as the area crucial for goal-directed behaviour and motivational control (Tremblay & Schultz, 1999). Evidence consistently shows that humans have a reward system that favours cooperation.

Nevertheless, even though evolutionary advantage can explain why most people are predisposed to cooperate and even suggests a theory for explaining the individual differences, it does not fully explain why some people are more cooperative than others.

3.2. The role of learning

In the same way as people are born with an ability to learn the language but not the ability to speak (Chomsky, 1959), people are born with certain cooperative predispositions, but not with rules for cooperation themselves. Children and adults observe the behaviour of others around them and do their best to imitate them, in a process known as 'learning by imitation'.

In an experiment (Bryan, 1971, pp. 2061–2065), children were invited to play a game of bowling, after which they had a chance to contribute to a charity out of their winnings, which would mean that they would have less money to spend on toys and sweets in the future. Therefore, any child's contribution would be costly for them and purely altruistic, as they know that they will get nothing out of it. Children are also left alone in the room and instructed that they are not observed by anyone, which means that they cannot act to impress others. Will the child contribute to a charity? There is no rational reason to do that and no possible benefit to be derived from it. Nevertheless, children donate to charities. How much and to what charities can be easily manipulated.

Findings replicated through several research groups and hundreds of children aged 6–11 produced strong evidence that children generally contributed around a quarter of their winnings to charities (Henrich & Henrich, 2007). Their donations increased when children were presented with a charity-donating human model to imitate. The more the model donated, the more children donated as well. If the model failed to donate, children contributed less than the 'no model' condition (Bryan, 1971, pp. 2061–2065; Grusec et al., 1978). Having a model present was much more effective than instructing children to contribute (Bryan & Walbek, 1970; Grusec et al., 1978). Not only did children imitate the act of donation, but they also imitated the order of putting the contributions into different charities (Rosenhan & White, 1967). The effect of learning from the model lasted for several months and extended to slightly different contexts (Rice & Grusec, 1975; Rushton, 1975).

Evolution favoured those genetically predisposed for social learning. Individuals most able to learn and imitate others were more likely to survive (Boyd & Richerson, 1988). Since individuals learn by imitation, they must choose who to imitate. Acquiring new information costs time and learning the wrong habit may be dangerous. In determining whom to imitate, individuals rely on their measure of prestige and success (Henrich & Gil-White, 2001). As they do not know which precise practices lead to that person's success, individuals tend to imitate others on a wide range of traits, relevant or not (Henrich & Henrich, 2007). Laboratory experiments have shown that people imitated other participant's economic strategies (Kroll & Levy, 1992; Pingle, 1995), beliefs (Offerman et al., 2002; Offerman & Sonnemans, 1998), and social interaction (Apesteguia et al., 2010). In these studies, individuals preferred to imitate others who were perceived to be most successful, even when the perceived success was not relevant to the task at hand (Ritchie & Phares, 1969; Ryckman et al., 1972). Outside of laboratory conditions, similar trends are observed, such as in the diffusion of innovation (Rogers, 1995), jaywalking (Mullen et al., 1990), the transmission of dialect (Labov, 1990), and even suicide (Booth, 1999; Jonas, 1992; Stack, 1982). Apart from 'learning from the best', humans also tend to imitate the behaviour of the majority in so-called conformist transmission (Boyd and Richerson, 1988; Kameda & Nakanishi, 2002; Muthukrishna et al., 2016). Therefore, what we learn from our surroundings often depends on who we are surrounded by, and by who of those are the most successful people or what behaviour most people around us exhibited.

The behaviours we imitate, including cooperation and punishment, often become entrenched into our reward systems as habits. As such, habits reflect the social learning of what we regard as right and wrong (Churchland, 2011; Graybiel, 2008). The pain of being shunned and the pleasure of belonging shape our behaviours so that we can exercise cooperation without thinking about it. As neurological evidence consistently shows that we constantly reward ourselves for cooperative behaviour (Tabibnia & Lieberman, 2007), it is likely that once we learn to cooperate with others, we are unlikely to stop; thus, cooperation becomes the default behaviour[1].

However, as explained earlier, cooperation consists of two elements: sharing with others and supporting them; and costly punishment that ensures others' long-term cooperation.

3.3. The learning of punishment

Even though habitually we might be more inclined to cooperate, rational deliberation may still lead us to the path of defection. Great benefits are drawn from cooperation, which ensures cooperators spread their genes. However, even more significant benefits could be drawn by a free-rider abusing others' cooperation, which should have led to their genes proliferating. However, this is not observed in any of societies. That is because other cooperators strongly deterred free-riding (Trivers, 1971). Humans punish to ensure cooperation (recent discussion of when and how punishment can lead to cooperation, and an up-to-date review of punishment in nature, see Taborsky et al., 2021). In our societies, we create whole criminal justice systems built upon the idea of punishing the offender and isolating them from society to deter others from committing crimes. Therefore, punishment is part of the cooperative strategy. These punishing mechanisms are also found in many other vertebrate societies and are like those observed in humans (Clutton-Brock, 2002). For example, non-cooperative behaviours are punished by rhesus monkeys (Hauser, 1992) and coyotes (Bekoff, 2004).

That is unsurprising; once emotions incentivising altruistic and cooperative behaviours evolved, cooperators would be vulnerable to exploitation by non-cooperative members. Therefore, a mechanism exists to protect the cooperators: a means of punishing defectors (Trivers, 1971). That mechanism is believed not only to be beneficial in a two-person interaction but is also thought to be relevant on a group level (Alexander, 1986; Nowak & Sigmund, 1998). This means that people punish those who have wronged them personally and punish those who have violated the whole group to which an individual belongs, protecting the entire group against defectors.

As such, human cooperation can be best summarised as "be nice but punish". We reward others for norm-abiding behaviours, but equally, as importantly, we punish them for social norm violations (Sober & Wilson, 2011).

Evidence from both ethnographic (Boehm et al., 1993) and laboratory (Fehr & Gächter, 2002; Ostrom, Walker, & Gardner, 1992) studies show that people tend to punish non-cooperators, even in one-shot games. Although punishing a violator of a social norm may be costly for oneself, it is believed that the effect of deterring others from cheating later leads to a group benefit, as well as individual benefit (Sethi & Somanathan, 1996). Even costly punishment should benefit the group and is essential for resource-sharing. This explains how punishment would become hardwired into humans the same way cooperation is, and why people punish even in conditions where no future benefit could be derived. Simulation studies showed that groups in which more group members retaliated against the defectors were more likely to survive than non-punishing groups. This is because punishment encourages cooperation, and cooperative groups are more likely to survive than non-cooperative ones (Boyd et al., 2003).

A neurological mechanism for punishment exists that was most likely passed on through the process of natural selection. More specifically, punishment feels rewarding for people, so they get conditioned to use it more. Studies involving punishment in economic games found activation in the brain's dorsal striatum (De Quervain et al., 2004). The striatum is a crucial part of reward-related neural circuits, evidence supported by both human (Delgado et al., 2003, 2004; Knutson et al., 2000; Martin-Soelch et al., 2001) and primate (Schultz & Romo, 1988) studies. More importantly, it is suggested that the striatum is implicated in detecting the rewards that follow a decision (O'Doherty, 2004). Therefore, punishment is likely to provide relief or satisfaction even though they might incur a cost due to that punishment.

All humans have predispositions for cooperation and punishment; however, there is much more to human behaviour than genes and neurological mechanisms. Our environments also play a role, and a vital role at that.

3.4. Culture-gene coevolution

As evidenced by the previous sections, both biology and cultural influences turn humans into cooperators. Our genetic predisposition heavily influences our culture and the environment. Those cultural outcomes, in turn, create a specific environment in which genes further evolve. The prime example of this interaction is the ability of certain groups to metabolise lactose. In most primates, lactase, an enzyme that helps break down lactose, is only found in infancy. Later, when the need for digestion of milk disappears, lactase disappears (McCracken, 1971). However, some regions, such as northern Europe and pastoral Africa, began adopting a culturally transmissive practice of milking large cattle, which led to natural selection preferring people that could retain lactase through adults over those who could not. This was happening because, in situations of food scarcity, people who could get nutrients from lactose were more likely to survive and hence passed on their genes (Bersaglieri et al., 2004; Mulcare et al., 2004). In other places, such as the Middle East and China, milk was more likely to have been turned into cheese and yoghurt, for which lactase was not necessary, and hence there was no natural selection of adults that could maintain lactase (Beja-Pereira et al., 2003). In the future, societies that have not developed the ability to absorb lactose will likely avoid drinking milk, thus making the ability to retain lactase unnecessary.

Cooperation in societies develops following a similar pattern in a process theorised by the dual inheritance theory (Boyd & Richerson, 1988), first mentioned in the previous subsection of this paper. Human behaviour is influenced both by the culture in which people grow up and their genes. For example, it is found that pathogen prevalence can predict collective (as opposed to individualistic) values in society. That means that cultures with a higher prevalence of deadly infectious diseases were much more likely to endorse collective values, probably due to a disease-preventing and -combating nature of collective action (Fincher et al., 2008). That shows that groups respond to their environment and form a culture that is most likely to help them survive, and in the case of being exposed to illnesses, those groups put more emphasis on helping the members of the group.

More evidence of the dual inheritance theory comes from studying the serotonin transporter gene (SLC6A4), which regulates serotonergic (5-HTT) neurotransmission. 5-HTT has a region known as 5-HTTLPR, which can either contain a long (L) or a short (S) allele, which result in different levels of 5-HTT expression (Hariri, 2009; Lesch et al., 1996). Individuals carrying an S allele have a lower 5-HTT expression and as a result are much more prone to negative emotion, including increased amygdala reactivity (Hariri et al., 2002; Munafo et al., 2008), heightened anxiety (Sen et al., 2004), negative bias and heightened risk of depression (Caspi et al., 2002; Taylor et al., 2006; Uher & McGuffin, 2008). In addition, population genetic studies show that in some areas, such as East Asia, 70–80% of the sample is an S allele carrier in some areas, such as East Asia, whereas in Europe, the percentage is typically 40–50% (Chiao & Blizinsky, 2010; Gelernter et al., 1997). That evidence would suggest that East Asian societies should have a higher prevalence of depressive and anxiety disorders than Europeans. However, that is not the case.

Studies have consistently reported a lower prevalence of anxiety and mood disorders than Western populations (Chiao & Blizinsky, 2010; Sorel, 2010). Culture-gene coevolution explains this contradiction by positing that cultural norms are adaptive. Therefore, values of collectivism that preserve social harmony over individualism were adapted in East Asian societies as an environment protecting from stress and reducing the risks of developing depression since the individuals are more likely to have the S allele. As a result, the relationship between the S allele of 5-HTTLPR and cultural values of collectivism-individualism was so strong that the former served as a sole predictor for the latter (Chiao & Blizinsky, 2010). Other explanations for the differences exist, however, the data by Chiao and Blizinsky supports the hypotheses.

This evidence shows that human social norms can be viewed as an outcome of culture-gene coevolution. Being one of those norms, cooperation survived and amplified in humans following this exact mechanism. Along with the theories of kin selection, reciprocity, costly signalling, and indirect reciprocity, another idea was put forward: group selection theory, which supposes competition for resources between groups, but explains cooperation within groups. That means that it is not the best individual who is likely to survive and pass on their genes, but the best group (Wilson, 1975). When it comes to humans, cultural differences between groups are much larger than genetic ones (Bell et al., 2009; Chudek & Henrich, 2011). Group competition favours those groups with stable social norms that ensure their group members' long-term prosperity and success (Boyd & Richerson, 1990; Henrich, 2004). These processes have shaped the environment in which the genes further developed: the genes that allowed the bearers to rapidly identify the social norms and adhere to them received an advantage (Chudek & Henrich, 2011). Since cooperation is a strategy that benefits most group members, cooperating groups are more likely to gain more resources and hence survive. Therefore, individuals with genes for identifying and supporting cooperation within those groups are more likely to prosper. Since the most successful individuals tend to be imitated in the first place, they are likely to spread their norms and genes for cooperation even further.

All these findings show us how cooperative behaviours evolved, and retribution and reciprocity are likely to have evolved by the same mechanism, considering how prevalent these behaviours are. The understanding of the biological and learning mechanisms of cooperation and punishment lie in the basis of RRM.

4. Retribution and reciprocity model

RRM states that people act in accordance with their retributive and reciprocal tendencies, which result from the interaction of biological mechanisms and learning. That means that even though most people are likely to exhibit reciprocal and retributive behaviours, there are individual differences in the extent and level to which those are expressed. These tendencies interact with people's perceptions of the environment, and those interactions can help us explain crime outcomes.

The Retribution and Reciprocity Model (RRM) identifies new concepts that can help to explain criminal behaviour and the framework of their interaction. These factors are perceptions of the environment (PoE), positive reciprocity (PR), negative reciprocity (NR), and retribution (R). Even though one might assume that positive and negative reciprocity could both be just called reciprocity, they are fundamentally different behaviours (Fehr & Gächter, 2000a, 2000b) which tend to manifest differently within an individual (Hoffman et al., 1998), and can be tested using different methods (Fehr & Schmidt, 2006). That means that there is a difference in levels within an individual, and one does not imply the other, so if a person is highly positively reciprocal, it does not mean that they would be negatively reciprocal to the same extent.

There are two types of reciprocity that are relevant for the model: direct and general. Direct reciprocity relates to the experience of personal contact with specific individuals or groups. It refers to the situations in which one person has a particular reputation in the eyes of the reciprocator, which is acted upon accordingly. Therefore, it depends on an ongoing set of interactions between a pair of people. For example, if person A punched person B, person B would have direct negative reciprocity towards that person, as their behaviour is something they have experienced first-hand and respond to that person directly. The same reasoning applies if person A lent person B money in the past: person B would be expected to lend person A some money if person A were to experience financial peril in the future.

Direct reciprocity relates to the direct experience of personal contact with specific individuals or groups. General reciprocity, in contrast, refers to situations where people do not have direct contact to guide their behaviour. Instead, they rely on their general expectations of the environment (including negative biases), or the aggregate of past experiences. For example, an individual could have an overall negative experience of the police force based on the stories they hear from friends (general reciprocity), but have a good relationship with the one police officer that showed kindness and helped them on an occasion (direct reciprocity).

General reciprocity, in the way I refer to it in this paper, takes its roots in the findings behind generalised reciprocity (Pfeiffer et al., 2005). Hamilton and Taborsky (2005) found that people are more likely to cooperate when they have been helped by others in the previous round, in a 'help anyone is helped by someone' manner. While the concept of general reciprocity in the way that I discuss is based on the findings that support a generalised reciprocity, for this application the concept is slightly different. In the case of general reciprocity for RRM, one can form an expectation of specific institutions, such as the police force, without necessarily having direct prior experiences with them.

In short, RRM suggests that when presented with an incentive to commit a crime, a person is influenced by the interaction of their perceptions of the environment and their reciprocal and retributive tendencies. Positive perceptions of the environment interacting with positively reciprocal tendencies usually lead to crime not being committed. In contrast, negative perceptions of the environment interacting with negatively reciprocal and retributive tendencies make crime more likely to occur (Fig. 1).

Positive and negative perceptions of the environment are hard to quantify, although not impossible. PoE refers to the persons' perceptions of places and circumstances. It could refer to a specific person, neighbourhood, or even an entire country. For the sake of this theory, "positive" refers to when a person feels they have been treated fairly, helped and supported by their environment, and feel they are getting something out of it. In contrast, "negative" means the opposite, that people feel that they were treated unfairly and being exploited. Perceptions of the environment are not binary but exist on a spectrum and are a continuous variable. As a result, the score can also be neutral. Perceptions of the environment are directly related to general reciprocity, as they affect how the person perceives the world in general and what expectations they have of the social norms and environment around them. Perceptions of the environment are involved in learning and observations of the world: people derive social norms from how people around them behave and apply them accordingly.

Reciprocity always means a response to something: therefore, only positive acts can trigger positively reciprocal responses, and only negative acts can trigger negative reciprocity. The same works for the perceptions of the environment. We all form our opinions about the world around us through past experiences and learning from the people around us, which shapes our understanding of the world around us.

PoE are important in and of themselves. For instance, a person is much less likely to assault a stranger who just smiled at them than someone who shouted at them. A teenager is much less likely to draw graffiti on the wall of a shop that has always given them a discount than a shop where the cashiers are rude to them (Fisher & Baron, 1982; Kahan, 2002). In general terms, people's perceptions about their environment inform what they think is acceptable or not in a particular situation and shape their expectations. For example, if a person thinks that everyone around them steals things from one another, they would be more likely to steal themselves. Even in trivial situations like someone stepping on their foot, each person may interpret the situation differently. A person with a negative perception of the environment, in which they believe the world is working against them, might lash out and think the person that stepped on their foot did so on purpose. On the other hand, a person who has a very positive view of the environment is more likely to believe that the situation was an accident.

As such, some people are much more susceptible to the positivity or negativity of their environment than others, and many factors feed into that variation; some people are more reactive or sensitive to their environments than others. I posit with RRM that the reason for this is the interaction of PoE with positively and negatively reciprocal tendencies. Since reciprocity is a response to something, it cannot be separated from an environment and a specific situation. To invoke positively reciprocal mechanisms, one has first to perceive an act of kindness. To invoke negatively reciprocal tendencies, one must recognise something as hostile towards them. That means that different levels of retributive and

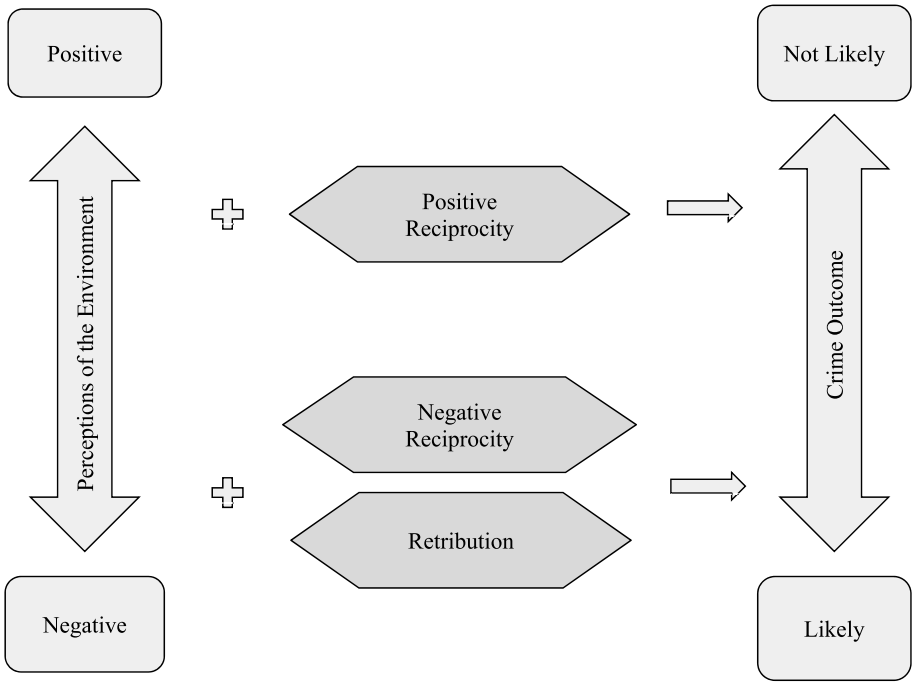

Fig. 1. The mechanism for the RRM.

reciprocal tendencies would result in different sensitivities to the environments.

Non-reciprocal types would most likely not be significantly influenced by the positivity or negativity of the environment. Instead, they would be likely to judge the situation solely by the initial motivation. For example, people scoring high on NR scores and low on PR scores would be very hard to deter from committing a crime by simply doing something nice to them; however, they would be easily pushed into committing a crime by doing something hostile towards them.

There are, of course, other individual factors and features of temperament that might influence crime propensity, such as impulsivity or negative emotionality. However, those factors are not included in this model for their multitude and complexity. There are also the immediate environmental factors, such as the presence of witnesses and availability of suitable victims, which also fall outside of the scope of this model since its focus is on simply determining the role of retribution and reciprocity in crime causation. There are also initial motivations, or reasons for why a person might want to commit a crime in the first place, that are only included as a very broad term without much evaluation and mean that something must trigger the person wanting to commit a crime.

Initial motivations are various aspects that have motivated a person to commit a crime, e.g., peer pressure or financial gain. It is the goal-directed preference for a behaviour-event contingency that involves an interaction between situational stimuli and personal preferences (Heckhausen & Heckhausen, 2008). Defining and examining these motivations is outside of the scope of this paper. Still, they play an essential role in understanding the role of the model, as without the initial motivation to commit a crime, there is no need for people to enact reciprocal mechanisms. RRM suggests that both NR and PR are enacted after an individual has perceived committing a crime as an option and could influence the willingness to commit a crime, the seriousness of a crime, type, or place. For instance, if a person is motivated to steal the money, they might decide how much they would steal based on the level of a relationship they have with their potential victim. The same mechanism works for organisations and other non-human entities, such as stealing from your company.

Retribution is similar to negative reciprocity in that it is also a response to a negative act, but there are some differences. In contrast to NR, in which one person responds to other people's specific negative actions towards them, retribution involves punishing the violator of a social norm in general. Therefore, the retributive tendency is a motivator to commit a crime. That means that the actor did not wish to commit a crime beforehand but was forced into it because of the need to punish the violator of a social norm.

The main conclusion drawn from RRM is that people who have felt that they were supported and understood by the society are less likely to commit a crime than those who might see the world as a hostile place and feel that for most of their lives they have been treated unfairly. A neurophysiological mechanism (discussed in Svingen, 2023) evolved to support these tendencies, supporting the finding that humans may be hardwired, or 'soft-wired' to behave in this way.

Criminologists have not overlooked society and perceptions of fairness. Social Control Theory explains crime through weak links to the community, described as weak social bonds (Hirschi, 2002). Strain Theory suggests that people who experience strains that cause negative emotions might cope with criminal strategies (Agnew, 2005). Defiance Theory suggests that people reoffend when a punishment is perceived as unfair or disrespectful (Sherman, 1993). Growing up in a deprived neighbourhood is found to be a risk factor for offending, suggesting a link between feeling worse-off and adopting criminal strategies (Welsh & Farrington, 2007). Together, these theories suggest that society, and perceptions of it by the offenders, matter when trying to explain criminality and that criminal behaviour may be reciprocal and retributive. In addition, having a model of retribution and reciprocity can add a mechanism in supporting these criminological theories.

I argue in this paper that many of the observations found by criminology that indicate criminality through the environment can be explained through the lens of reciprocity and retribution. RRM would argue that weak bonds do not cause crime but influence reciprocal feelings. People with weak social ties or who experience strains might feel the need to lash out against society because they believe that they have gotten nothing out of it. In contrast, people with strong social ties might encounter opportunities to commit a crime but would not act on those opportunities because of the tendency to reciprocate positively towards the society that has been fair and supportive of them. Without strong social ties, there is no reciprocal motive to stop a person from committing a crime. Strain itself might reduce positive reciprocal tendencies and heighten retributive tendencies. Therefore, RRM could add to the understanding and the explanatory power of many of the already existing theories of crime.

RRM could also help explain individual differences when some people commit crimes, and others do not, despite experiencing identical strains or having similar social bonds. This discrepancy might be attributed to the fact that some people, who grew up in a good environment and felt society's support, might reciprocate by not resorting to criminal coping strategies. But, on the other hand, others who think humanity has mistreated them might feel the need to seek retribution and hence may adopt a criminal coping strategy.

RRM would suggest that retribution can help explain why some people choose to re-offend and some choose not to. Defiance theory presents evidence that unemployed people are more likely to re-offend if they are incarcerated, whereas employed people become less likely to re-offend after incarceration (Sherman, 1993). RRM offers a new detail by stating that unemployed people would feel negative reciprocity and retribution. People who are employed tend to have higher degrees of trust in the society around them, feel more protected and supported (Westholm & Niemi, 1986), and hence feel the need to reciprocate positively.

5. Conclusion

This paper outlined the reasons for looking at retribution and reciprocity, defined them, and combined all the essential factors into the Retribution and Reciprocity Model (RRM).

Even though criminologists tend to concern themselves with the relatively rare event of committing a crime, it is essential to look at how humans organise their lives if we are to understand crime. Cooperation may be understood as a defining feature of human society, and hence understanding it might shed more light on crime as an act of non-cooperation. Although cooperation does not seem like an obvious consequence of the "survival of the fittest" understanding of evolution, numerous mathematical models have shown that cooperation is often the most rational course of action in the long run that allows for most individual advantage.

Looking at cooperation is vital in criminology, as it plays such an essential role in human lives in general. As such a fundamental foundation of human behaviours, it follows that cooperation plays a role in crime. Many acts of crime can be understood as a classic case of defection against society: acting in a selfish manner that damages the group. However, other acts of crime could be understood as acts of cooperation, such as gang crime.

I argue that the most important aspects of cooperation are those of reciprocity and retribution. To test the role of these tendencies in crime, I organise them into a Retribution and Reciprocity Model (RRM). RRM suggests that people possess different levels of negatively reciprocal, positively reciprocal, and retributive tendencies. These, in turn, interact with the individual's perceptions of the environment and elicit a response resulting in them either committing or not committing a crime. The same feelings would also be responsible for deciding to cooperate with the criminal justice systems or not, and the same feelings would determine whether we criminalise a certain act or not.

This paper presented and evidenced a model that can form a significant contribution to the explanation of why people commit crime and why issues of perceptions of fairness and relative deprivation play such a significant role in the study of criminal decision-making.

Declaration of competing interest

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