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What the Evolutionary and Cognitive Sciences Offer the Sciences of Crime and Justice

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Abstract

Science has become increasingly interdisciplinary, marked by rapid expansion of social science fields melding with "natural" sciences previously considered less relevant for the study of humans. Psychology, in particular, now depends heavily on insights from medicine, biology, sociology, genetics, and cognitive science, and has done so for years. By grounding itself in evolutionary theory, moreover, psychology has moved toward a more mature science of human mind and behavior. The crime sciences—criminology and criminal justice—are poised to make similar progress. While already interdisciplinary fields, we make the case that the evolutionary and cognitive sciences can unify existing knowledge about crime and justice, help to pose new and interesting questions to study, and can push the fields forward in ways that will benefit both the scientific world as well as society, in general.

Keywords: *Evolutionary Psychology*; *Cognitive Science*; *Criminology*; *Consilience*

Key Points:

- The natural and social sciences have become tightly interlaced across the decades
- Evolutionary theory has aided the process by serving as the shared foundation
- In this context, the combination of the psychological and cognitive sciences has accelerated our understanding of the human brain and mind
- The crime sciences have become similarly interdisciplinary; however, they have yet to take advantage of the insights offered by evolutionary theory and cognitive science
- We propose a roadmap for consilience in the crime sciences moving forward

1.

What the Evolutionary and Cognitive Sciences Offer the Sciences of Crime and Justice

Calls for consilience of knowledge, as described by Wilson (1999) decades ago, evoked mercurial receptions across the social sciences, to put it mildly (Pinker, 2002). Still, the clarity of hindsight offers an encouraging vista of how things have changed over time. Consider the field of psychology. By virtually any metric, this is an academic field in which consilience has flourished. Perhaps the largest "social science" arena, various edges of psychology have become so tightly welded to medicine, genomics, and neuroanatomy that bright boundaries are simply absent. Tracking all the cross-pollination becomes tricky indeed, and with good reason. Various branches and subbranches have natural affinities for each other, and they function to shed light on problems across fields that seemed previously intractable (Gazzaniga, 2009).

The deeper animating force for this ongoing consilience, moreover, is evolutionary theory, a tool which allows psychological scientists the ability to best contextualize their results. It's hard to imagine how this could have worked differently, as Darwinian logic provides the foundation on which all knowledge about life on the planet can be grounded (Duntley & Shackelford, 2008). Returning to Wilson (1999) for a moment, his guiding assumption was that like all animals, humans occupy a place in a branching tree of life. Darwin, of course, had beaten him to this conclusion over a century prior. Like every other species, our placement in life's branching tree was not immediately realized. Our existence is owed to a gradual and sometime glacial process of change, contributing to a slow physiological, cognitive, and cultural departure from our primate kin.

Make no mistake, our evolutionary history sparked an ongoing cultural evolution, as well. Our species has erected complex and complicated social milieus that shape, and are shaped by, us (Heinrich, Boyd, & Richardson, 2008). It was only a matter of time before a field concerned almost exclusively with mental processes realized that to invoke the mental meant invoking the neurological. The neurological, in turn, demanded an understanding of the physiological, which compelled scholars to grasp on some level the evolutionary process that created it all. Consilience driven by evolutionary insights in any field interested in human beings, like it or not, is most likely a *fait accompli*.

No Longer Islands unto Themselves

Though they, too, have been undergoing their own version of consilience, criminal justicians and criminologists remain comparatively more isolated in their work (Barnes et al., 2014; Duntley & Shackelford, 2008). The difference is simply one of degree. Insights from economics, sociology, social psychology, and even behavioral and molecular genetics have made vital inroads into the criminological sciences proper (Barnes et al., 2014; Boutwell & Adams, 2020; Tanksley et al., 2020). This is a hallmark of scientific progress, and it simplifies our goal here. Instead of starting from scratch, what we're asserting is that just a bit more integration will knit together the knowledge flowing from all the fields probing the worst behaviors of human beings. The logic of evolutionary psychology melded with the insights of cognitive science, we propose, constitutes the next logical and necessary step toward a mature science of crime.

Borrowing Some New Tools

Because we're not starting from scratch, there is no need to invent new tools or strategies, we can just borrow strategically from others. In fact, we can start with perhaps the most vital tool of evolutionary theorists. Reverse engineering something to divine its possible purpose, or lack thereof, is a broadly useful strategy in science (Pinker, 1997; Tooby & DeVore, 1987). Traits emerge and persist because they promoted fitness in our ancestors, because they came along for the ride with other adaptive phenotypes, or because of historical "accidents" of a type more formally known as genetic drift (Buss, 2007; Pinker, 1997). Thinking about a phenotype (like violence or aggression) and working backwards to understand its possible purpose in our past can yield invaluable insights (Duntley & Shackelford, 2008).

Our ancestors faced a grab-bag of recurrent problems, many of which had to do with dealing with other people. How does one navigate an encounter with a non-relative whose intentions cannot be readily discerned simply by looking at them (Buss, 2007)? What strategy is best for navigating a dispute over food, or a possible mate? Simple physical force might suffice sometimes, but that strategy fails when one encounters a larger, stronger individual. What constitutes "fairness?" This is a deceptively complicated question, yet it was an unavoidable one if mixed groups of related and unrelated humans wanted to live together and cooperate with some degree of success.

The point is, of course, that human beings have had to solve the *cognitive* problems of "each other" for a very long time, and natural selection has had the opportunity to design a mind with at least some capacity to meet the challenge. This is precisely the reason why evolutionary psychologists have thought about human mental processes using a Darwinian lens for decades now. And the relevance of this work for criminology and criminal justice should, at most, be only thinly veiled. Understanding why people take advantage of each other, sometimes violate official social codes (laws), obey those codes, and ultimately understanding where the codes come from in the first place, all reside at the heart of the crime sciences (Black, 1976; Tyler, 1990). It is worth mentioning again, moreover, that the sheer number of scholars across fields taking advantage of evolutionary logic—including psychiatrists, cognitive scientists, anthropologists, and even a small number of criminologists—testifies to its broad applicability (Kavish & Boutwell, 2018; Shackelford, 2020; Tielbeek et al., 2018).

The component parts of our anatomy offer immediate clues when we attempt to reverse engineer them to discern their purpose. Duntley and Shackelford (2008) mentioned a few of these, such as the obvious examples of the heart and lungs. The first representing a powerful pump which circulates oxygenated blood continuously throughout the body, and the second serving as the hardware needed to extract oxygen from the air and release carbon dioxide from the body. Other examples could be listed *ad nauseum*. Far from a new point, it is worth repeating here that the advantages of one design aspect over another need not be huge to be noticed by natural selection (Duntley & Shackelford, 2008). A trait offering the tiniest advantage, say 1%, (or, more precisely, the genetic variants underlying that trait), can surge close to fixation in a population within only a few thousand generations—which, it bears reminding, is an evolutionary "eye blink" (Falconer & MacKay, 1996; Nilsson & Pelger, 1994; Duntley & Shackelford, 2008).

Of course, we would be remiss not to mention some of the unfortunate design fallouts that arise from mindless, blind selection (Dawkins, 1996; Marcus, 2009). The passage of the male urethra directly through the prostate, protections from choking that were sacrificed in the production of speech, cell divisions that are essential but which risk error and overabundance, and thus can yield cancer, are but a few of the starker examples (Dawkins, 1996; Pinker, 1997). With the aid of a clever analogy, it has been convincingly argued that many of our "design features"—including the design of human brains and minds—look a lot like a *kluge*—a clumsy, sometimes redundant, often inelegant solution to an engineering problem (Marcus, 2009).

Nonetheless, just as natural selection gradually sculpted physiological mechanisms with specific problem-solving functions, so too did it gradually sculpt the information-processing mechanisms that produce preferences, desires, emotions, and attitudes. Evolutionary processes, in other words, set in place a “conspiracy” of mental processes that work in the service of solving ancestrally recurrent problems (see chapter 1, this volume). None of this should be controversial, or even the least bit surprising. To endorse a Darwinian understanding of life necessitates that we endorse some version of what was just stated.

That said, the version of this logic that one accepts could manifest as a “stronger” or “weaker” variety. For instance, one might argue that the mind is full of specific modular adaptations, each designed to solve *specific* problems (Tooby & Cosmides, 1992). Alternatively, one may be more swayed by a version in which some number of more general modules exist, capable of plying their problem-solving skills across various types of problems (see Buss, 1991; Pinker, 1997, concerning this debate). For our discussion here, where one lands on this spectrum is irrelevant. The point is that you cannot, on the one hand, ponder the evolution of physiological systems and, on the other hand, assert that the human brain was birthed fully formed, untouched by selective forces that have been, and are now, exerting influences on our species (Buss, 1991).

A key point made by Duntley and Shackelford (2008) is quite relevant to this discussion. Humans, they remind us, do not have specialized physiological weaponry—something like long pronounced fangs or sharp talons for when its necessary to battle a rival. What we do have is a “mind” produced by functioning in our brain. They argue, and we concur, that the mind houses information-processing adaptations. These “modules” function to coordinate feelings and emotions, and ultimately behaviors, capable of solving the social interaction problems that humans have dealt with for so long.

So important is our use of cognitive toolkits to deal with each other, that Tooby and DeVore (1987) went so far as to argue that our species occupies a “cognitive niche” (see also Pinker, 2010). Any social interaction can run a spectrum ranging between easy cooperation to intense and possibly violent conflict. Strategies that coordinate cooperation whenever possible and avoid conflict, were likely more beneficial than either trying to go it alone or attempting to kill every would-be rival that stumbled into your path (Trivers, 1971). Sometimes violence might be needed, of course—if one group is threatening another group, for instance—but in such cases, coordination and cooperation are still essential if the hostile group is to be fended off by those under threat (Buss & Shackelford, 1997). What's essential to realize is that selective pressures were likely exerted around the need for strategies aimed at winning the near constant competitions over scarce resources, while also figuring out the motives and strategies of those you were in competition with (Buss & Shackelford, 1997; Duntley, 2005).

The contemplation about ancestral problems and their plausible solutions brings us to an intersection between topics that crime scientists care deeply about. To see what we mean, consider that when valuable resources are scarce, injuring or incapacitating a rival makes sense in certain settings (Duntley and Shackelford, 2008). The benefits of controlling the contested resources, in such cases, can immediately plummet for the rival. If it becomes apparent that standing your ground will result in serious injury or death, discretion becomes the better part of valor. Put differently, causing, or giving a credible threat that you will cause, pain or damage to a rival, their most prudent strategy becomes simply walking away (Duntley and Shackelford, 2008). The aggressive individual, in this instance, has won.

Circling this topic of credible threats, a bit more, Pinker (2007) wryly noted that a mobster complimenting your store and then in the same breath noting that it'd be a shame if something happened to it, is not engaging in idle chit chat. The mafioso has threatened something that you value. It's thinly veiled, but also very credible, as you happen to know that this guy burned down a neighbor's business not two weeks ago. So, unless you fork over some money (i.e., a valued resource), your store may burn down, maybe even with you in it! A collection of certain evolved adaptations, demented as they might seem in a modern world, can generate lifelong strategies for exploiting and abusing others. Indeed, some scholars have argued that these mental capacities represent the forerunners of the psychopathic tendencies disproportionately prevalent in some of the most chronic offenders in the population (Lalumiere, Harris, & Rice 2001; Mealey, 1995; Pitchford, 2001).

What is hopefully becoming clear by now is that understanding the nature of recurrent conflicts in our evolutionary history can offer us useful insights into conflicts between people today. These evolutionarily enduring conflicts and the adaptations produced by selection to navigate them afford the framework for an evolutionarily informed crime science. Stopping here, however, and not adding more meat to the bone of what we've described, would be unsatisfying.

It is one thing (a useful thing) to describe a psychological architecture that contains tools for cooperation, exploitation, subversion, and violence. Yet, to have a deeper understanding about these adaptations, evolutionary science requires the additional layer of cognitive science. To connect the dots requires that we more precisely describe terms like "brain", "module", and "mind", something cognitive scientists have been thinking hard about for some time (Gazzaniga, 2005; Gazzaniga & Steven, 2005; Pinker, 2002).

Natural selection shaped brains just as it did hearts and lungs, that seems clear, but the real reason why that's important is that it resulted in the mental modules which underpin the functioning of *minds* (Barkow, Cosmides, & Tooby, 1992; Pinker, 2007). When individuals contemplate an action, when we think about the pros and cons of doing something—say, stealing something or hurting someone—these are happening in our minds. So far, we have not provided much discussion in way of what minds do and how they operate when running the evolved cognitive software that we've been referring to as psychological adaptations. The next section fills in the gaps we have created for the reader up until now.

Evolutionary Science Meets Cognitive Science

The best way to move the discussion forward here is by first moving back a little further in time. In the early days of evolutionary psychology, a frequent charge leveled at the field is one of unadulterated and unabashed "reductionism" (Barkow, Cosmides, & Tooby, 1992; Pinker, 2002). Critics loudly and correctly noted that there is no specific brain region for "mate selection" or "rape" or any other specific behavior (Duntley & Shackelford, 2005). Brains just aren't built like that, and of course, the critics were correct. Conveniently, we are not aware of any well-informed evolutionary psychologists that argued for the existence of such mythical brain regions. Evolutionary psychologists have, in fact, argued *against* the likelihood of such specific brain regions for at least three decades (see, e.g., Tooby & Cosmides, 1992; Pinker, 1997; Symons, 1992).

The interest and concern of evolutionary psychologists was always largely about *minds*, not necessarily brains. It was understood that minds came from brains, that no ghosts floated around in the skull (Pinker, 2002). But no serious scholar thought that brain scans or inspection at autopsy would reveal little neural enclaves where cooperation happened, or where deception took place, and nothing else. As it would happen, just around the bend were some key insights from cognitive science which would provide clarity concerning the confluence of brains, minds, cognition, and evolutionary purpose. Led primarily by Michael Gazzaniga along with others, the emergence of cognitive neuroscience—a field which also served to merge insights from neurology and neuroscience—would end up illuminating ideas from evolutionary psychology

(Gazzaniga, 2008). In an interesting twist, too, work conducted under the auspices of cognitive neuroscience relied on key insights from within evolutionary psychology, practically from the start. For crime scientists, the need to pay attention to this work stems from the simple fact that much of it deals directly with the topics of morality, justice, and fairness, along with a cadre of topics encountered in the confines of traditional criminology and criminal justice research (Aharoni et al., 2008; Gazzaniga, 2008; Miller et al., 2010).

A thorough review is beyond our current scope, but such reviews have been published (see Aharoni et al., 2008; Goodenough & Tucker, 2010; Schacter & Loftus, 2013). What we can offer is a "crash course" which, though incomplete, will reveal why the early revelations in the field are relevant for the science of crime and justice. In 1981, Roger Sperry was awarded[1] the Nobel Prize for his work with patients suffering treatment resistant epilepsy. The surgical intervention employed with these patients involved severing the corpus callosum —a tract of fibers connecting the hemispheres of the brain (Bogen, Fisher, & Vogel, 1965). In some, but not all cases, too, the corpus callosum bisection included the patient's anterior commissure (Bogen et al., 1965; Gazzaniga, 1995). The intent of the procedure was to limit the ability of the seizures to spread across hemispheres (Bogen et al., 1965; Gazzaniga, 1995).

The surgery was effective in that patients noticed no immediately ill effects and experienced marked reductions in seizures (Bogen et al., 1965; Gazzaniga & Sperry, 1967). To interact with a patient who had undergone either partial or complete commissurotomy would not immediately suggest evidence that they had undergone the procedure. General cognitive abilities were preserved, memory and recall abilities left in intact, and personality traits were generally unaffected (Gazzaniga, 1995). The hidden effects of the surgery became apparent in the confines

[1] David Hubel and Torston Wiesel shared in the prize, honoring their work on the visual system.

of specific lab tests—but once revealed, they were striking (Gazzaniga, 1995; 2005; Volz & Gazzaniga, 2017). It was known that visual information presented to the right visual field arrives in the left hemisphere for processing, and visual information in the left visual field is dealt with by the right hemisphere (McGilchrist, 2010; see Figure 2 in Volz & Gazzaniga, 2017, for a more detailed depiction).

Put a little differently, isolating visual information so that it is only processed by the right hemisphere, for example, leaves the left hemisphere functionally in the dark about what was seen and what is happening. Volz and Gazzaniga (2017) recount a particularly illustrative case of patient P.S. P.S. was presented with a picture of a chicken claw, but only to his left hemisphere. The patient's right hemisphere was shown a snowy image. P.S. was then asked to point to pictures related to what had been seen by either the left hemisphere (using the right hand) or the right hemisphere (using the left hand). The right hand pointed to a chicken and the left hand pointed to a shovel. When asked why he had chosen those pictures, P.S. informed the experimenter of his reasons, which must have felt completely logical. The claw belonged to a chicken, and shovels, P.S. asserted, are pretty necessary if you need to clean out the chicken shed (paraphrased from Figure 4 in Volz & Gazzaniga, 2017).

The "reason", as others have noted, was pure confabulation, it had to have been given that the speaking left hemisphere was not aware of why the left hand had pointed to the shovel (Gazzaniga, 1995). It had no idea what was shown to the right hemisphere (Volz & Gazzaniga, 2017). The left hemisphere *created* an explanation, albeit a plausible one, for what was going on (Gazzaniga, 1995). These early revelations would lead to a cascade of research across decades of time, work that would encompass topics ranging from causal inference to moral reasoning

(Gazzaniga, 1995; 2005; Gazzaniga & Steven, 2005; Miller et al., 2010). Without cataloguing every study—there are too many—a few broad points are relevant.

First, the brain has a type of "modular" architecture, though not the variety which some critics of evolutionary psychology argued against (Clune, Mouret, & Lipson, 2013; Gomez-Robles, Hopkins, & Sherwood, 2014; Sporns & Betzel, 2016). Neuroanatomists provided what were at first rudimentary, and then remarkably precise, maps of various neural regions that contributed to a variety of different functions. The cerebellum, medulla, amygdala, and neo-cortical layers, for example, processed information collaboratively in various instances when engaging in certain tasks. Still, modularity of brain structure was apparent. The ability to explore the functional roles of different regions was rapidly maturing during this time, further clarifying the overlap and distinctions between what different neurological regions did exactly. The amygdala does more than just one thing, as do the pons and pre-frontal cortex. And while regions certainly work in collaborative fashion, as we have noted, this need not always be the case. The cerebellum modulates motor movements but is largely and generally uninvolved with language processing, for instance (see Glickstein, 2007).

Modularity Redux

Years of rancorous palaver might have been avoided in evolutionary psychology had two concepts not been conflated. Hopefully dwelling on this now, by referring to the work mentioned above, will smooth the incorporation of evolutionary and cognitive insights into the crime sciences. Those concepts are: 1) brain and 2) mind. As we have already pointed out, evolutionary psychologists argued for the existence of *mental* modules, not modules of neurological tissue *per se* that have bright boundaries and which serve a singular function. The "mental" qualifier here is crucial because it trains our focus on minds—what they do and what they are for (see Franklin, 1995). Minds are produced by brains, but to speak of minds is to speak of something distinct in key respects from brains (Franklin, 1995). Functioning in Broca's Area coordinates aspects of language and speech. But speaking and reasoning with words is also a mental process that can create different mental states used to solve different types of challenges in real life (Gazzaniga, 1980; 2018).

Mental states do not correspond with fidelity to brain functioning in an isolated area (Gazzaniga, 2018; Sperry, 1976). In fact, even if one endorsed a view of the brain as an all-purpose "module-less" organ (which is unsupported and outmoded), such an organ could still produce a modular mind. Mental states often inform the solving of real-world problems. The real-world challenge of courting a mate would involve different mental states than those needed when engaging in combat with a conspecific trying to kill you. So, even though neurological science has revealed the brain to have a "layered and modular architecture" (Gazzaniga, 2018), had that *not* been the case, modular minds could still abound.

When Gazzaniga and colleagues (for review, see Volz & Gazzaniga, 2017) tested the split-brain patients, evidence of modularity was revealed, yet again. Hemispheres were responsible for different tasks and possessed certain capabilities that appeared distinct unto them. To offer some general examples, the left hemisphere held the ability to speak and to perform certain types of causal inference analyses (Volz & Gazzaniga, 2017). The right hemisphere, among other things, seemed to handle tasks relevant to recognizing human faces. Yet important for our purposes, it also seemed to be essential for engaging a "module" used to probe the true intentions of other people, necessary information when doing the moral calculations that we humans use practically every day (Miller et al., 2010; Volz & Gazzaniga, 2017).

Creeping Toward Cognitive Crime Sciences

As a thought experiment (loosely paraphrased from Miller et al., 2010), imagine observing a co-worker preparing coffee for a friend at work. After adding what they honestly believed to be sugar, their friend dies because as it would turn out, the sugar was in fact poison mistaken for sweetener. Now, imagine observing the same scenario, but instead you know that when the co-worker adds sugar, they genuinely believe it to be poison, even though it is in fact only sugar. The friend drinks the coffee and is fine. Who is the more loathsome, morally culpable person? When presented with a similar vignette, split-brain patients responded in an interesting manner. Miller et al. (2010; p. 2220) summarized their results thusly:

> *The present study demonstrates that full and partial callosotomy patients fail to rely on agents' beliefs when judging the moral permissibility of those agents' actions. This finding confirms the hypotheses that specialized belief-ascription mechanisms are lateralized to the right hemisphere and that disconnection from those mechanisms affects normal moral judgments. Moreover, the neural mechanism by which interhemispheric communication occurs between key left and right hemisphere processes seems complex. Since the partial anterior callosotomy patients also showed the effect, it would appear the right TPJ calls upon right frontal processes before communicating information to the left speaking hemisphere*.

Given the frequent social interaction of humans, the ability to "read each other's minds" (known more formally as "theory of mind"; see Miller et al., 2010; Premack & Woodruff, 1978), is essential. In other words, it's often quite useful and even necessary for us to be capable of inferring something about what a person was thinking when they violated a social norm. In modern contexts, did the person run over a child because they fell asleep at the wheel, or because they were sending a text message? The result would be the same, but the mental state of the driver mitigates what we think about culpability. Pointing out the broader importance of understanding this process more fully, Aharoni and colleagues (p.148) observed that:

> *Ultimately, a keen knowledge of why people break the law might gain leverage from understanding not how free agents make choices but how causal brains influence people to follow some rules and not others*.

Such knowledge can lead us to a better understanding in general of how our minds—as well as conglomerate of minds, such as a jury—assesses criminal culpability when we are asked to judge the moral responsibility of another's action.

As mentioned, these mind reading skills—as clarified by the work with split-brain patients—seem to be a modular feature of the right hemisphere (Miller et al., 2010). When you disrupt the right hemisphere's ability to inform the left with this information, you disrupt the moral calculus which cues the typical assignment of culpability (Miller et al., 2010). Natural selection designed a brain capable of inferring intent in others (Baron-Cohen, Leslie, & Frith, 1985). These skills litter the arena of topics that crime scientists are interested in. They seem fundamental when pondering and describing how juries deliberate, how judges' reason, and how law enforcement interacts with citizenry, along with a host of other research topics (Gazzaniga, 2008).

Where to Next?

Admittedly, readers may be dissatisfied at this point, as we are wrapping up our discussion having revealed no great insight into the causes of crime. This is just the reality of where things stand. We see all roads converging at the nexus of evolutionary and cognitive science and feel strongly that this will bolster an understanding of what is happening when individuals engage in fraudulent, aggressive, and violent acts. Yet, this anticipated convergence and the positive results it will serves right now to simply illuminate the pathway, it doesn't get it us to the end of it. There is much left to do.

What we have argued, we feel compelled to point out too, does not minimize or obviate work already done by crime scientists. This work has revealed some well-replicated and robust results that will be vital moving forward. Consider one of the strongest correlates of crime: self-control (Pratt & Cullen, 2000; Vazsonyi, Mikuška, & Kelley, 2017). The ability to regulate impulses, behaviors, and desires is a broadly important human trait, yet its precise cognitive nature is a topic in need of more work. Similarly, over five decades of research in behavioral genetics has unequivocally demonstrated that all quantitative traits are partly heritable, including antisocial, self-regulatory, and aggressive behaviors (Beaver, Barnes, & Boutwell, 2014; Barnes et al., 2014; Polderman et al., 2015). The existence of trait heritability is no longer surprising, but neither is it particularly insightful at this point. If genetic variation creates meaningful behavioral variation for criminogenic outcomes, it does so indirectly and by having at least some effects on neurological structure and functioning, which would then have some impact on cognitive processing (Polderman et al., 2015). We have barely started exploring these causal pathways.

As work of this nature begins to proceed in earnest, though, likely to be most pressing for many in the public (and many criminal justice professionals) are the *perceived* implications it might have for choice and free will. In anticipation of this, the neuroscientist Sam Harris observed (2012, p.1),

> *Without free will, sinners and criminals would be nothing more than poorly calibrated clockwork, and any conception of justice that emphasized punishing them (rather than deterring, rehabilitating, or merely constraining them) would appear utterly incongruous*.

Concerns of this nature, it would seem, might be assuaged with some careful reasoning (Dennett, 1984). For example, while certain causal processes can produce aggressive and violent behavior, other causal processes can reduce or prevent the same behaviors (see Dennett, 1984; Harris, 2012, and Volz & Gazzaniga, 2008).

To understand how and why, one need only consider that the broad goal of cognitive behavior therapy, psychopharmacology, or some combination of the two, is to change cognition and behavior in a causal fashion, but for the better. Talking about "causation" does not mean abandoning ideas of responsibility or personal change (Dennett, 1984; Harris, 2012). An uninformed embrace of fatalistic determinism would dictate that trauma victims be abandoned to their PTSD, a bizarre notion made more repugnant given the emergence of promising new therapies (Brown et al., 2021; Harris, 2012; Mitchell et al., 2021). In fact, we must retain meaningful ideas about causality—such as trauma *causing* a stress disorder—if we desire to embrace the idea of interventions *causing* positive change. Insights from evolutionary and cognitive science aid this process tremendously by assisting in the search for causal pathways and mechanisms (see also Duntley & Shackelford, 2008). Far from a hindrance, these fields promise to be widely useful, both for building a robust crime science, but also a more ethical and efficacious framework for aiding in the rehabilitation of those who have run afoul of societal mandates.

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