

Evolutionary psychological influences on the contemporary causes of terrorist events

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Introduction

We write this chapter with some trepidation. The source of our concern lies in the knowledge that many researchers interested in terrorism will see little worth in exploring how evolutionary psychology (EP) attempts to make sense of terrorist behaviour. EP is a field unfamiliar to many. Some view it as controversial. It is regularly the subject of criticism, some valid and some misguided, but which taken together often results in its exclusion from scientific discussions on the causes of human behaviour. In the context of terrorist behaviour, there is little direct evidence with which to convince sceptics of its value, realized or nascent. Moreover, compared to other domains, it is often difficult to see how the task of preventing terrorism might be informed by insights from EP.

According to EP, the process of natural selection, originally described by Darwin (1859), has equipped humans with a set of evolved psychological mechanisms that conferred a survival and reproductive (or 'adaptive') advantage in our ancestral past and which, in combination with contemporary developmental and environmental factors, influence how we interpret and behave in different situations, whether those behaviours are currently advantageous or not (for an overview see Buss 2005). We refer to these species-wide adaptations that occurred in our historical environment as 'ultimate' causation. An evolutionary psychological analysis of terrorism focusing on ultimate causation differs from developmental approaches, which focus on 'distal' causal processes, namely, those events that occur over an individual's life-course that are judged to increase (or reduce) the likelihood of engaging in terrorist acts. At the opposite extreme of causal analysis is the applied approach most associated with environmental criminology and crime science (Laycock 2005). This considers how 'proximal' causal mechanisms in or near the immediate crime setting generate criminal or terrorist events through psychological (Clarke 2008) and ecological (Cohen and Felson 1979; Brantingham and Brantingham 2008) processes, and in particular how this understanding can be used to formulate situational interventions (see Clarke 1997).

For evolutionary psychologists, all three levels of causation – ultimate, distal and proximal – are seen to operate in conjunction with an individual's goals to generate purposive behaviour, with some adaptive function in the here-and-now (Tinbergen 1963; Davies et al. 2012). The individual may set out to behave with a specific purpose in mind, or he/she may encounter an unforeseen opportunity that activates a general readiness to pursue a particular goal.

The often used example concerns why we eat. The proximal causal explanation for why we eat is because we are hungry, and consuming food sates our appetite and assuages our hunger. Developmental mechanisms explain how food preference and food-acquisition abilities emerge from conception to maturity. Yet the ultimate explanation is that a preference to eat in our ancestral past would have increased the likelihood of surviving and reproducing compared to conspecifics with food apathy. The evolutionary functions of the conscious purposes may be hidden from the agent – for example, only after Darwin's insights in the nineteenth century did it become clear why we like sweet things.

In this chapter we integrate the concept of ultimate causation derived from EP with the proximal situational perspective of causal mechanisms and goals, with the view to better understand, predict and prevent terrorist behaviour and events. The developmental perspective, while important, is not central to our current analysis. Those working in crime science, and more especially situational crime prevention, have only recently begun to show an interest in terrorism (Clarke and Newman 2006; Freilich and Newman 2009; Roach et al. 2005) and EP (Ekblom, in press; Roach and Pease 2013; 2014), while to the best of our knowledge there appears to be little research linking situational theories, EP and crime or terrorist behaviour. It is our contention that EP has something useful to say about how we respond to and act on information in the immediate environment, and that a better appreciation of evolutionary influences on person-situation interactions might helpfully inform efforts to reduce the proximal causes of crime and terrorist behaviour or disrupt criminals'/terrorists' proximally active, tactical goals.

The chapter is structured as follows. We begin by setting out some prevalent misconceptions about EP that we argue account for the lack of interest in the approach among terrorist researchers, and that need to be dispelled before we can proceed with our proposed analysis. Next, we set out the parameters of our analysis, and describe terrorism in a manner that is amenable to an evolutionary perspective. Given the difficulties in defining terrorism, we select the concept of tribalism as a significant exemplar of a terrorism-supporting mechanism and our focus for analysis. We move then to the main goal of this chapter: integrating the proposed causes of terrorist behaviour, from ultimate causes rooted in our evolutionary past to proximal causes and goals in the immediate environment. This analysis is conducted within the framework of the 'conjunction of terrorist opportunity' (Roach et al. 2005), a conceptual model that seeks to link a range of situational and offenderbased, proximal causes of terrorist events. We conclude by reflecting on the implications of our exercise for research and prevention.

Clarifying misconceptions about evolutionary psychology

Evidence in support of evolution by natural selection is overwhelming (Coyne 2009; Dawkins 2009). Virtually all scientists accept that the anatomy and physiology of an organism, including humans, can be explained by natural selection. However, extending that logic to accept that human behaviour has similarly been shaped by selection pressures over evolutionary time is more controversial, even among ardent Darwinists. Acceptance of this premise requires that one also accept that human behaviour is, at some level, dependent upon hard-wired brain structures that have evolved in the same way as other physical attributes. Such a premise runs counter to the deeply rooted tradition in those fields most closely associated with the study of crime and terrorism – such as sociology and criminology – where a blank-slate model of human behaviour predominates (as with some learning theories, see Burgess and Akers 1966). From these perspectives, individuals are depicted as devoid of instincts – and the causes of criminal and terrorist behaviour, and the propensities that underlie it, are ascribed solely to social and developmental processes occurring over each individual's lifetime. Many social scientists are further offended by the associated challenge from EP to the concept of rationality and the disconcerting proposition that human beings perform many actions for 'ultimate' reasons that are hidden from them (Cosmides and Tooby 1997; Ekblom, in press).

Against the background of these concerns comes misunderstanding of the implications of EP for human behaviour in general and for crime and terrorism in particular. The misunderstanding can take several forms. At its most extreme is the assumption that EP depicts human behaviour as genetically determined, predestined at birth, insensitive to environmental inputs and in ignorance of human morality. This is clearly anathema to proponents of antisocial and violent behaviours as products of socialisation and developmental experiences. It is also dangerously close to Lombroso's (1876) crude and widely discredited application of Darwinian theory in the context of criminal behaviour, namely that criminals constituted evolutionary throwbacks who could be reliably identified by virtue of physical characteristics such as asymmetrical facial features. One would struggle to find a contemporary card-carrying evolutionary psychologist who claims that everything in human psychology is genetically predetermined. As we will emphasize throughout this chapter, EP works off a biosocial model of human behaviour. Just as a fundamental component of evolutionary biology is that the expression of our genes (phenotype) is

determined by environmental factors, so too do evolutionary psychologists hold that human behaviours are the product of internal (nature) and external (nurture) factors in complex and protracted interaction.

The charge of genetic determinism in part reflects a common misunderstanding of a core concept in EP, namely ‘hard-wired’. EP suggests that the human brain is equipped with numerous evolved psychological mechanisms as a consequence of recurrent selection pressures that continue to inform contemporary human behaviour (see Table 3.1). These mechanisms are domain-specific: they are not generalized, pan-situational predispositions (e.g. aggression) but rather they are activated under certain conditions (e.g. aggression when insulted by a sexual rival). We are not consciously aware of these mechanisms and nor are we slaves to them. Hard-wired is often taken to mean permanency and behaviour fixity. This is incorrect. It is simply not possible for any biological process to provide us with a repertoire of preprogrammed responses to every situation we will encounter during our physically and socially complex lives – that is why we evolved intelligence. In any case, in any given situation there are usually multiple competing causes and goals influencing behaviour so the outcome is rarely a simple ‘stimulus-evolutionary response’ one. Moreover, the sorts of problems individuals must solve can vary depending upon whether they are male or female, rich or poor, or old or young. Evolved psychological mechanisms are *flexible* cognitive programmes that are responsive to individual circumstances and behavioural contexts, and provide for *adaptive* solutions to life’s challenges. We can and often do act against our psychological mechanisms. Roach and Pease (2012) eloquently liken this to cutting wood: the notion that evolution makes for uniform behaviour is just wrong ... wood has a grain. Anyone who has worked with wood will tell you how much easier it is to work with the grain than across the grain. Evolution provides the grain for behaviour, but we don’t have to work with it. (p.3)

Some of us can resist the biscuits.

Table 3.1 Ten ‘hard-wired’ psychological mechanisms and their hypothesized evolutionary function. Adapted from Buss (1995).

Psychological Mechanism	Function
Fear of snakes	Avoid poison
Superior female spatial-location memory	Increase success at foraging/gathering
Male sexual jealousy	Increase paternity certainty
Preference for foods rich in fats and sugar	Increase caloric intake
Female mate preference for economic resources	Provisioning for children
Male mate preferences for youth, attractiveness, and waist-to-hip ratio	Select mates of high fertility
Landscape preferences for savannah-like environments	Motivate individuals to select habitats that provide resources and offer protection appropriate to our physical and mental capabilities to exploit them and cope with hazards
Natural language	Communication/manipulation
Cheater-detection procedure	Prevent being exploited in social contracts
Male desire for sexual variety	Motivate access to more sexual partners

A related misunderstanding of EP that is central to this chapter is the view that a focus on ultimate causal processes might unhelpfully lead to a neglect of proximal causes of human behaviour. It is easy to see the origins of this misconception. Most EP research is interested in ultimate causes of human behaviour, to complement the proximal explanations that dominate the social and behavioural sciences. However, it is not practised in ignorance of proximal causation. Indeed, as indicated above, the chief message of EP is that hard-wired psychological mechanisms, including purposive ones, are contingent on stimuli in the proximal environment. This sort of gene-environment interaction is powerfully demonstrated in Caspi et al. (2002), who elegantly show that the probability of maltreated children developing violent and antisocial tendencies is mediated by the availability of monoamine oxidase A (MAOA) – an enzyme responsible for the breaking down of biochemicals such as dopamine. Higher levels of MAOA were found to suppress the criminogenic effect of child maltreatment. Yet the profound insight by Caspi

and colleagues was that the apparent violence-promoting effect of low levels of MAOA is only initiated if individuals are subjected to maltreatment during childhood – a genetic effect contingent on proximal causes. Part of the motivation behind this chapter is that a focus on the proximal causes of crime and terrorist behaviour has meant crime science has yet to fully embrace an evolutionary perspective on person-situation interactions. But the evolutionary component is not a simple add-on. The ‘preprogramming’ to ‘expect’ and to be ready for the occurrence of certain stimuli emerges through protracted and cumulative interaction between human genes and environment throughout the process of development and learning. The bringing forth of particular behaviours in particular situations may be precipitated (Wortley 2001, 2008) in situ (as with instant provocations); it may also be potentiated by a short-term build-up of mood (Van Gelder et al. 2013). Each of these processes takes in both evolutionary and environmental influences.

Setting out the parameters of our analysis

Before we can connect terrorism with evolution and situational causation we must take care to mark out the phenomena that our theories and research are intended to explain and practically influence. Terrorism comprises diverse aspects. It is variously: a strategy to achieve societal- or international-level goals; the recruitment, maintenance and operation of terrorist groups; the tactical terrorist behaviour committed by groups and individuals in support of strategy, including preparation, execution and post-event actions; the terrorist events resulting from those actions; and the climate of terror which terrorists seek to create and maintain (the inverse of community safety) as a means of influence. We can also distinguish, following Roach et al. (2005), two kinds of *target* of terrorist action: the tactical ‘target vectors’, i.e. immediate victims or people put in fear, and material assets damaged/disrupted, as instrumental means; and the strategic ‘target audience’, i.e. the government, or large company, say, that the terrorists want to influence as their ultimate end. The situation in turn comprises diverse entities and agents which the terrorists must cope with as threats or exploit as opportunities.

Within these diverse aspects of terrorism, crime science primarily focuses on criminal or terrorist events and their proximal causes (Clarke and Newman 2006). This analysis covers the tactical behaviour of terrorists leading to, during and immediately after those events, plus the immediate situation/s in which they occur. As will be seen, EP potentially informs our understanding of the perceptions, emotional/motivational reactions and behaviour of all the agents present in (and beyond) the proximal circumstances of terrorist events, both individually and as groups and societies. The proximal is therefore just our starting point from which we work back upstream, causally speaking, carefully seeking to identify emergent phenomena and processes on the way, and always looking for the possible contribution of evolutionary causes, including influences on offenders’ and others’ goals that are active before the crime situation, or activated in it.

We note the whole contextual array of causal mechanisms that start from immediate ecological interactions between offender and crime situation, and proceed in two interwoven branches. On the offender side they extend to the offender’s tactical goals, decisions and reactions, to conditions firing up motivation and emotion over a longer timescale and perhaps greater physical distance, to more distal developmental processes, which contribute to an individual’s predisposition to aggression, violence or destructiveness, to genetics. On the environmental side there extends a counterpart branch of opportunities, niches, habitats, markets, social structure/ecosystems and so forth. Connecting both sets of branches at the tips are the ultimate evolutionary causes – how the ancestral organisms adapted to ancestral environments. Such ultimate causes are at the very least ancient hominin prehistory and at most have operated in ‘deep time’ over hundreds of million years. But in the here-and-now, according to EP, they must act to influence the behaviour of offenders and other agents through genes and developmental processes, and through the environments in large part created and maintained by other human agents.

The question remains, however: what behaviours are to be judged to be acts of terrorism? Defining terrorism has proven challenging wherever attempted (e.g. Bassiouni 2002; Saul 2006; Sosis and Alcorta 2008). The key *legal* quandary is how to characterize the phenomenon while avoiding, say, criminalisation of violent resistance by freedom fighters to oppressive regimes, and while more generally separating the legal concept of proscribed and

condemned harmful intent and behaviour from matters of politics and value. *Scientific* attempts to characterize terrorism encounter a similar problem, and indeed face the additional requirement of developing an objective viewpoint detached from the cultural and institutional assumptions in which even the most disinterested legal perspectives and discourses are inevitably steeped. From an evolutionary perspective it is yet more challenging to make connections between prehuman and early human behaviour and environments on the one hand, and the refined, culture-bound notions of crime, and even more so of terrorism, on the other. The hypothesized conditions under which our distinctively human mental adaptations arose – referred to collectively as the ‘environment of evolutionary adaptedness’ (EEA: Bowlby 1969) – are located mostly in the Pleistocene epoch (1.8m–11,000 BP). Modern humans and their predecessors lived in small hunter-gatherer tribes, all of whose members knew each other intimately; there was no permanent settlement, agriculture, private property, large interacting populations, or mass communication. Imagine, for example, trying to find a convincing counterpart of a contemporary terror attack in a group of *Homo erectus* or a band of modern humans roaming the tundra in the Paleolithic. Imagine, too, trying to find convincing homologous behaviour among a contemporary band of chimpanzees. Terrorism and terrorist behaviour have only emerged as complex societies have developed. While *cultural* evolution can contribute to our understanding of the origins and nature of terrorism per se, *biological* evolution can only suggest how humans, by virtue of their EEA, came evolutionarily predisposed to evolve the strategy and tactics of terrorism when the social environment was right for it; and as individuals *ready-prepared* to be motivated and capable of committing terrorism when this emerged.

One promising approach – which will be adopted here – is described by Sosis and Alcorta (2008) when endeavouring to find a similarly detached way of addressing the relationship of religion/religiosity and terrorism. Rather than trying to define religion directly, they avoid the quagmires concerning what constitutes religion by delineating the core adaptive features of religion that facilitate cooperation. ‘This is important because we suspect that similar to their religious counterparts, successful secular terrorists employ some of these core features, such as emotionally evocative symbols, rituals and myths.’ (pp. 116–7). In support of this they refer to the practices of the Tamil Tigers in Sri Lanka who employed (among other methods) secular suicide bombing. They go on to say, the secular-religious distinction made by Western societies with institutionalized religious systems may not be a useful paradigm for examining the determinants of terrorist activity. Rather, analyses would be better served by concentrating on *how terrorist organisations use the* particular characteristics of the human religious adaptive complex we outlined here to inspire group commitment and individual action. (p.117: our italics).

Our own approach, therefore, is to examine *terrorist-supporting behavioural*, cognitive and motivational tendencies and capacities originating in our adaptations to our EEA, and to explore how this adds to our understanding of people and groups playing various roles in today’s world of terrorism – the offenders, target vectors, target audiences, preventers and others. Note that this is a broader focus than on the terrorist offender alone – understanding the *terrorized or terrorisable* is equally important.

The evolution of terrorism-supporting mechanisms: the case of tribalism

So what, then, are the evolved human behavioural patterns that support the development of terrorist behaviours and ideologies? As a starting point, we suggest the following non-exhaustive list of overlapping attributes:

- A capacity for aggressive behaviour as a means of exerting power and defending reputation and status, especially among adolescent males.
- A capacity for detecting cheating, attributing deservedness and for extracting vengeance or formal punishment.
- A capacity for distinguishing between human groups based on racial, linguistic, social, political, religious, etc. identifiers.
- A capacity for in-group solidarity/loyalty and a related capacity for emotional/motivational response to perceived attacks on in-group identity.
- A capacity for individual and collective feelings of territoriality.
- A capacity for seeing people as objects and suppressing empathy, often on the basis of out-group identifiers.

- A capacity for cooperation, enabling the development of collective responses to problems affecting the in-group.
- A capacity to maintain effective collaborative relationships with a finite yet substantial number of people, considerably more so than other primates (our so-called 'Dunbar number' is approximately 150 people (Dunbar 1992)).
- A capacity to organize in-groups along hierarchical lines and for members to assume leadership and follower roles.
- A capacity for moral belief systems that can define an in-group and justify action against out-groups in pursuit of a moral cause.
- A capacity for belief in, and motivation by, rewards distant in time and space, including after death.

We do not have the space in this chapter to set out the evidence and trace the evolutionary development of each of these attributes. However, many of them can be collected under the broader concept of tribalism. There is evidence that tribalism is a universal behavioural pattern across humans (McDonald et al. 2012; Tajfel et al. 1971) and it has also been observed in other primates (Mahajan et al. 2011). In a major review of the social psychological research, Van Vugt and Park (2009) concluded that:

humans have a pronounced tribal psychology, comprising tendencies to (a) quickly distinguish ingroup from outgroup members and prefer ingroup members, (b) form deep affections toward ingroups, (c) dislike disloyal ingroup members, (d) actively discriminate against outgroup members, and (e) engage in competition with outgroups. (2009, p. 9)

Intergroup conflict has been pervasive throughout human history. Most terrorist behaviour has a group dimension. The moral cause is usually a collective or group concern, which may involve conformity to particular practices and beliefs, and define group membership and by extension non-membership (e.g. co-religionists are in; others are to be influenced – maybe converted – or killed). Terrorists are driven by, and actively exploit, group processes in running their own organisation or network, including using group symbols, language, religion and identity (Sosis and Alcorta 2008). Even so-called lone wolf terrorists typically identify with the cause of a wider group (Watts 2012). Group membership factors may supply or deny legitimacy to some counterterrorist actions, influencing whether they will be productive or counterproductive in their influence on particular audiences.

McDonald et al. (2012) succinctly summarise the ultimate explanation for tribalism. Group living afforded humans huge survival and reproductive benefits. These covered both strength in numbers, pooling of resources and scope for division of labour; also cooperative parenting, protection from predators and territorial defence. Such advantages could have created selection pressure for the evolution of psychological mechanisms favouring a desire to cooperate and our need to 'belong'. But there is still the need to explain 'why humans are so fiercely tribal in the sense that they are motivated to engage in discrimination and aggression against members of other groups.' (p. 671). This element is of central relevance to terrorism. McDonald et al. (2012) connect it to a wider pattern in which it is men who almost exclusively perpetrate aggression against members of other groups. Setting out (and adducing evidence for) this 'male warrior' hypothesis, they argue that this 'fierce' tribal inclination is an adaptive response to the threat of coalitional aggression and intergroup conflict perpetrated by 'warrior males' in both ancestral and modern human environments. The warrior male tendency in turn derives from the ultimate goal of acquiring or protecting reproductive resources.

Tribalism and contemporary proximal and distal processes

To recapitulate, the ultimate causes in evolutionary history can only influence hereand- now behaviour in the immediate terrorist-attack situation, and in the preparation for that attack, by influencing proximal causal mechanisms. But there is no 'action at a distance': the ultimate causes have to get to the proximal ones. It is *distal* processes, including psychological development, socialisation and learning that connect the evolutionary history to the proximal. The major route is via information (knowledge for survival and reproduction in past environments) stored in our genes. But distal processes conduct evolutionary influences via other channels too, in particular through cultural (memetic) transmission from present and past society. Cultural and genetic evolution are hence intertwined, because that culture may itself have been shaped by genetic influences (the classic example is the retention of childhood lactase enzymes by adult Europeans and certain East Africans, enabling adults to digest

milk, that co-evolved with dairying culture). All cultures will have elaborated on, and distinctively shaped, our universal genetically based human tendencies to tribalism, and it is these elaborations that are culturally transmitted. Drawing a boundary between the proximal and the distal is somewhat arbitrary; moreover, the boundary depends on whether we are considering a group or individual perspective. For groups, we consider as distal the process of establishment of an interacting and collaborating group of individuals motivated by a common moral cause and seriously contemplating terrorist actions to further that cause. We consider as proximal for the group, all the actions of that established group in furthering its strategy (in our case specifically through the planning and execution of terrorist attacks). This will cover recruitment and socialisation of new group members, including those member's own 'terrorism involvement' decisions. But while this is proximal for the *group* as just defined, it is distal for that *individual*. Given our psychological focus, where there is divergence between these perspectives we emphasize the individual over the group (and note there is still much controversy over the existence of group-level genetic selection – e.g. Dawkins 2006; Pinker 2012). We now review the field of proximal mechanisms in some depth. This is followed by coverage of distal processes, in a more limited treatment intended just to bridge the conceptual gap between ultimate and proximal causation.

Proximal processes

Proximal for our purposes covers the immediate causes operating within the terrorist attack situation during the event and shortly before it, including preparations. Conventionally, crime science has organized its understanding of the proximal causes of criminal and terrorist events via the ecological 'routine activities' perspective (Cohen and Felson 1979), where a likely offender encounters a suitable target in the absence of capable guardians. Also relevant is the environmental approach of crime pattern theory (Brantingham and Brantingham 2008), which suggests the places where likely offenders and suitable targets are most likely to converge, whether by deliberate planning by the former, or coincidence of offender and victim routines. To these has been added the psychological 'rational choice' perspective (Cornish and Clarke 1986) in which the immediate decision to offend is influenced by (perceived) opportunity in the shape of the risk of harm, effort and reward. A more recent addition, which takes us beyond rational opportunity factors in isolation, has been crime precipitation (Wortley 2001, 2008). This covers situationally induced perceptual, motivational, emotional and interpersonal processes (prompting, provocation, pressure and permission) in or near the proximal crime situation that may activate a goal, the search for an opportunity and its exploitation. Obviously, precipitation can only account for the triggering of impromptu attacks, but may also influence the manner in which planned attacks are conducted and escalate the severity of the response, for example, the beating of a recalcitrant hostage.

The conventional formulation has several shortcomings for present purposes. First, while the constituent perspectives cover most of the relevant field of causation equally well for terrorism as for crime, the situational orientation underlying them all has not traditionally focused on powerful and persistent ideologically based offender motivation of the kind that drives people to extremes such as suicide bombing, and accordingly to make great effort to circumvent barriers (i.e. displacement). Likewise, situational approaches generally assume the offender wishes to avoid bodily harm, which may not hold in suicide missions. More generally, the emphasis on the situational side and the deliberate 'cardboard cutout' offender (Cornish and Clarke 2008; Ekblom 2007), albeit understandable for historical reasons, leaves very little beside 'likely' or 'motivated' and 'rational' for EP to work with.

Calls to incorporate within a situational analysis of crime a more detailed and realistic picture of offender psychology – one that more fully recognizes the importance of the person-situation interaction that underpins the logic of ecological approaches (Wortley 2012) – would seem even more pressing when terrorists are the subject of the analysis. Although the emphasis on the situation remains, evolutionary psychological influences obviously have to come via the offender (and agents playing other roles in the event) before they can interact with the situation: a more detailed model is needed.

The 'conjunction of criminal opportunity' (CCO: Ekblom 2010, 2011) attempts to integrate these perspectives, plus more on the offender side, into a single, finegrained, comprehensive and consistent set of causal elements with an

equally consistent terminology. CCO covers *agents* occupying several active roles (offender, crime preventer, crime promoter) and *entities* (material or human target, target enclosure, wider environment, resources for offending that the agents have to cope with or exploit). Roach et al. (2005) adapted and extended this to the 'conjunction of terrorist opportunity' (CTO), adding *offender* enclosures (e.g. hideouts) and dividing targets into target *vectors* (whose injury or damage is the message) and target *audience* (the recipients of the message whom the terrorists seek to influence). We shall use CTO here, modified as necessary with more recent thinking. CTO is summarized in Box 3.1 and described in more detail below.

Box 3.1 The conjunction of terrorist opportunity: proximal causes of terrorist events (modified from Roach et al. 2005)

Terrorist:

- 1 Predisposition
- 2 Lack of resources to avoid terrorism
- 3 Readiness to act
- 4 Resources for committing terrorist acts
- 5 The decision to act

Situation:

- 6 Presence of terrorist in situation
- 7 Target vectors and target audience
- 8 Target enclosure
- 9 Wider environment
- 10 Absence/incapacity of terrorism preventers
- 11 Presence/capacity of terrorism promoters

-It should be noted that (like 'routine activities') CTO does not claim to be a theory of-the causes of terrorist events, but a detailed description of the broad proximal-elements – the offender in the situation – that come together to define such events,-and through which the causes are channelled. As such, more specific theories and-causal mechanisms can be arranged upon the framework (for example, what prompts-people to perceive a terrorist opportunity, or how the executive function might-inhibit a terrorist action). The theories can then be related to one another on the-same conceptual 'workbench' in the search for gaps, overlaps and clashes; and a-more consistent and comprehensive terminology developed to support thinking,-communication, knowledge management and practical innovation. CTO makes no-distinction between offender-centred causes that are common to all humans (e.g. the-generic capacity for aggression) versus those that indicate individual differences (e.g.-a person with a particular predisposition to be aggressive). The choice of perspective-is up to the researcher: here, we emphasize the former, universal alternative.-CTO sets out 11 proximal causes of acts of terrorism (Box 3.1). We now consider the-implications of evolutionary theory to each of these causes in turn, starting with the-offender/terrorist side of CTO (1–6) and moving to the more ecological factors (7–11). Although the 11 proximal causes are intended to be an exhaustive list, within-each cause, for reasons of space, coverage is just illustrative and at this stage in the-development of crime science and EP, contains some speculation.

1 Predisposition

As already described, humans may be predisposed to form coalitions and groups; to-possess a group identity or identities; to perceive/assign group membership of other-individuals; to evaluate other groups for threats posed to their own group's interests-(in terms of territory, resources, reproductive opportunity); and to take action to-influence, harm or destroy groups thus perceived as threatening.

2 Lack of resources to avoid terrorism

Personal resources to avoid terrorism (and criminal behaviour more generally)-include empathic ability (which may be species universal though subject to variation)-and perspicacity/tact in handling others' group-related sensitivities and interests;-also relevant is the ability to resist charismatic leaders, group pressures and-permissions.

3 Readiness to act

Readiness refers to emotional/motivational states that can be triggered, boosted or-diminished, and given direction (as goals) towards some target which may comprise-members, or assets, of another group. The states may persist and be amplified-especially if reinforced by group processes involving, for example, social judgement-(Tajfel et al. 1971), which may nowadays be mediated over the Internet. Broader,-less-immediate influences acting in earlier situations may potentiate the readiness-over time, for example, a series of perceived insults from some out-group. Proximal-influences awakening and directing readiness in the immediate attack situation may-operate through provocation (e.g. perceived insults/strategic threats to group) or-prompting (e.g. triggering recollections of resentment, enmity, etc.), although-whether such 'spontaneous' attacks count as terrorism is unclear. There may be a-similar readiness in relation to perceived betrayal or defection within the terrorist group.

4 Resources for committing terrorist acts

Resources (e.g. Ekblom and Tilley 2000; Gill 2005) may be psychological, or-ecological ('out there' in the environment, such as weapons). Psychological resources-include effectiveness at undertaking terrorist activity within a group, skill at-mobilising other group members or ability to identify members of opposing groups-based on language, ethnic or religious symbols. The ability to inhibit empathy-towards out-group members is a likely candidate for EP, as may be our ability to-persuade others. The ability to self-justify may not be of EP origin however, though-self-deception in general may be a specifically evolved capacity (Trivers 2011), as may-be the generic capacities for communication and imitation that spread such-justification, and the potency of group support in underwriting that justification.-The ability of humans to collaborate and cooperate is a highly evolved universal-species characteristic; as said, a defining component of group life, closely connected-with 'cooperation-for-conflict' whether with other humans or predatory/competing-animals. As part of such collaboration, personal resources may be disseminated-between group members, through teaching of skills and knowledge; likewise ecological resources are often shared.

Tool use is rare and limited among non-humans, but an evolved universal human-characteristic. It is of practical importance in terrorism, especially where such-activity is asymmetric – i.e. not just battle groups of similar size sloggng it out, but-smaller numbers on one side compensated by weaponry such as IEDs. The sight of-weapons has been shown to prompt aggressive behaviour (Berkowitz and LePage-1967) though whether there is an evolutionary psychological component (which-would relate to weaponry in general, since AK47s were seldom seen in the-Pleistocene; or to an even more general tool-related priming) is uncertain.

5 The decision to act

Objective opportunity for a particular agent – say a terrorist – is a combination of some *goal*, favourable *situational conditions* (covering both the entities and the-other agents identified in CTO) and the terrorist's *resources* to exploit the-vulnerabilities and cope with the hazards in those conditions. There may not be any-group-related EP contribution here, only a general – evolved – adaptability to *take*-opportunities based on a more or less sophisticated capacity for quasi-rational-choice, and sometimes to creatively *make* them. However, EP may come in more-phenomenologically when we consider *perceived* opportunity. The capacity of-*affordance* – involving the ability to see utility in items and places in the-environment (Ekblom and Sidebottom 2008; Gibson 1950; Taylor and Currie 2012)-where they relate to one's goals – is part of the same picture.

Precipitation is perhaps more fruitful as a locus of possible EP influences. Perception-of threat may be prompted by sight of out-group members in particular places or-doing particular things; and perceived insults may provoke retaliatory action.-Humans may be evolutionarily predisposed to perceive, even to actively look out for,-threats to group esteem or well-being and to respond aggressively, hence 'ready for-readiness', in the same way it is proposed that we are primed to detect cheating-(Tooby and Cosmides 1992). This overlap between predisposition, perception and-readiness illustrates the challenge, but hints at the value, of making analytic distinctions within a holistic cognitive system.

Ecological factors are found in the immediate attack situation or in the broader-proximal environment in which attacks are conceived, planned and prepared. They-are often only indirect channels for potential EP mechanisms – it is how the terrorist-is *primed* to perceive and respond to them that may be EP-mediated. The capacity of-a swastika to provoke a socialist, say, and the capacity of the socialist to be provoked-by the swastika are essentially two sides of a single coin (Ekblom 1994) combining-objectivity and subjectivity; not independent properties. But given that the-environment of the terrorist importantly includes people (and groups) playing other-roles (preventer and promoter), and constituting human targets, the EP influences-on *these* agents may be significant, whether those factors are serving to provoke the-terrorist, say, or to make the targeted people respond the way the terrorists desire-(intimidation or fleeing straight into a second bomb rather than defiance).

6 Presence of terrorist in situation

One or more terrorists has to be able to influence particular situations, whether these-are the attack situation itself or prior scenes in a complex sequence of preparations,-and whether the presence is the material or cyber version. Presence brings risks of-identifiability/recognisability, and the scope for one group to exclude another from-its territory. Group factors include ethnically distinct facial or other bodily features,-which may be largely genetic, although non-psychological. Our ability to recognize a-huge number of individuals, though imperfect, is a key evolved capacity. Our-distinguishing features may be embellished or concealed by grooming, clothing and-adornments, which tendency may in turn be cultural in content but partly genetic in-origin.

Group factors and collective territoriality may make it easy/difficult for visibly or-audibly different groups to travel to and to get into particular situations and/or be-perceived to fit in/not to fit in; and to be suspected of malintent through (prejudicial)-stereotyping. Routine movement patterns exploited by terrorists as targets or cover-may be group-related, e.g. pilgrimages or commuting, and may well relate to species specific-tendencies (imagine how a group of mutually unacquainted chimpanzees would get on packed into a commuter train).

7 Targets

Targets are of two main sorts. Target *vectors* are the direct object of the terrorist act.-Crime science has generated a set of situational risk factors for the choice of target-vectors for terrorism (Clarke and Newman 2006). EVIL DONE comprises Exposed,-Vital, Iconic, Legitimate (in the eyes of the terrorists and their supporters),-Destructible, Occupied (i.e. containing human targets), Near and Easy. How far any-of these reflect a specific EP component, and in our current illustration, a-tribalism/group-relevant one, is debatable: most may simply reflect the-pragmatics/rationality of foraging tactics (e.g. *Near, Easy*) addressed by any roving-animal. However, *Iconic* may reflect emotional/motivational properties of the target-audience, namely what (the terrorists believe) the audience values in the target-vector such as, say, Big Ben. Such valuation may partly derive intensity from their-symbolic significance to the target audience group, and we seem to have evolved to-react to collective symbols and especially threats to them. *Legitimate* is full of-possibility for emotional/motivational factors and perception of threats from outgroups-who thus 'deserve' attack, and there may be EP influences on these.

'Righteous' or 'vengeful' aggression may be inherently rewarding to express-(McCullough 2008), whether it is the terrorists or their opponents who act it out. *Occupied* may reflect the presumed universal tendency of people to respond more to-harm to humans than to property, and such responses may be stronger when it is members of our in-group who are harmed, especially but not exclusively kinfolk. Again this may indirectly determine what is rewarding to terrorists.

The target *audience* is the population that the terrorists wish to influence; often that-population will be a group (community, country, company, etc.). Influence is-attempted by threatening or attacking target vectors and creating pressures on the-audience via a 'climate of fear'. Vector-audience interactions are important (and may-be further complicated by being channelled through political processes involving-leadership and coalitions). The reward-value to the terrorists of the target vectors-depends partly on how they can be harmed and how they react, but also on the-vectors' influence in turn (which sometimes may be posthumous) on the target-audience. Humans' emotional reactions to the occurrence of bad events have evolved-to awaken empathy and prompt assistance (a capacity shared with hominid apes),-and being in an in-group with the target audience may boost this

(or at least will not-inhibit it). Astute terrorists are well aware and able to exploit this in seeking to-influence the target audience; though they run the risk of inadvertently engendering-*defiance*, which is of course antagonistic to the desired *intimidation*. Audience-members, particularly leaders of groups such as nations, cities or non-geographical-communities (e.g. religions) will seek in turn to foster defiance and buttress against-intimidation. To the extent that this discourages terrorists from trying anything on a-given population, this serves as a 'preventer' activity.

-Extending Roach et al.'s (2005) analysis of targets, other foci of terrorist action may-be distinguishable, such as those whom a terrorist group wishes to recruit, convert or-prevent from leaving. Such targets may be subject to violent acts or threats of-intimidation sometimes used to promote conformity and loyalty within a group. This-is not specific to terrorism, being a feature of 'outlaw' groups more generally; but it-may often be exploited by terrorist groups. The tribalism EP hypothesis does-however note the special opprobrium people generally feel towards traitors and-splitters within their group, and terrorists may use or consciously exploit this-pressure.

8 Target enclosure

Terrorists are infamous for hideouts, caves, compounds, weapons stashes, etc., which-may be owned for group benefit and managed via group processes. They can also-take hostages and barricade themselves in 'offensible space' (Atlas 1991). Likewise-targets of terrorism may be protected in similar enclosures, for equivalent tactical-reasons. Whether this is anything more than the result of pragmatic adaptation to-topological realities is unclear, as are any specifically group-related EP factors,-although 'prospect-refuge' processes may be an EP candidate and buildings often-have group-related emotional significance (as with the 'Iconic' risk factor).

9 Wider environment

The wider environment (which may contain enclosures) has two broad kinds of influence on criminal/terrorist behaviour:

1 tactical/logistical (where the lie of the land, built environment, etc. favour preventers over offenders or vice-versa in terms of 'script clashes' (Ekblom 2012) such as conceal vs. reveal, pursue vs. escape, use force vs. resist, etc.); and

2 motivational/emotional, which can relate to instrumental issues such as containment of attractive target vectors, or symbolisation of group ownership or status.

-Whether such territoriality is specifically EP-influenced in humans (as asserted in-popular writing, e.g. Ardrey 1966) is debatable. Its apparent universality may simply-stem from humans' generic adaptive response to universal features of two- or threedimensional-environments. However, there is a body of literature on humans'-apparently evolved aesthetic preferences for certain types of environment (reviewed-e.g. in Silverman and Choi 2005). Aesthetics is an evolved mechanism for guiding-our preferences in the here-and-now environment; interestingly, the-*emotional/motivational mechanism* currently active in proximal circumstances may-have evolved to confer *tactical/logistical advantage* by attracting humans to those-places to which they are best adapted to instrumentally cope with risk and exploit-opportunity (hence the CTO elements of readiness, rational choice and resources for-offending work together). Hypothesized preferences include, beyond the familiar-'savannah' landscape of the EEA, those for coherence, legibility, optimal complexity-and mystery; and a balance between 'prospect and refuge' (Appleton 1996).-According to the last, within a given landscape the preferred locations are vantage-points combining unimpeded visual prospects with a ready scope for concealment or-withdrawal to a safe refuge.

Whether such preferences interact with any EP tendencies towards our tribalism-example is unclear, but more generally they do have interesting implications for the-foraging and exploration of terrorists and criminals (e.g. when undertaking hostile-reconnaissance). Within crime science, incorporating such ideas could enrich the-'awareness space' concept of crime pattern theory, and connect with 'Exposed', 'Near'-and 'Easy' of EVIL DONE.

10 Absence/incapacity of terrorism preventers, and

11 Presence/capacity of terrorism promoters

Preventers are people, organisations or groups who reduce the risk (probability and-harm) of crime or terrorism events; promoters increase that risk. In both cases there-are varying degrees of responsibility/culpability – ranging from the person whose-mere act of passing by at the wrong moment disrupts an attack or blocks a-surveillance camera, through to deliberate action in securing a control room door or-in supplying terrorists with moral support, permissions and pressures, and logistical-help.

Group membership in itself may influence whether individuals act as preventer or-promoter; and groups (both members and leaders) may actively supply such-influences in mobilising such behaviour. Compliance and acceptance mechanisms-may be in operation to support group norms and loyalty. Relevant to this is Felson's- (1986) 'handler' role in which certain people exert a preventive influence over-offenders – and as he states, the offenders need appropriate psychological 'handles',-i.e. a 'receptor mechanism' for that influence. EP-enhanced tribalism may contribute-both to the handles and the handlers. The 'anti-cheating' complex of detection and-response (Tooby and Cosmides 1992) is an EP mechanism likely to motivate-preventers' attempts to control crime; it may also drive offenders' and promoters'-attempts to control fellow terrorists' disloyalty, free-riding and quitting or splitting-the group. In all cases, we should note that prevention and promotion is relative to-the norms and interests of particular groups: what is promotion of terrorism for-wider society may be prevention of desertion or betrayal for the terrorist group.

Distal processes

As said, our review of distal processes is cursory and intended mainly to suggest links-between ultimate and proximal causation. Fundamentally, from the moment of-conception of a human individual the information/instructions stored in its human-genotype – the product of biological evolution's experience for survival over-millennia – has to feed into the developing body, which becomes the phenotype that-endures for a single lifetime and generates our behaviour. Of special interest is the development of the brain.

-Many of the contributions of evolution are transmitted from gene to body during the-development phase from zygote to adult, controlling the development process (the-study of this process is known as 'evo devo'). For example, a human gene variant for-linguistic ability may kick in to cause particular parts of the brain to grow faster or-for longer than their counterparts in chimpanzees. Such processes may simply-'unfold' or 'mature' with elementary material input from the environment (nutrients,-oxygen, warmth) but limited informational input. In other cases, particularly after-birth, genetic influences are combined with environmental inputs of a progressively-more subtle kind. The combined product of this layer of gene-environment-interaction in turn interacts further with the physical and social environment as the-child develops. EP influences can thus exert themselves via a range of developmental-processes. These are distal from terrorist acts and events but – with benefit of-hindsight – in some individuals, in some circumstances, they can be shown to have-led towards them. The distal-to-proximal processes operate over various timescales-and include child development and maturation; socialisation and enculturation; and-learning of various kinds ranging from Pavlovian and operant processes to social-learning; also inventiveness and problem-solving.

Learning continues throughout life, although with language acquisition for example,-there may be critical periods of sensitivity to environmental inputs, followed by-diminished flexibility. Socialisation/enculturation in most cases are predominantly-over by young adulthood, but never fully finish. Radicalisation of adolescents or-indeed of mature adults is one such process that is highly relevant to terrorism. EP-influences may be incorporated at any of these stages and they may operate-interactively – for example, priming certain experiences to be rewarding (which will-then shape any learning that gives access to such rewards) or making certain-connections or actions easier to learn than others, or harder to unlearn. In this-connection Breland and Breland's (1961) famous 'On the Misbehavior of Organisms'-article showed that what a given species was ready to learn was related to its-ecological adaptations – thus, for example, pigs could not be stopped from rooting-activity with their target

objects (in this case, they had to place tokens in ... a piggy-bank) even if this was at the expense of reward (in the same way that the Ekbloms'-pet rabbit remains impervious to vigorous and sustained attempts to teach him not-to chew the furniture). Ecological factors, in the form of life circumstances and prior-situations experienced by the growing individual, contribute to the learning,-socialisation and enculturation process. Some of these will be relatively 'timeless'-(e.g. establishing relationships with siblings) while others will bear the imprint of-history (e.g. growing up in a refugee camp, or in a particular war).

Group membership will supply and shape some of these experiences, and will also-contribute influences such as whom to attend to and/or imitate and learn from.-Whether we are evolutionarily primed specifically to attend to and learn from ingroup-members, or leaders/celebrities especially, is a possibility. Developmental-processes are involved in the construction of individuals' identity, and frustrated or-conflicting identity may be a developmental problem whose resolution can involve alignment with, and recruitment to, extremist groups and causes.

Implications for situational prevention

Although this chapter is primarily conceptual and exploratory in focus, in this final-section we give some attention to the preventive implications of our analysis. Our-intention is not to develop a catalogue of fully formed prevention strategies, but-rather to suggest possible directions for further work in this area. We follow in the-footsteps of Roach and Pease (2011) who similarly call for the development of an-'evolution-evidenced crime reduction programme'. Roach and Pease discuss diverse-forms of crime prevention, although our focus here is largely confined to how-insights from EP might inform situational crime prevention applied to the proximal-environment of terrorist attacks or preparations for those attacks (e.g. obtaining-explosives or undertaking hostile reconnaissance). Our argument is thus. EP suggests-that the human brain contains numerous psychological mechanisms. These-psychological mechanisms are present today because they initiated behaviours which-increased the likelihood of solving *specific* adaptive problems in our ancestral past,-irrespective of whether those problems are still with us today, or whether the evolved-solutions remain appropriate in today's cultural and ecological context. Because-these mechanisms are specialized, as opposed to 'general-purpose', they are only-activated in particular conducive settings (Tooby and Cosmides 2005). The task-of-the evolutionary-minded practitioner of prevention is hence to identify those-psychological mechanisms that might reduce the likelihood of someone engaging in-criminal and terrorist behaviour (such as stimulating empathy) and the situational-conditions in which these mechanisms are most likely to be activated. Doing so-would inform the manipulation of contemporary environments. To this aim we-suggest two avenues worthy of exploration, now discussed in turn: increasing the-effectiveness of situational preventive interventions by manipulating the-environment in ways that activate crime and terrorist-related psychological-mechanisms; and avoiding the unintended consequences of such interventions.-Finally, we briefly consider the EP implications for prevention as we trace back from the proximal dynamics of the terrorists event.

Boosting the effectiveness of situational prevention

Firstly, we consider the design of situational interventions, and in particular, designs-that speak to the psychological mechanisms, which according to EP, are 'hard-wired'-in our brains. To the best of our knowledge, there are currently no examples of-counterterrorism strategies that have been explicitly inspired by EP. There is,- however, a recent example concerning a situational crime prevention measure that-was specifically designed with EP in mind and that serves to illustrate the concept.-Nettle and colleagues (2012) report an evaluation of signage designed to deter cycle-thieves. The signage being evaluated showed a pair of human eyes and contained the-message 'cycle thieves, we are watching you'. The watching eyes signs were-implemented across three sites at a British university campus. Compared to the rest-of the campus, there was a 62% reduction in reported cycle thefts the year following-intervention. As Nettle et al. (2012) describe, the design of watching eyes posters-draws heavily on evidence from EP in two ways. First is the well-established finding-that human decision-making is sensitive to situational contingencies and often-decisions are made using 'fast and frugal' heuristics as opposed to slow deliberation-in search for an optimal outcome (see Kahnemann 2011; Gigerenzer and Gaissmaier-2011; Todd 2000). This makes evolutionary sense: when faced with recurrent threats-to survival, natural selection would favour those who responded quickly to pertinent-stimuli and survived most of the time (so-called error management theory, Haselton-and Buss 2000). Second is the influence on human decision-making of the

presence-of watching eyes. Studies in both laboratory and real-world settings demonstrate that-the presence of images depicted watching eyes is reliably associated with more-prosocial behaviours, from charity donations (Powell et al. 2012) to collecting litter-(Ernest-Jones et al. 2011). This so-called 'watching eyes effect' is explained by-recourse to our ancestral environment, as Nettle et al. (2012, p.2) write:-The rationale for the effect is that being observed committing an act is-likely to lead to social repercussions, either positive or negative, and thus-it makes sense that when observed, people tailor their acts so as to be-more socially desirable. The watching eyes in the studies are always just-images, and thus cannot in fact observe anything. The effect occurs-nonetheless, since humans have fast, automatic psychological mechanisms-which have evolved to respond to all eye-like stimuli.

Returning to terrorism, clearly the motivations for stealing a bike are likely to be very-different from those underpinning terrorism. Nor do we claim that simple posters of-the sort described by Nettle and colleagues (2012) will be sufficient to reduce the-likelihood of terrorist events. Yet the watching eyes effect is considered to be a-universal trait, applicable to prospective terrorists as it is to bike thieves or burglars.-And we have research showing that powerful motivational states engendering-behaviour can be beneficially influenced by situational factors, as with suicide-(Clarke and Mayhew 1988) and violent assaults in bars (Graham and Homel 2008).-Therefore, when implementing any situational measure designed to reduce the-opportunities for behaviours associated with terrorist acts, such as entering a secure-space or carrying weapons, there may be grounds to try and ensure the design and/or-message is consistent with EP – going with the grain of the wood, and hopefully even-exploiting it. And at the very least we can get a clearer idea of which kinds of-intervention, in which contexts, may be the most difficult to get to succeed.

Most ways of organising situational prevention knowledge build on the 25 techniques-of situational crime prevention (Clarke and Eck 2003). These contain an assemblage-of methods like 'target removal' or 'making compliance easier', arranged under-generic rational-choice mechanisms such as reducing the risk, increasing the effort-or reducing the reward. Taking evolutionary approaches further, we might ask what-mechanisms in our EP influence the perception of and appetite for, risk, effort and-reward? And what things, events or states are perceived as rewarding or aversive?-Much has been written on evolution and rational choice (reviewed in Ekblom, in-press) and clearly this is an avenue to explore. If specialized cognitive modules for-dealing with, say, cheating, vengeance, insult, etc. are the order of the day in human-minds, then this rather questions the validity of arranging the 25 techniques under-universal generic columns (for example, reducing the value of *material* assets may-need to work very differently from attempts to reduce the value of *human* targets).-A similar table of techniques has been developed by Wortley (2008) specifically-focusing on situational precipitators, causal factors in the environment that awaken-or intensify motivation or emotion in-situ through prompting, provocation, pressure-and permission which then drive the search for, and exploitation of criminal-opportunity. This is causally richer territory for exploring the implications of-specialized, inherited, cognitive modules (and see Ekblom 2007). A third approach,-developed in the context of applying situational prevention to the control of hostile-reconnaissance by terrorists (Ekblom and Hirschfield 2014), and consistent with-CTO, is the Ds framework. Currently 11 in total, these sharply focus on the-mechanisms by which offenders might be influenced; the most relevant ones to-investigate for evolutionary input comprise Deter (known and unknown),-Discourage, Demotivate, Disconcert and Deceive.

Avoiding adverse consequences of situational prevention

It is well-known that ill-conceived and poorly managed attempts to control-behaviour (including criminal behaviour) can provoke unintended backfire effects-(e.g. Sherman 1993; Martin and Osgood 1987). Psychologists refer to this as-reactance, which is thought to arise from a perceived curtailment of personal-freedom (Brehm 1966), though how far this is a human universal or culture specific-is not clear. Just as situations might be altered in a bid to stimulate psychological-mechanisms that might reduce the probability of criminal behaviour, it is important-to consider that some situational measures formulated in ignorance of these-mechanisms might be counterproductive by precipitating these hard-wired-responses (Wortley 2008). This can clearly be seen in the psychological mechanisms-associated with tribalism described earlier. Disseminating messages that conform to-or promote the delineation of an in- and out-group may boost a retreat to in-groups.-Similar mechanisms may operate regarding vengeance. (At the time of writing we-have just learned of the 'vengeance' attack by the Taliban in Peshawar which killed-132 children and 9 adults.) Various studies have been conducted (e.g. Jaffe 2011;-

McCullough et al. 2010) but with as yet limited application to terrorism. Situational-interventions to limit vengeance and its cycle might usefully be explored although the-situations effectively changed by such measures might be way upstream of some terrorist events, and in the immediate aftermath of others.

Upstream of the proximal

Preventive interventions clearly go far beyond the proximal situation. Roach and Pease (2013) acknowledge a wider range, on the situational and offender sides. The CTO framework indicates how each of the causal elements can be followed up to understand the 'causes of the proximal causes', and identify interventions in these, covering earlier developmental experiences and life circumstance situations which influence mood and motivation of individuals and groups, radicalisation, and the conflicts and competition which generate terrorism. But however remote and complex, all such influences have to end up as active causes in the heads of individual terrorists in the immediate situations of preparation and attack. EP can influence each of these processes, potentially at any stage. Embittered refugee parents, social reject-status at school, perceived attacks on cherished beliefs and customs, association and identification with a particular group, can in the wrong circumstances lead to a terrorist career. Potentially, evolutionary psychological influences can make these more or less likely to lead to terrorism – depending on context. And they offer 'handles' to manipulate through careful interventions. Situational prevention emerged partly as a result of problems with social engineering approaches (Clarke 1997). And current EP-based social engineering seems to have run into difficulties, especially that based on group-level selection theory (Coyne 2011). Our view is that while such approaches should continue to be explored, this should be done in ways that are the least likely to do harm. Meanwhile, the advantages of the situational approach in connecting highly specific situational stimuli to what may be evolved preparedness to respond to such stimuli offers, we believe, a much tighter linkage to explore and hopefully to exploit.

Conclusion

EP remains at the margins of the study of criminal and terrorist behaviour. This is attributed to concerns with EP more generally (such as the inability to directly observe our ancestral past) and the application of evolutionary thinking to crime in particular (where a blank slate model predominates). Our intention with this chapter was to continue the work of a small cadre of researchers who suggest that EP might usefully advance efforts to better understand, detect and prevent criminal behaviour. To this end, we attempted to connect the ultimate (evolutionary history) causation of human behaviour, which is the province of EP, with proximal (situational) causes which, to date, have successfully been applied in the service of situational crime prevention. We used the 'conjunction of terrorist opportunity' as a framework to try and make these causal ends meet, focusing by way of example on tribalism as a terrorist-promoting attribute that has its origins in our ancestral past, where cultural/technological change has raced ahead of our biological tendencies, with serious threats to our well-being and perhaps survival.

As is the case with any branch of science attempting to encroach on a new domain, the acceptance of EP among terrorist scholars in general and in situational prevention in particular will in large part be determined by its ability to generate testable hypotheses – and some of these tests may well involve undertaking experimental preventive action. However, the rarity of terrorist events, while a blessing, does place serious challenges to our methods of evaluation, which have normally relied on the analysis of reliable statistical patterns. A possible research agenda for the future could be to establish evidentiary criteria and develop methodologies to satisfy them; identify tactical circumstances and psychological states relevant to various stages of terrorist activity, from recruitment to detonation: systematically chart possible examples of relevant evolutionary psychological causes (perhaps organising these, and identifying gaps, using CTO, an exercise truncated here on space grounds); and where evidence of causation of terrorism or of effectiveness of interventions is missing, consider how we might validly transfer the knowledge we have of everyday crime prevention across to counterterrorism contexts. Much as we do with, say, mouse models for the testing of drugs prior to trying them on humans, it may even be possible to identify 'models' of elements of terrorist behaviour in more everyday equivalents, on which to test out causes and trial our interventions.

References

- Appleton, J. (1996). *The Experience of Landscape*, revised edn. New York, Wiley.
- Ardrey, R. (1966). *The Territorial Imperative: A Personal Inquiry into the Animal Origins of Property and Nations*. New York: Kodansha America.
- Atlas, R. (1991). The other side of defensible space. *Security Management*, March, 63–66.
- Bassiouni, C. (2002). Legal control of international terrorism: A policy-oriented perspective. *Harvard International Law Journal*, 43, 83–103.
- Berkowitz, L. and LePage, A. (1967). Weapons as aggression-eliciting stimuli. *Journal of Personality and Social Psychology*, 7, 202–207.
- Bowlby, J. (1969). *Attachment and Loss: Vol. 1. Attachment*. New York: Basic Books.
- Brantingham, P.J. and Brantingham, P.L. (2015). Crime pattern theory. In R. Wortley and L. Mazerolle (eds), *Environmental Criminology and Crime Analysis*, 2nd edn. New York: Waveland Press.
- Brehm, J. (1966). *A Theory of Psychological Reactance*. New York: Academic Press.
- Breland, K. and Breland, M. (1961). The misbehavior of organisms. *American Psychologist*, 681–684.
- Burgess, R. and Akers, R. (1966). A differential association reinforcement theory of criminal behavior. *Social Problems*, 14, 128–147.
- Buss, D. (1995). Evolutionary psychology: A new paradigm for psychological science. *Psychological Inquiry*, 6, 1–49.
- Buss, D. (ed.). (2005). *The Handbook of Evolutionary Psychology*. New York: Wiley.
- Caspi, A., McClay, J., Moffit, T., Mill, J., Martin, J., Craig, I., Taylor, A. and Poulton, R. (2002). Role of genotype in the cycle of violence in maltreated children. *Science*, 297 (5582), 851–854.
- Clarke R. (ed.) (1997). *Situational Crime Prevention: Successful Case Studies*, 2nd edn. Harrow and Heston: Guilderland.
- Clarke, R. (2008). Situational crime prevention. In R. Wortley and L. Mazerolle (ed.), *Environmental Criminology and Crime Analysis*. New York: Waveland Press.
- Clarke, R. and Eck, J. (2003). *Become a Problem Solving Crime Analyst in 55 Small Steps*. London: Jill Dando Institute, University College London.
- Clarke, R. and Mayhew, P. (1988). The British Gas suicide story and its implications for prevention. In M. Tonry and N. Morris (ed.), *Crime and Justice: A Review of Research*, 10. Chicago, IL: University of Chicago Press.
- Clarke, R. and Newman, G.R. (2006). *Outsmarting the Terrorists*. New York: Praeger Publishers.
- Cohen, L.E. and M. Felson. (1979). Social change and crime rate trends: A routine Activities approach. *American Sociological Review*, 44, 588–608.
- Cornish, D. And Clarke, R.V. (ed.) (1986). *The Reasoning Criminal*. Springer: New York.
- Cornish, D. and Clarke, R. V. (2008). The rational choice perspective. In R. Wortley and L. Mazzerolle (ed.), *Environmental Criminology and Crime Analysis*, 2nd edn. New York: Waveland Press.
- Cosmides, L. and Tooby, J. (1997). *Evolutionary Psychology: A Primer*. Retrieved on 20 December 2014 from : <http://www.cep.ucsb.edu/primer.html>.
- Coyne, J. A. (2009). *Why Evolution Is True*. Oxford University Press, Oxford.
- Coyne, J. A. (2011). *Can Darwinism Improve Binghamton?* New York Times Sunday Book Review, 9 September. Retrieved on 22 December 2014 from www.nytimes.com/2011/09/11/books/review/the-neighborhood-project-bydavid-sloan-wilson-book-review.html.

- Darwin, C. (1859). *On the Origin of Species by Means of Natural Selection*. London: John Murray.
- Davies, N., Krebs, J. and West, S. (2012). *An Introduction to Behavioural Ecology*, 4th edn. Oxford: Wiley-Blackwell.
- Dawkins, R. (2006). *The Selfish Gene*, 30th anniversary edn. Oxford: Oxford University Press.
- Dawkins, R. (2009). *The Greatest Show on Earth: The Evidence for Evolution*. New York: Free Press.
- Dunbar, R.I.M. (1992). Neocortex size as a constraint on group size in primates. *Journal of Human Evolution*, 22 (6): 469–493.
- Ekblom, P. (1994). Proximal circumstances: A mechanism-based classification of crime prevention. In R. V. Clarke (ed.), *Crime Prevention Studies*, vol. 3. Monsey, NY: Criminal Justice Press.
- Ekblom, P. (2007). Making offenders richer. In G. Farrell, K. Bowers, S. Johnson and M. Townsley (eds), *Imagination for Crime Prevention: Essays in Honour of Ken Pease*. Crime Prevention Studies 21. Monsey, NY: Criminal Justice Press/Devon, UK: Willan Publishing.
- Ekblom, P. (2010). The conjunction of criminal opportunity theory. *Sage Encyclopedia of Victimology and Crime Prevention*, 1, 139–146.
- Ekblom, P. (2011) *Crime Prevention, Security and Community Safety Using the 5Is Framework*. Basingstoke: Palgrave Macmillan.
- Ekblom, P. (2012). Happy returns: Ideas brought back from situational crime prevention's exploration of design against crime. In G. Farrell and N. Tilley (eds), *The Reasoning Criminologist: Essays in Honour of Ronald V. Clarke*, pp. 163–198. Crime Science series. Cullompton: Willan.
- Ekblom, P. (in press). Evolutionary approaches to rational choice. In W. Bernasco, H. Elffers and J.-L. Van Gelder (eds), *The Oxford Handbook on Offender Decision Making*. Oxford: Oxford University Press.
- Ekblom, P. and Hirschfield, A. (2014). Developing an alternative formulation of SCP principles – the Ds (11 and counting), *Crime Science*, 3 (2).
- Ekblom, P. and Sidebottom, A. (2008). What do you mean, 'Is it secure?' Redesigning language to be fit for the task of assessing the security of domestic and personal electronic goods. *European Journal on Criminal Policy and Research*, 14 (1), 61–87.
- Ekblom, P. and Tilley, N. (2000). Going equipped: Criminology, situational crime prevention and the resourceful offender. *British Journal of Criminology*, 40, 376–398.
- Ernest-Jones, M., Nettle, D. and Bateson, M. (2011). Effects of eye images on everyday cooperative behavior: A field experiment. *Evolution and Human Behavior*, 32, 172–178.
- Felson, M. (1986). Linking criminal choices, routine activities, informal control and criminal outcomes. In D. Cornish and R.V. Clarke (eds), *The Reasoning Criminal: Rational Choice Perspectives on Offending*. Springer-Verlag, New York.
- Freilich, J.D. and Newman, G. (ed.) (2009). *Reducing Terrorism through Situational Crime Prevention*. Crime Prevention Studies, vol. 25. Boulder, CO: Lynne Rienner Publishers.
- Gibson, J.J. (1950). *The Perception of the Visual World*. Boston, MA: Houghton Mifflin.
- Gigerenzer, G. and Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, 62, 451–82.
- Gill, M. (2005). Reducing the Capacity to Offend: Restricting Resources for Offending. In N. Tilley (ed.), *The Handbook of Crime Prevention and Community Safety*. Cullompton: Willan.
- Graham, K. and Homel, R. (2008). *Raising the Bar: Preventing Aggression in and around Bars, Pubs and Clubs*. Cullompton: Willan.
- Haselton, M.G. and Buss, D.M. (2000). Error Management Theory: A new perspective on biases in cross-sex mind reading. *Journal of Personality and Social Psychology*, 78, 81–91.

- Kahneman, D. (2011). *Thinking Fast and Slow*. New York: Farrar, Straus and Giroux.
- Laycock, G. (2005) Defining crime science. In M.J. Smith and N. Tilley (eds), *Crime Science: New approaches to preventing and detecting crime*. Crime Science Series. Cullompton: Willan.
- Lombroso, C. (1876). *L'uomo delinquente*, English translation by M. Gibson and N.H. Rafter (2006) *The Criminal Man*. Durham, NC: Duke University Press.
- Mahajan, N., Martinez, M., Gutierrez N., Diesendruck G., Banaji M. and Santos L. (2011). The evolution of intergroup bias: Perceptions and attitudes in rhesus macaques. *Journal of Personality and Social Psychology*, 100, 387–405.
- Martin, F.P. and Osgood, D.W. (1987). Autonomy as a source of pro-social influence among incarcerated adolescents. *Journal of Applied Social Psychology*, 17, 97–107.
- McCullough, M. (2008). *Beyond Revenge: The Evolution of the Forgiveness Instinct*. San Francisco: Jossey-Bass.
- McDonald, M., Navarrete, C. and Van Vugt, M. (2012). Evolution and the psychology of intergroup conflict: The male warrior hypothesis. *Philosophical Transactions of the Royal Society B*, 367 (1589), 670–679.
- Nettle, D., Nott, K. and Bateson, M. (2012). 'Cycle thieves, we are watching you': Impact of a simple signage intervention against bicycle theft. *PLoS ONE*, 7(12): e51738. doi:10.1371/journal.pone.0051738.
- Pinker, S. (2012). *The False Allure of Group Selection*. Retrieved on 22 December 2014 from <http://edge.org/conversation/the-false-allure-of-group-selection>.
- Powell, K.L., Roberts, G. and Nettle D. (2012). Eye images increase charitable donations: Evidence from an opportunistic field experiment in a supermarket. *Ethology*, 118, 1096–1101.
- Roach, J. and Pease, K. (2011). Evolution and the Prevention of Violent Crime. *Psychology*, 2(4), 393–404.
- Roach, J. and Pease, K. (2013) *Evolution and Crime*. London: Routledge.
- Roach, J. and Pease, K. (2014). Evolutionary perspectives on crime prevention. In G. Bruinsma and D. Weisburd (eds), *Encyclopedia of Criminology and Criminal Justice*. New York: Springer Verlag.
- Roach, J., Ekblom, P. and Flynn, R. (2005). The conjunction of terrorist opportunity: A framework for diagnosing and preventing acts of terrorism. *Security Journal*, 18(3), 7–25.
- Saul, B. (2006). *Defining Terrorism in International Law*. Oxford: Oxford University Press.
- Sherman, L. (1993). Defiance, deterrence and irrelevance: a theory of the criminal sanction. *Journal of Research in Crime and Delinquency*, 30, 445–473.
- Silverman, I. and Choi, J. (2005). Locating places. In D. Buss (ed.), *The Handbook of Evolutionary Psychology*. New York: Wiley.
- Sosis, R. and Alcorta, C. (2008). Militants and martyrs: Evolutionary perspectives on religion and terrorism. In R. Sagarin and T. Taylor (eds), *Natural Security: A Darwinian Approach to a Dangerous World*, pp. 105–124. Berkeley and Los Angeles: University of California Press.
- Tajfel, H., Billig, M., Bundy, R. and Flument, C. (1971). Social categorization and intergroup behaviour. *European Journal of Social Psychology*, (2), 149–178.
- Taylor, M. and Currie, M. (2012). *Terrorism and Affordance*. London: Bloomsbury.
- Tinbergen, N. (1963). On aims and methods of ethology. *Zeitschrift für Tierpsychologie*, 20, 410–433.
- Todd, P.M. (2000). The ecological rationality of mechanisms evolved to make up minds. *American Behavioral Scientist*, 43 (6), 940–956.
- Tooby, J. and Cosmides, L. (1992). Psychological Foundations of Culture. In J. Barkow, L. Cosmides and J. Tooby (eds), *The Adapted Mind*. New York: Oxford University Press, pp. 19–136.

Tooby, J. and Cosmides, L. (2005). Conceptual Foundations of Evolutionary Psychology. In D. Buss (ed.), *Handbook of Evolutionary Psychology*, 5–67. Hoboken, NJ: Wiley.

Trivers, R. (2011). *Deceit and Self-Deception: Fooling Yourself the Better to Fool Others*. Penguin: London.

Van Vugt, M. and Park, J. (2009). The tribal instinct hypothesis: Evolution and the social psychology of intergroup relations. In S. Stürmer and M. Snyder (eds), *Psychology of Helping: New Directions in Intergroup Prosocial Behavior*. London: Wiley Blackwell.

Watts, C. (2012). *Radicalization in the U.S. Beyond al Qaeda: Treating the Disease of the Disconnection*. Program on National Security. Philadelphia: Foreign Policy Research Institute. Retrieved on 15 December 2014 from www.fpri.org/docs/media/PaperRadicalization_in_the_US_Beyond_al_Qaeda_Watts.pdf.