

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

Review of expertise and its general implications for correctional psychology and criminology.

Dr. Claire Nee and Dr. Tony Ward

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Author Note

Claire Nee, International Centre for Research in Forensic Psychology, Department of Psychology, King Henry Building, University of Portsmouth, Portsmouth, PO1 2DY, U.K. Tony Ward, School of Psychology, Victoria University of Wellington, PO Box 600, Wellington, New Zealand.

Correspondence concerning this article should be addressed to Claire Nee, Department of Psychology, King Henry Building, University of Portsmouth, Portsmouth, PO1 2DY, U.K. E-mail: claire.nee@port.ac.uk. Telephone: +44 (0)2392 846308. Fax: +44 (0)2392 846300

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Abstract

In this introductory article we begin by setting out the aims of this special issue, including: why the expertise paradigm may prove fruitful in understanding the proximal processes surrounding cognition, emotion and behavior at the scene of the crime; and to draw together strands of an emerging field at this important time in its development. We then go on to outline what we see as the key components of perceptual and procedural expertise as defined in mainstream cognitive psychology. We then review strands of complementary knowledge from allied fields in cognitive science that have developed in parallel and lend support for core basic elements of expertise. Adopting the notion that expertise is on a continuum and that most individuals will not reach the extreme end of competence, we describe a model of functional expertise which most people could achieve with practice. Finally, we then discuss 'dysfunctional expertise' that offenders might display through practice in a particular criminal domain and consider how this might enhance our understanding and prevention of criminal behavior.

Keywords: Dysfunctional expertise; automaticity; situational awareness; schema; offender

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1. Aims of the special issue

One of the many challenges faced by researchers working in the domain of offender behavior and rehabilitation, is to understand more clearly the proximal processes involved in the decision to commit a crime i.e. the decisions taken in the days and hours leading up to, during and immediately after the crime. Over the last decade or so, a number of authors in the fields of forensic psychology, criminology and allied disciplines have alluded to (explicitly or otherwise) a distinct form of decision-making utilized by the offender at several points along this decision chain. More recently referred to explicitly as expertise in criminal decision-making (Bourke, Rose & Ward, 2012; Garcia-Retamero & Dhimi, 2009; Nee & Meenaghan, 2006; Topalli, 2005; Ward, 2000; Wright & Decker, 1994, 1997; Wright, Logie & Decker, 1995) numerous other authors have described these processes using related concepts such as bounded rationality and cognitive templates or scripts (Bennett & Brookman, 2010; Brantingham & Brantingham, 1993; Copes & Vieraitis, 2009; Leclerc & Wortley, 2014; Shover & Honaker, 1992; Cherbonneau & Copes, 2006; Opp, 1997; Cornish & Clarke, 1986; Wright & Decker, 1997). The aim of this special issue therefore is to draw together strands of an emerging field at this important time in its development. A particularly valuable and exciting aspect of our current enterprise in our view, is the contribution of scholars from a variety of disciplines, allowing a richer, more triangulated and more valid contribution to the development of theory in the field. We hope that this endeavor will make a considerable step forward in our understanding of the cognitive processes surrounding a variety of crimes, and in so doing enable us to intervene more effectively and ultimately reduce criminal behavior.

2. Aims of this article

The aim of this article is to review what is known about expertise in mainstream cognitive psychology and to discuss related concepts from allied fields that appear to be telling similar stories in order to weave together a more cohesive explanation of offender decision-making. We will adopt an integrative pluralist approach to theory building (Kendler, 2005; Mitchell, 2003; Ward, 2014), seeking to draw together several levels of analysis focused on explaining the process of interest using different perspectives (in our case psychology, criminology, economics and neuropsychology). We will end with a discussion of

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the implications our findings have for forensic psychology and allied criminal justice fields, and what the future might hold.

3. What is expertise: elements and controversies

Scholars have written about expertise for decades from a variety of perspectives. Notable work has been done on chess players, pilots, doctors, typists, and firefighters to name but a few (see Vicente & Wang, 1998 for a review). Others have noted a number of unifying aspects that appear to define expertise whatever the domain (Palmeri, Wong & Gauthier, 2004; Feltovich, Prietula & Ericsson, 2006). Expertise refers to both structural representations of knowledge and skills in memory as well as observable, behavioral manifestations. For the purposes of this article, we define expertise as the acquisition of *cognitive processes and consequent behavior that are demonstrably superior to those new to a given domain, in the sense that they are faster, more cognitively economical, are triggered automatically in relevant environments and are based on considerable experience and honing of skill over time* (Ericsson, 2006a).

It is important to say at the beginning of this article that we strongly adhere to the notion of a continuum of expertise (Chi & Bassok, 1989; Hoffman, Shadbolt, Burton & Klein, 1995) from novices to masters and acknowledge that it is rare for individuals to reach the extreme end of proficiency, except through continual, deliberate and challenging practice (Ericsson, 1996). Most individuals we regard as experts in their fields, be they surgeons or car mechanics, reach a plateau of expertise and are not expected to make concerted attempts to increase their mastery, other than to keep up-to-date with skills and knowledge, through everyday practice and experience (Ericsson, 2006b). This is distinct from, for instance, highly accomplished sports people or musicians who continuously engage in challenging practice to increase their mastery. Nevertheless, examples of everyday expertise can be seen from early on in the expertise continuum and we will return to this issue again below in relation to offenders.

4. Elements of expertise

4.1. Chunking

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One of the most established aspects of any description of expertise in decision-making is the idea of *chunking* in memory. As the novice begins to practice a behavior (intentionally or otherwise) that they are eventually to become experienced in, they learn to recognize (through repeated exposure and consequent learning through trial and error) which cues are more relevant to making accurate inferences (i.e. successful decisions) about the environment and which cues to ignore. As a result of becoming more proficient at recognizing the cues and patterns in our environment through practice, we begin to chunk or group our memories of these patterns and cues in long term memory to enable us to retrieve them more quickly and therefore respond more efficiently and effectively to problems or challenges (Shanteau, 1992). Some of the earliest experimental examples of chunking come from the world of chess. De Groot (1946/1965), for instance, showed how experienced chess players had markedly superior memory for chess positions presented for only a few seconds, compared to newer players. Over time, we also begin to chunk and store the features associated with our more successful patterns of *response* to these cues (in other words strategies that inform our behavior) within the same memory structure, and all this useful knowledge including recognition of cues and how to respond develops into a cognitive schema. Cognitive schemas are memory shortcuts and involve the structure and organization of these chunks of information in long term memory. They comprise abstract, prototypical maps or mini-recipes regarding how to respond, given particular regular and familiar configurations of cues in our environment (Fiske & Taylor, 1991). They allow individuals to respond automatically (recognize x, respond y) and their principle function is to simplify decision-making and behavior, freeing up space in working memory to deal with more conscious and immediate issues and to preserve cognitive resources for these from an evolutionary point of view (Shanteau, 1992).

A good example of a developing a basic cognitive schema is learning to drive. Many of us remember wondering when we started to learn how on earth we were going to master foot pedals, steering wheel, gear stick and visual perception of the incoming environment simultaneously, but with practice things quickly become increasingly automatic until we barely have to think about what to do. As a result of increased experience through repeated exposure to learning events, those with expertise do not necessarily have more schemas, but those they have become larger and more complex (Fiske & Taylor, 1991). Returning to

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work in the chess field, Chase & Simon (1973) showed that the cognitive chunks held by expert chess players store complex configurations of typical chess piece arrangements plus knowledge about how to act on them successfully. Using these chunks they make fast and frugal decisions based on heuristics to evaluate what to do next. More inexperienced players, with far less exposure to these configurations, are hindered by a step-by-step approach, imagining as many outcomes to chess moves as possible, using chunks with single chess pieces. When presented with random configurations of chess pieces however, experts become little better than novices indicating that their superiority is largely based on experience, rather than innate ability (Gobet & Simon, 1996). Interview and experimental work indicates that schemas used by the experienced are more complex, coherent, strategy-oriented and interconnected compared to the less discriminate and more superficial recollections about tasks that novices report (Dane & Pratt, 2007; Hambrick & Engle, 2002). This allows for increasingly accurate, automatic and unconscious recognition of relevant stimuli and instantaneous action (Chase & Simon, 1973; Logan, 1988); faster coding of familiar stimuli (Chi, Feltovich & Glaser, 1981; Klein, 1993); and the ability to multi-task (Palmeri, Wong & Gauthier, 2004).

Alongside the chess examples, evidence of chunking has been noted as a fundamental component of expertise in a variety of experienced professionals. In medicine, for instance, diagnostic expertise has been related to three types of knowledge structure in memory: causal; analytical; and experiential (see Norman, Eva, Brooks & Hamstra, 2006 for a review). Chunking occurs in all three in order to allow quick and easy analysis and diagnosis of potential illnesses from the vast array of knowledge stored after the clinician initially recognizes a pattern of symptoms (also stored in the same schema). Similarly, experienced computer programmers can remember significantly more lines of programming after brief presentations in comparison to students (Barfield, 1997; Ye & Salvendy, 1994) suggesting larger and more densely structured chunks.

4.2. Automaticity

A controversial aspect of experienced decision-making, which has special resonance in the world of forensic psychology, is the issue of how quickly the process becomes automatic and therefore potentially unconscious. Based on groundbreaking experiments

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using visual searches that encompass targets and distracters in the 1970s (the most notable of which is Logan, 1988; Posner & Snyder, 1975; and Schneider & Shiffrin, 1977) true automaticity was thought to require four distinct features (the process should be unintentional, outside awareness, uncontrollable and highly resource-efficient). Further, it has been suggested (and is still thought to be the case by a number of scholars) that for cognitive processes to become fully automatic, they require thousands of repetitions of an experience in an identical performance environment (Shiffrin & Schneider, 1977). However, if this were the case (using the car driving example again) it would take considerably longer than typical to develop the expertise required to drive a car and for it to become automatic. Additionally, one would have to undertake lessons in precisely the same environment and in the same car each time. It is known from other work that the nature of cognitive processing changes within a very short period of practice (e.g. becomes less deliberate, Schneider & Shiffrin, 1977) and that brain changes in relation to expertise can be seen after one hour of practicing a task (Hill & Schneider, 2005). In the offending world, markedly superior, automatic, recognition memory for burglary-related environmental cues have been demonstrated in experienced but teenage burglars, compared to non-burgling young offenders who were in turn more knowledgeable than police officers and then students (Logie, Wright & Decker, 1992; see Nee, 2015, this issue for a fuller account). This suggests that levels of automaticity can build up relatively quickly (in very young people) and may not require thousands of repetitions of identical trials, but fewer trials (perhaps in the hundreds, Logan & Etherton, 1994) in similar but not identical environments.

Later developments in mainstream cognitive psychology have in fact suggested that not all four features need to be satisfied for a process to be considered automatic. From Kahneman and Tversky's groundbreaking work in the 1970's and 1980's onwards (e.g. Kahneman & Tversky, 1979) on heuristic decision-making there is an abundance of examples of psychological processes that are partly automatic. For instance, the initial decision to drive a car might be done with intention and awareness, but once the process has begun, it becomes autonomous and automatic in nature (Bargh, 1994). The medical practitioner has the conscious intention of diagnosing and assisting the patient but quickly resorts to

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automatic, heuristic decision-making when presented with an array of symptoms (Norman et al, 2006).

The limited research in the forensic field suggests that offenders demonstrate a level of automaticity in terms of unintentional recognition of offender-related cues which are highly resource-efficient in the commission of the crime (Nee & Meenaghan, 2006; Topalli, 2005; Ward & Hudson, 2000). Whether these behaviors are completely without awareness and control requires much more research but, at first glance, they seem to satisfy Bargh's notion of automaticity. Indeed, Bargh's description of 'preconscious' automatic processes (Bargh, 1990; 1994; Bargh, Schwader, Hailey, Dyer & Boothby, 2012) supported by several other authors from experimental work (Posner & Snyder, 1975; Treisman & Gelade, 1980), seems highly relevant to offender decision making and provides a strong explanation for the continual scanning of the everyday environment for offence-related cues thought to occur in burglars and other offenders (Felson, 2002; Nee & Taylor, 2000; Wright & Decker, 1994). Preconscious automaticity does not require a conscious goal or intention in order to be activated but refers to the routine interpretation, evaluation and categorization of cues in the environment that happen before a deliberative response (Bargh, 1994). One *may* be aware of this process but there is no pre-requisition to be aware for it to occur (see Bargh, Gollwitzer, Lee-Chai, Barndollar & Trotschel, 2001, for a series of experiments demonstrating pre-conscious appraisal affecting subsequent decision-making and behavior).

Preconscious automatic processes associated with environmental triggers that are strongly associated with reward (or threat) seem to be 'chronically accessible' (Bargh, 1994, p.4) allowing for an 'eternal vigilance' (Bargh, 1994, p.5). Consequently, because this automatic and preconscious scanning of the environment for cues related to one's expertise has no pre-requisite conditions, it has a strong and frequent impact on one's subsequent conscious decision-making and behavior (Bargh et al, 2012). Moreover, these automatic appraisals are unaffected by increased cognitive load (see Bargh, 1994 for a review of studies), for instance when one is under the stress of undertaking a crime. Importantly too, the strength of the potential reward, linked to positive affect in memory, makes some cues more powerful and salient than others, affecting motivation and allowing goals to be activated unconsciously (Chartrand & Bargh, 2002).

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4.3. Situational awareness and selective preconscious attention

A further consequence of this continual pre-conscious scanning of the environment undertaken by individuals relatively experienced in any domain, is the increasing ability to automatically attend to and prioritise meaningful cues relevant to one's expertise. In a review of research on memory capabilities in mental calculation, medical diagnosis and chess, Ericsson and Kintsch (1995) proposed that experts become increasingly skilled at recognising, encoding and storing information that could *potentially* be important in their future decisions. According to their model, this information is stored in long term working memory (LTWM a much larger store than typical working memory). Experts continually update their models of LTWM (perhaps through eternal vigilance) giving them superior situational awareness. This concurrent awareness of the environment is one of the key advantages that experts have. It clearly allows for instant superior evaluation of a situation/encounter (Endsley, 2006). But further, when a subsequent potentially 'valuable' environment is encountered, even with partial relevance to the individuals' expertise (Chiesi, Spilich & Voss, 1979), the potential is instantly and automatically recognized due to the abstract representations in LTWM of what is invariant (and therefore vulnerable or meaningful) in the environment.

Useful inferences can be made about even small amounts of partial information (Duckworth, Bargh, Garcia & Chaiken, 2002; Gilovich, 1981), explaining how expertise can generalize to novel but partially familiar environments. This has been further illuminated in the world of spatial navigation and neuroscience. In a body of work, Maguire and her colleagues have found neural correlates which suggest a two-track system in the brain for dealing with well-learned routes and novel routes in expert London taxi-drivers – individuals who have to continually integrate novel features with well-learned ones when finding new routes on a daily basis (e.g. Woollett & Maguire, 2010; Hartley, Maguire, Spiers & Burgess, 2003 p 673). Novel routes appear to activate the anterior hippocampus, while well-known routes activate the caudate nucleus. Moreover, a complimentary process appears to emerge between the two areas of the brain when the individual is engaged in learning a new route (Hartley et al, 2003), perhaps indicating that novel features are being merged with familiar ones (e.g. I don't know road x, but it is near road y, and there is a shopping

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area ahead). This supports the idea that new features can be integrated into schemas quickly in those experienced at a task and that skills/knowledge can be built up quickly without repetitions in identical environments. This works well up to a point where too much new information has to be integrated (see Woollett & Maguire, 2010 later in this article).

4.4. Multi-tasking

Another feature of expertise with clear implications for the forensic field is the well-established notion that the automatic, unconscious and therefore highly efficient decision-making of the expert frees up space for other, more conscious deliberations and problem-solving in working memory (see Palmeri et al, 2004 for a review). As automaticity increases with repeated exposure to learning events, reaction time gets faster, cognitive load effects get smaller, and dual-task interference diminishes such that the automatic (highly learned) task uses minimal cognitive resources and frees these up for the alternative (more-novel, less learned, or more resource-demanding) task (Logan & Etherton, 1994). A considerable body of evidence exists for this ability to multi-task from the world of dual task experiments. For example, experienced typists can type proficiently while reciting nursery rhymes (Shaffer, 1975). Accomplished pianists can repeat heard words while playing complex pieces (Allport, Antonisa & Reynolds, 1972). Experts carry out their expert behavior more-or-less automatically, allowing them to attend to other parts of their environment more deliberately (such as burglars consciously listening for cues suggesting the return of homeowners, Nee & Meenaghan, 2006). Those new to a task will have their cognitive resources drained by the more deliberate, analytical or 'compensatory' decision-making of the novice (Ericsson & Kintsch, 1995).

Thus the direct study of expertise in a number of domains has furnished us with a reasonably strong and evidence-based understanding of a number of features associated with it. There is no reason why these insights would not apply to and help us understand the decisions and behavior of the experienced offender. Before turning to a discussion of this however, it would be unwise not to learn lessons from strands of complementary knowledge that have developed over the decades in allied areas of scientific enquiry.

5. Kahneman's System 1 and System 2

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Kahneman and colleagues, renowned for their experimental work on probabilistic thinking and theory on heuristic decision-making in everyday life and in the world of economics, have over the decades referred to a dual system of decision-making: one intuitive, automatic and unconscious; and one effortful, deliberate and reasoning (now referred to as System 1 (S1) and System 2 (S2), (Stanovich & West, 2000, Kahneman, 2011). In Kahneman's iteration, S1 engages in automatic and continuous appraisal of the environment and heavily guides what S2 attends to. S1 acts as an efficiency filter based on repeated instances of learning (associating new information with existing patterns) and aims at preserving S2's 'limited budget of attention' for things worth attending to, or which require deliberate processing (p. 23). S2 then engages in deliberate, conscious, step-by-step evaluation and problem-solving. Contributions of particular importance for our purposes are Kahneman et al's evidence that *a*) like a form of parallel (constant) processing (Treisman, 1969) S1 cannot be turned off (Kahneman, 2003, also alluded to by Bargh in his discussions of preconscious attention – see above) which will have important consequences for deciding to commit crimes; *b*) while efficient, S1 is often prone to error due to its over-reliance on the 'availability heuristic' (Tversky & Kahneman, 1974). This indicates how decision-making is decidedly biased towards instances/memories that are more salient for us, purely because we have had more frequent exposure to them. Finally, *c*) S1 and 2 are often in competition and conflict with each other. Once S2 is invoked, the automatic evaluations of S1 will continually assist the deliberations of S2 (e.g. S1: there is danger of violence/S2: I have to manage this situation so I'm not hurt). As can be seen from this example, S2 is the process that exerts self-control, responding to S1's potentially more impulsive evaluation (see later in this article for a discussion on how these concepts have an impact on preventing crime).

6. Klein's Recognition-primed decision-making

Away from the laboratory, Klein spent much of his career observing a wide range of professional experts (most notably pilots and firefighters) making decisions in naturalistic, cognitively demanding settings. He and his colleagues noted what they described as intuitive (or what might be described above as automatic, unconscious, preconscious, System 1) rather than analytical (conscious, deliberate, step-by-step, System 2) decision-making as characteristic of expertise (Klein, 1999, 2009; Klein, Calderwood & Clinton-Cirocco, 1984). Expert decision-making according to Klein's group involved richer, more

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complex mental models or mindsets of how things worked (as a result of tacit, unconscious knowledge built up over years) that develop as a result of practice and repeated exposure to learning experiences. Decision-making on the ground, under pressured circumstances, could be comfortably explained by the concepts reviewed above. Expertise-relevant environmental cues appeared to be instantaneously recognized from a mental repertoire of patterns (schemata) and a solution was rapidly generated (the first one that would work rather than the optimal one), known as satisficing rather than optimizing (Simon, 1957). This brings us neatly to the next example.

7. Simon's Bounded Rationality

The concept of bounded rationality (Simon, 1957) has had some history in forensic/criminological contexts and was first put forward in this field as part of Cornish and Clarke's Rational Choice Perspective on criminal decision-making at the scene of the crime (Carroll & Weaver, 1986; Cornish & Clarke, 1986; Johnson & Payne, 1986). Since then, more refined versions of the Rational Choice Perspective have been developed which more explicitly note the involvement of automatic processes (Wortley, 2014) and the involvement of emotion (Van Gelder, 2012). Simon's (1957) original idea moved away from traditional econometric descriptions of reasoning in which accurate and full information about the problem at hand is assumed and can be doggedly analyzed to reach the best decision, to suggest that everyday decision-making involves a much curtailed process utilizing rules of thumb (heuristics) that had worked before (Carroll, 1978, 1982). The most thorough account of developments in the field of bounded rationality has been captured by Gigerenzer and Selten (2002) and many of its concepts complement the explanations described earlier in this article well. In contrast to Kahneman's (2011) view of human information processing which they suggest involves an over-emphasis on the errors that are made by our reliance on heuristics, Gigerenzer and colleagues put forward a compelling argument that bounded rationality should not be seen as a limited, less than optimal exercise. Based on Simon's (1957) ecological notion that thinking has developed as part of a dynamic process strongly affected by the structure of the environment we live in, they propose that bounded rationality is an evolutionary adaptation allowing us to maximize successful outcomes under typical everyday constraints that are limited on time and information (Gigerenzer et al, 1989; Todd, 2002). This involves a simple search for cues in the environment using fast and

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frugal, tried and tested, heuristics based on previous success, and the use of simple stopping rules and decision rules as soon as the information gathered is evaluated as good enough to generate a response (this could be within milliseconds). Optimization (in the econometric, analytical, non-compensatory sense) is considered to be no real option in most environments according to this body of work, as full accurate, information is only very rarely possible and therefore guesswork is required (less accurate than using heuristics, Gigerenzer & Selten, 2002; Klein, 1997). Supported by a considerable amount of empirical evidence (see Gigerenzer & Selten, 2002, for a review), scholars in this field suggest that individuals use an 'adaptive toolbox' based on simple rules and heuristics to make the majority of our decisions, as opposed to the thorough cost-benefit analysis more commonly associated with the idea of rationality.

8. Skinner's Rule governed behavior

Coming from an unquestionably behaviorist stance, it would be difficult not to draw parallels between what Skinner (1956) and others (e.g. Vaughan, 1987) described as rule-governed and contingency-driven behavior in relation to expertise. Through a process of trial and error and the modeling of significant others, we learn which cues in the environment (discriminative stimuli) as associated with rewarding behavior and these set up internalized rules of thumb about how to behave in the future (rule-governed behavior). Behavior is shaped and maintained by these rewards and reinforcement. On encountering an environment with ample opportunity (contingencies) for reward one is highly likely to respond in a particular way (contingency-driven behavior). Skinner (1966) noted that rule-governed behavior is more likely to involve deliberation to some extent, while automatic response to cues is likely to be more habitual and impulsive. By this he clearly does not mean indiscriminate however, as the response will be based on knowledge of the value of the cue.

9. Functional and dysfunctional expertise

We emphasized the notion of a continuum of expertise at the start of this article, which has been explicitly described (Bedard & Chi, 1991; Chi, 2006; Hoffman, 1998) and alluded to (Bargh, 1994; Klein, 1997) by many scholars and this is important to re-iterate here. This 'relative' approach assumes that most motivated novices can reach a level of

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expertise with practice and our aim in studying this is to understand the conditions that allow this expertise to be learnt (Chi, 2006). For instance, someone who has learnt to drive a vehicle, or to type at speed, or to speak a second language fluently, may not have the same level of expertise as a pilot or surgeon, but they can still be considered expert in comparison to a novice on a variety of measures (Bargh, 1994; Klein, 1999) in their respective fields. They have a level of what we describe as *functional expertise* - the requisite skills and knowledge in a domain to function well at what they do (often as a means of supporting themselves) which can be learnt and which differs from those new to the field. To support this Weick (1995) has noted that schemas are only as complex as they need to be, depending on the environment that the expertise is associated with.

Drawing together different strands of explanation above, this functional expertise seems to involve:

1. Automatic, unintentional, pre-conscious appraisal of the environment that cannot be turned off
2. Superior, automatic recognition of the environmental, offence-related cues meaningfully related to the domain of expertise
3. The activation of complex cognitive schemas, built up through practice, allowing instantaneous, compensatory access to a rich number of exemplars and heuristics which will in turn guide:
4. Speedy responses to environmental cues that have worked in the past in the form of the playing out of behavioral scripts, allowing a relatively automatic commission of the act.

It is reasonable to suggest levels of consciousness during the process may increase and therefore become more controllable somewhere between steps 3 and 4, but this might vary considerably depending on the complexity of the task and the agent undertaking it. Much of behavior is over-learned and habitual – we have all been subject to, for instance, the intention to deviate from our journey to work to undertake an extra task, only to find ourselves at our office door (at which point the process becomes conscious) having automatically and unconsciously reverted to an the over-learned route (known as an action slip, Norman, 1981; Sellen & Norman, 1992). Conversely, as Bargh (1994) points out, one has the intention to drive at the *start* of the process, but once initiated, the behavior

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becomes automatic and unconscious. As Kahneman (2003, 2011) and others (Nordgren, Bos & Dijksterhuis, 2011) importantly note, it may be that the conscious and unconscious processes work together and are sometimes in conflict.

10. Implications for understanding criminal behavior and preventing it

Where does this leave us with the offender in terms of expertise, intentions and control? We would suggest that the process of instigating a criminal activity in an experienced offender will involve the same processes outlined above, though in this case given the potential outcome, it would seem more appropriate to describe the process as *dysfunctional expertise*. A number of examples of cognitive and behavioral processes that would fit with this model have already been cited in the emerging literature (e.g. implicit planning (Ward & Hudson, 2000) and use of automatic scripts (Bourke, et al, 2012) in sex offenders; speedy and superior knowledge of environmental cues (Brantingham & Brantingham, 2004; Clare, 2011; Nee & Taylor, 2000) and automatic scripts (Nee & Meenaghan, 2006; Wright & Decker, 1994) in burglars, and of course are in abundance in this special issue.

In this section, we start by highlighting some of the issues we face regarding 'dysfunctional' expertise in the offender. We then look at what is known in cognitive psychology about the limitations and problems associated with expert thinking to see if there are ways we can utilise this to prevent crime. Finally, we summarize what we this might mean for primary crime prevention (scene of the crime); secondary crime prevention (diversion of those at high risk); and tertiary crime prevention (intervention with persistent offenders) before turning to the final section of the article.

We are in the early days of understanding, from a scientific point of view, how expert cognitive processes apply to the whole chain of decisions that eventually results in a criminal act. Limited evidence exists suggesting that acquisitive offenders (Nee & Taylor, 2000), violent offenders (Topalli, 2005) and preferential child molesters (Ward & Keenan, 1999) engage in pre-conscious, pre-attentive scanning and interpretation of the environment using offence-relevant cues, some of which eventually feed into a more deliberative process to undertake the crime. It is likely that this 'pre' stage is occurring

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continuously and unconsciously (Kahneman, 2003; Logan 1992). In these studies offenders have also spontaneously described the use of discriminative cues at the scene of the crime (for instance during target selection in burglary) in an effortless way and two studies have elucidated automatic, unconscious processes during the commission of the crime (Bourke, Ward & Rose, 2012; Clare, 2011; Nee & Meenaghan, 2006). As noted above, a considerable challenge for correctional psychology and criminal justice will be to understand more clearly at what point in the offence chain deliberation, consciousness and therefore control comes to the fore and to what extent this can be changed.

Consciousness is often depicted in cognitive psychology as an all-or-nothing phenomenon, with separate processes underpinning conscious and unconscious processing. Modern models of consciousness however, underpinned by neuroscience, present an infinitely more complex picture, suggesting multiple dissociable (but also possibly interconnected) levels of consciousness that are graded and dynamic (Cleeremans & Jimenex, 2002; Morin, 2006; Nordgren et al, 2011). As Kahneman (2011) notes, in typically developing individuals, a complex picture emerges where both conscious and unconscious processes often act together and are in conflict. This could be good news from a crime prevention viewpoint as in general it refers more to System 2's effortful control over the impulses of System 1. It is worrying however, that in the little evidence we have of decision-making and behavior during the offence, the act of offending seems strongly governed by habitual, gratuitous and largely unconscious decision-making. This is supported by ample evidence from neuroscience suggesting that those from offending backgrounds rely more on parts of the brain that govern more impulsive and immediate reactions (such as the amygdala) rather than the later developing areas in the pre-frontal cortex associated with effortful control (see Nee & Ioannou, forthcoming; for an overview). It is also known that under pressured conditions, one is likely to rely more strongly on automated responses (Bourke et al, 2012; Sellen & Norman, 1992, Van Gelder, 2012). This is clearly an area for future research with a variety of offender populations.

11. When expertise goes wrong – lessons from cognitive psychology for the prevention of crime

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A robust body of research exists from both an experimental and observational viewpoint indicating that expert cognitive processes have limitations in a variety of ways, which we look at in succession now.

11.1. Errors

As we have seen above, heuristic decision-making in any domain in which we are highly experienced is usually an adaptive, efficient process allowing us to make fast, effortless, resource-preserving choices. However, because we are essentially taking a cognitive short-cut by instantly matching environmental cues with prototypical exemplars within our mental schemas we sometimes make errors, especially if we are in ambiguous, pressurized situations (Klein, 2009). Errors occur because our intuitive interpretation of the environment a) is automatic (out of our conscious control), b) may result by interpreting only partial information in our environment, c) is biased: by previous experience of what worked in the past; by our personalities; by what is most salient, common or available in our mental representations, d) is prey to over-learned action slips and over-confidence as our expertise increases. Experimental research in a variety of domains (e.g. chess, physics, music) has shown that experts consistently and significantly overestimate their abilities to solve problems in their fields, compared to novices and intermediates (Chi, 2006) and are therefore less likely to be cautious about their abilities. Additionally, because experts' expectations are shaped by the typical environments they work in they gloss over the superficial detail that novices notice and concentrate on the deeper, abstract structure of the information they encounter. Thus, young, qualified doctors are quicker at diagnosis than medical students because they have a mixture of psychopathology knowledge and clinical experience in their schemas, whereas the students report more detailed psychopathology knowledge but have little clinical experience to draw upon (Schmidt & Boshuizen, 1993).

Ironically in our case, we may wish to exploit these findings to increase the chance of error at the scene of the crime, thus increasing the chances of the crime being aborted (for example an over-confident, experienced car thief may gloss over the innovative security features of a new model of car, causing the alarm to sound). Kahneman and Klein (2009) note that a reasonably predictable environment is one of the two fundamental conditions for the development of expertise (the other being the opportunity to learn). In terms of

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basic situational crime prevention, we need to change the aspects of the potential scene of the crime into something that is not expected, make sure that new deterrent strategies are not glossed over, or alternately, embed them carefully in a predictable environment in order to disrupt the crime once it has started. This is likely to invoke the analytical, conscious appraisal system, increase anxiety and result in a re-evaluation of the risks and costs involved in going through with the criminal act. Whichever way the crime is stopped, ultimately all agents will benefit.

11.2. Inflexibility

Linked to this context-dependence is the concept of inflexibility in expertise. This has been demonstrated in many domains and indicates that once a successful way of responding to a situation has become fixed through repeated learning (or 'cognitively entrenched' (Dane, 2010)), experts lose the flexibility to problem solve creatively as their expert schemas are automatically invoked given certain cues (see Ericsson and Lehmann, 1996 for a review). A convincing recent example of this comes from the Maguire stable on navigational expertise. London taxi drivers were significantly superior to novices in applying their expert navigational strategies in learning to navigate a completely new area outside London (like burglars going to a new residential area, with new but architecturally familiar housing). But when asked to learn notable deviations to routes they already knew in London (over half of the stimuli were new – like burglars entering what seems like a familiar property-type but finding something radically different inside), it took them longer than the novice group (Woollett & Maguire, 2010). According to the authors, the taxi drivers' existing schemas which had been automatically invoked by the familiar information, no longer functioned under the weight of new information, but nevertheless could not be inhibited, and competed with attempts to use new strategies to integrate this new information, rendering them slower than the novices. Although this is the kind of activity taxi-drivers have to contend with everyday, they verbalized how stressful and cognitively demanding it was to learn completely new areas within a familiar setting (e.g. when Canary Wharf was built in London) and only overcame the challenge through daily repeated exposure (until presumably this large amount of new information was integrated into existing schemas).

12. How can this help us to prevent criminal activity?

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The findings above seem most compelling in relation to the thought processes proximal to the commission of the crime. As such they will be helpful for reducing the vulnerability of the environment in which crime occurs, but will also have useful implications in the rehabilitation of offenders and for those at risk of becoming offenders. We will look at each in turn.

We reviewed above some promising evidence that the decision chain associated with a particular crime may involve a considerable amount of preconscious scanning and appraisal of the environment for cues associated with vulnerability and reward (which may be hours, days or more away from the actual crime, during the individual's routine activities (Felson, 2002)). At some point, levels of intention to commit the crime increase (this area in particular, needs substantial further research using a variety of methods). As alluded to above, however, the concept of consciousness is a complex one and may be underpinned and steered by multiple levels of unconscious and partly conscious activity. This is not to say that offenders have an inexorable drive to commit crime and have no control over their actions. The whole aim of this special issue is to highlight the levels of expertise offenders have and decades of research has indicated that the majority of offenders are not opportunistic and exercise discrimination and prior learning in their commission of crimes (see first paragraph) even when heavily misusing drugs (Wright & Decker, 1994; 1997). On the other hand, they only have as much control as any typical individual operating in a familiar environment, whose actions are arguably mostly dominated by reward-driven routine and habit.

12.1 Situational crime prevention

In terms of reducing the vulnerability of the criminogenic environment, the clear message from cognitive psychology is that automatic, expert schemas and behavioral scripts only work (and only develop in the first place) in reasonably familiar environments. For each offence type we need to capitalize on the fact that the offender is expecting the predictable in the environment (s)he operates in. It is not possible to change the whole environment in which we live, but relatively unpredictable features within predictable criminogenic environments will rouse the individual from automatic into deliberative thinking (like the London taxi drivers above) and this may be the perfect opportunity to have them re-

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evaluate and abandon the crime. The over-confidence of the expert offender, who is therefore likely to act upon an environment that is only partially familiar is also worth bearing in mind as an aspect that might be capitalized on.

12.2. Rehabilitation for experienced offenders

This leads on to rehabilitation for those entrenched in a life of crime. Part of any intervention needs to acknowledge and address the considerable levels of automaticity in the offense decision chain and a big challenge will be to find effective ways of assisting individuals to become more aware of their pre-conscious automatic scanning of the environment, and what to do when they become aware of this, be it before, during or after the crime. Mindfulness techniques may be of use and promising work also comes from the world of stereotyping in which Devine (1989) builds on Bargh's work with a series of experiments. Devine, Bargh and others (Blair & Banaji, 1996) have demonstrated in numerous experimental settings how stereotypes can be automatically and unconsciously activated through priming techniques. Yet Devine (1989) demonstrated that once activated and some level of awareness is reached, one can be taught to automate a habit of *non-stereotyping* (e.g. a script of fairness) which becomes instantly activated immediately after the original stereotypical thought is invoked. A clear application of this research finding is to cognitive restructuring and empathy work with sex offenders. In treatment programs, sex offenders are taught to substitute different thinking routines when confronted with victims or thinking about possible offense situations (Yates, Prescott, & Ward, 2010). For example, when feeling sexually aroused or angry with a potential victim they are encouraged to think about the situation from alternative viewpoints, or to imagine the possible negative consequences of committing an offense. As Bargh (1994) notes however, it is still up to the individual whether or not they exercise this control, whether they are aware of the existence of the automatic influence and whether they have sufficient attentional resources and ability to act in a pro-social way. An acknowledgement should also be made by rehabilitative professionals, that entrenched, dysfunctional, automatic schemas will compete forcefully with attempts by the individual to implant new ways of thinking (as noted by Woollett & Maguire, 2010, above) and that the latter will take time, motivation and repetition to become automatically activated (Devine, 1989). On a negative note regarding opportunities to intervene with these cognitive processes in the correctional field,

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crime detection and therefore conviction rates are very low (detection rates are typically less than a third of all crimes in the UK, for instance (Smith, Taylor & Elkin, 2013)), and the vast majority of offenders receive no intervention during their sentence (National Audit Office, 2010), so opportunities for intervention are currently very limited.

12.3. Reducing opportunity for those at risk of becoming offenders

This leads us to the challenging world of reducing criminogenic risk in those 'at risk' of offending. Is it possible to prevent or reduce the opportunities for expertise in offending behavior to develop in young people? It seems unlikely if you accept that the childhood of most offenders and children at risk will have been rife with anti-social modelling experiences from significant others and where anti-social behavior is often rewarded. We also have evidence that offending expertise can build up very quickly from work with young offenders (Logie, Wright & Decker, 1992). We will have to be creative about how we can work in 'at-risk' settings and this is clearly going to be more effective outside the criminal justice arena and within the educational one. Again though, there is some hope from the expertise literature, that a motivated young person can replace an anti-social automatic schema with a pro-social one.

13. Future directions

Where to begin? We have mentioned more than once in this article the need for future research. Alongside descriptive, interview studies that have suggested differences in offender decision-making to those without this experience there have been a small number of experimental studies directly studying the differences between experts and novices, with promising findings. In this article we have drawn together scientific knowledge from allied areas of study which provide the basis of a theory of dysfunctional expertise. For various types of criminal behavior we now need to: 1) repeat some of the basic experiments from the cognitive psychology paradigm with experienced offender populations and a variety of control groups in order to test our predictions in a robust way (the majority of experimental research reviewed above has been done with typically developing populations who may perform differently to the specialist population of offenders, who often grow up in less than optimal conditions (Nee & Ioannou, forthcoming); 2) elucidate more clearly through mixed methods research some exacting questions about the decision chain: under what conditions

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might pre-conscious scanning develop into an intention to offend and is this always acted upon; how distant is this development in time and space from the actual offence; what automatic and reasoned processes occur *during* the offence; at what point on the decision chain and under what conditions will the best opportunities arise to re-evaluate the decision to commit a crime; what happens in the hours and days *after* the crime – a significantly overlooked area; and finally, the often neglected role (especially in acquisitive offenders) that emotion plays in decision-making at all of these points – (such as anger, guilt, shame and emotions associated with arousal, impulsivity and reward – see Day, 2009; van Gelder, 2012 and van Gelder, Ellfers, Reynaud & Nagin, 2013, for recent discussions of cognition and emotion in offenders. Little is known for instance, outside the world of sex offending, about how the decision-making process interacts with other internal moderators and cues such as fatigue, IQ, substance misuse, mental disorder and personality variables. In tandem with in-depth interviewing, experimental and quasi-experimental designs involving observation and measurement in naturalistic and simulated environments are likely to yield especially valid results (Nee, forthcoming). There is extensive work to be done, but all of these avenues of inquiry will strengthen the foundations upon which to build this understanding of offenders, which we hope will be fruitful for theory and the practice of preventing crime in all its shapes and forms. We hope that this special issue provides a large step forward in this respect.

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References

- Allport, A., Antonisa, B., & Reynolds, P. (1972). On the division of attention: A disproof of the single channel hypothesis. *The Quarterly Journal of Experimental Psychology*, *24*, 225-235.
- Barfield, W. (1997). Skilled performance on software as a function of domain expertise and program organization. *Perceptual and Motor Skills*, *85*, 1471-1480.
- Bargh, J. (1990). Auto-motives: Preconscious determinants of thought and behavior. In E. T. Higgins & R. M. Sorrentino (Eds.) *Handbook of motivation and cognition* (Vol. 2, pp. 93-130). New York: Guilford Press.
- Bargh, J. (1994). The four horsemen of automaticity: awareness, intention, efficiency, and control in social cognition. In *Handbook of Social Cognition* (1-40). R. Wyer, T. Srull (Eds.), Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.
- Bargh J. A., Gollwitzer P. M., Lee-Chai A., Barndollar K., Trötschel R. (2001). The automated will: nonconscious activation and pursuit of behavioral goals. *Journal of Personality and Social Psychology*, *81*, 1014–1027 10.1037/0022-3514.81.6.1014.
- Bargh, J. A., Schwader, K. L., Hailey, S. E., Dyer, R. L., & Boothby, E. J. (2012). Automaticity in social-cognitive processes. *Trends in Cognitive Science*, *16*(12), 593-605.
- Bedard, J., & Chi, M. (1992). Expertise. *Current Directions in Psychological Science*, *1*, 135–139.
- Bennett, T., & Brookman, F. (2010), 'Street Robbery', in F. Brookman, M. Maguire, H. Pierpoint & T. Bennett (Eds.), *The Handbook on Crime*. Devon: Willan.
- Blair, I., & Banaji, M. (1996). Automatic and controlled processes in stereotype priming. *Journal of Personality and Social Psychology*, *70*, 1142-1163.
- Bourke, P., Ward, T., & Rose, C. (2012). Expertise and sexual offending: A preliminary empirical model. *Journal of Interpersonal Violence*, *27*, 2391- 2414.
- Carroll, J.S (1978). The effect of imagining an event on expectations for the event: An interpretation in terms of the availability heuristic. *Journal of Experimental Social Psychology*, *14*, 88-96.
- Carroll, J.S. (1982). Committing a crime: The offender's decision. In V.J. Konecni and E.B. Ebbesen (Eds.), *Social-Psychological Analysis of Legal Processes*. San Francisco: W.H. Freeman.
- Carroll, J. & F. Weaver, (1986). Shoplifters' perceptions of crime opportunities: a process-tracing study. In D. Cornish & R. Clarke (Eds.), *The reasoning criminal: rational choice perspectives on offending* (pp. 25-42). New York: Springer-Verlag.
- Clare, J. (2011). Examination of systematic variations in burglars' domain-specific perceptual and procedural skills. *Psychology, Crime & Law*, *17*(3), 199–214.
- Cleeremans, A., & Jiménez, L. (2002). Implicit learning and consciousness: A graded, dynamic perspective. In French, R. M. & Cleeremans, A. (Eds.), *Implicit learning and consciousness: An empirical, philosophical and computational consensus in the making* (pp. 1-40). Hove, England: Psychology Press.
- Chartrand, T.L. & Bargh, J.A. (2002). Nonconscious motivations: their activation, operation, and consequences. In A. Tesser, D. Stapel, & J. Wood (Eds.), *Self and motivation: emerging psychological perspectives*, (pp. 13–41), Washington, DC: American Psychological Association.
- Chase, W. G., & Simon, H. A. (1973). Perception in chess. *Cognitive Psychology*, *4*, 55-81.

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

- Cherbonneau, M., & Copes, H. (2006). Drive it like you stole it: auto thieves and the illusion of normalcy. *British Journal of Criminology*, 46, 193–211.
- Chi, M. (2006). Two approaches to the study of experts' characteristics. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 21-30). Cambridge: Cambridge University Press.
- Chi, M. T. H., & Bassok, M. (1989). Learning from examples via self-explanations. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser* (pp. 251–282). Hillsdale, NJ: Erlbaum.
- Chi, M. T. H., Feltovich, P., & Glaser, R. (1981). Categorization and representation of physics problems by experts and novices. *Cognitive Science*, 5, 121–152.
- Chiesi, H.L., Spilich, G.J., & Voss, J.F. (1979). Acquisition of domain related information in relation to high and low domain knowledge. *Journal of Verbal Learning and Verbal Behavior*, 18, 257–273.
- Copes, H. & Vieraitis, L. (2009). Bounded rationality of identity thieves: Using offender-based research to inform policy. *Criminology and Public Policy*, 8, 237-262. 10.1093/bjc/azl001.
- Cornish, D. B., & Clarke, R.V.G. (1986). Introduction, in D. B. Cornish & R. V. G. Clarke, (Eds.), *The reasoning criminal: Rational choice perspectives on offending*, (pp.1-13). New York: Springer-Verlag.
- Dane, E. (2010). Reconsidering the trade-off between expertise and flexibility: a cognitive entrenchment perspective. *Academy of Management Review*, 35, 579–603.
- Dane, E., & Pratt, M. G. (2007). Exploring intuition and its role in managerial decision making. *Academy of Management Review*, 32, 33-54.
- Day, A. (2009). Offender emotion and self-regulation: implications for offender rehabilitation programming. *Psychology, Crime and Law*, 15, 119-130.
- Devine, P. (1989). Stereotypes and prejudice: their automatic and controlled components. *Journal of Personality and Social Psychology*, 56, 5-18. 10.1037/0022-3514.56.1.5
- Duckworth, K.L., Bargh, J.A., Garcia, M., & Chaiken, S. (2002). The automatic evaluation of novel stimuli. *Psychological Science*, 6, 515-519.
- Endsley, M. (2006). Expertise and situation awareness. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 21-30). Cambridge: Cambridge University Press.
- Ericsson, K. A. (1996). The acquisition of expert performance: an introduction to some of the issues. In K. A. Ericsson (Ed.). *The road to excellence: The acquisition of expert performance in the arts and sciences, sports, and games* (pp. 1–50). Mahwah, NJ: Erlbaum.
- Ericsson, K. A. (2006a). An introduction to the Cambridge handbook of expertise and expert performance: its development, organization and content. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 3-20). Cambridge: Cambridge University Press.
- Ericsson, K. A. (2006b). The influence of experience and deliberate practice on the development of expertise. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 683-704). Cambridge: Cambridge University Press.
- Ericsson, K. A. & Kintsch, W. (1995). Long-term working memory. *Psychological Review*. 102, 211-245. 10.1037/0033-295X.102.2.211

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

- Ericsson, K., & Lehmann, A. (1996). Expert and exceptional performance: evidence on maximal adaptations on task constraints. *Annual Review of Psychology*, *47*, 273–305.
- Felson, M. (2002). *Crime and everyday life*, 3rd ed. Thousand Oaks, CA: Sage.
- Feltovich, P. J., Prietula, M. J., & Ericsson, K. A. (2006). Studies of expertise from psychological perspectives. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 41-68). Cambridge: Cambridge University Press.
- Fiske, S.T., & Taylor, S.E. (1991). *Social cognition* (2nd Ed.). New York: McGraw-Hill.
- Garcia-Retamero, R., & Dhami, M. K. (2009). Take-the-best in expert-novice decision strategies for residential burglary. *Psychonomic Bulletin & Review*, *16*, 163-169. 10.3758/PBR.16.1.163.
- Gigerenzer, G., Swijtink, Z., Porter, T., Daston, L., Beatty, J. & Krüger, L., (1989). *The Empire of Chance: How probability changed science and everyday life*, Cambridge: University Press.
- Gigerenzer, G. & Selten, R. (2002) *Bounded Rationality: The Adaptive Toolbox*. Cambridge, MA: MIT Press.
- Gilovich, T. (1981). Seeing the past in the present: The effect of associations to familiar events on judgments and decisions. *Journal of Personality and Social Psychology*, *40*, 797-808.
- Gobet, F., & Simon, H.A. (1996). Recall of rapidly presented random chess positions is a function of skill. *Psychonomic Bulletin & Review*, *3*, 159–163.
- Gobet, F., & Simon, H. A. (1998). Expert chess memory: revisiting the chunking hypothesis. *Memory*, *6*, 225–255.
- de Groot, A.D. (1946/1965). *Het denken van de schaker*. [The thought of the chess player.] Amsterdam: North-Holland. (Updated translation published as *Thought and choice in chess*. Mouton, The Hague.
- Hambrick, D. Z., & Engle, R. W. (2002). Effects of domain knowledge, working memory capacity, and age on cognitive performance: An investigation of the knowledge-is-power hypothesis. *Cognitive Psychology*, *44*, 339-387.
- Hartley, T., Maguire, E., Spiers, H., & Burgess, N. (2003). The well-worn route and the path less traveled: distinct neural bases of route following and wayfinding in humans. *Neuron*, *37*, 877-888.
- Hill, N. & Schneider, W. (2006). Brain changes in the development of expertise: Neurological evidence on skill-based adaptations. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 653-682). Cambridge: Cambridge University Press.
- Hoffman, R. R. (1998). How can expertise be defined?: implications of research from cognitive psychology. In R. Williams, W. Faulkner, & J. Fleck (Eds.), *Exploring expertise* (pp. 81–100). New York: Macmillan.
- Hoffman, R., Shadbolt, N., Burton, A., & Klein, G.. (1995). Eliciting knowledge from experts: A methodological analysis. *Organizational Behavior and Human Decision Processes*, *62*, 129-158.
- Johnson, E., & Payne, J. (1986). The decision to commit a crime: An information processing analysis, in D. B. Cornish and R. V. G. Clarke (Eds.), *The reasoning criminal: Rational choice perspectives on offending* (pp.170-185). New York: Springer-Verlag.

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

- Kahneman, D. (2003). A perspective on judgment and choice: Mapping bounded rationality. *American Psychologist*, *58*, 697-720.
- Kahneman, D. (2011). *Thinking, Fast and Slow*. New York: Farrar, Strauss, Giroux.
- Kahneman, D., & Klein, G. (2009). Conditions for intuitive expertise: A failure to disagree. *American Psychologist*, *64*, 515-526.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*, 263-291.
- Kendler, K. S. (2005). Toward a philosophical structure for psychiatry. *American Journal of Psychiatry*, *162*, 433-440.10.1176/appi.ajp.162.3.433.
- Klein, G., (1993). A recognition-primed decision (RPD) model of rapid decision making. In: Klein, G.A., Orasanu, J., Calderwood, R., Zsombok, C. (Eds.), *Decision Making in Action: Models and Methods*. (pp. 138-147). Ablex Publishing Corporation, NJ.
- Klein, G. (1997). Developing expertise in decision making. *Thinking and Reasoning*, *3*, 337-352.
- Klein, G.(1999). *Sources of Power: How People Make Decisions* Cambridge, MA: MIT Press.
- Klein, G., Calderwood, R., & Clinton-Cirocco, A. (2010). Rapid decision making on the fire ground: The original study plus a postscript. *Journal of Cognitive Engineering and Decision Making*, *4*, 186-209.
- Leclerc, B. & Wortley, R. (2014). (Eds). *Cognition and crime: offender decision-making and script analysis*. Oxford: Routledge.
- Logan, G. D. (1988). Toward an instance theory of automatization, *Psychological Review*, *95*: 492-527.
- Logan, G. D. (1992). Attention and preattention in theories of automaticity. *American Journal of Psychology*, *105*, 317-339.
- Logan, G. D., & Etherton, J. L. (1994). What is learned during automatization? The role of attention in constructing an instance. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*, 1022-1050.
- Logie, R.H., Wright, R.T. & Decker, S. (1992), Recognition Memory Performance and Residential Burglary, *Applied Cognitive Psychology*, *6*, 109-123. 10.1002/acp.2350060203.
- Mitchell, S. D. (2003). Biological complexity and integrative pluralism. Cambridge: Cambridge University Press.
- Morin, A. (2006). Levels of consciousness and self-awareness: A comparison and integration of various neurocognitive views. *Consciousness and Cognition*, *15*, 358-371.
- National Audit Office (2010). *Managing offenders on short custodial sentences*. London: The Stationary Office.
- Nee, C., White, M., Woolford, K., Pascu, T., Barker, L. & Wainwright, L. (in press). New methods for examining expertise in burglars in natural and simulated environments: preliminary findings. *Psychology, Crime and Law*.
- Nee, C. & Ioannou, S. (forthcoming). What have neuroscientific approaches to research taught us about acquisitive offenders?
- Nee, C. & Meenaghan, A. (2006). Expert decision-making in burglars. *British Journal of Criminology*. *46*, 935-949. 10.1093/bjc/azl013
- Nee, C. & Taylor, M. (2000). Examining burglars' target selection: interview, experiment, or ethnomethodology? *Psychology, Crime & Law*, *6*, 45-60. 10.1080/10683160008410831
- Norman, D. A. (1981). Categorization of action slips. *Psychological Review*, *88*, 1-15.

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

- Nordgren, L.F., Bos, M.W., & Dijksterhuis, A. (2011). The Best of Both Worlds: Integrating conscious and unconscious thought best solves complex decisions. *Journal of Experimental Social Psychology, 47*, 509-511.
- Norman G; Eva K; Brooks L; Hamstra S; 2006. Expertise in medicine and surgery. In K. Ericsson, N. Charness, P. Feltovich & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 339-353). Cambridge: Cambridge University Press.
- Opp, Karl-Dieter. 1997. Limited rationality and crime. In (Graeme Newman, Ronald V. Clarke, and S. Giora Shoham, eds.), *Rational choice and situational crime prevention*. Brookfield, VT: Dartmouth.
- Palmeri, T.J., Wong, A.C. & Gautier, I. (2004). Computational approaches to the development of expertise. *Trends in Cognitive Science, 8*, 378-386.
- Posner, M., & Snyder, C. R. R. 1975a. Attention and cognitive control. In R. L. Solso (Ed.), *Information processing and cognition: The Loyola symposium*. Hillsdale, NJ: Erlbaum.
- Schmidt H & Boshuizen, H 1993 On Acquiring Expertise in Medicine. *Educational Psychology Review, 5*, 205-221.
- Schneider, W. & R. M. Shiffrin. (1977). Controlled and automatic human information processing: 1. Detection, search, and attention. *Psychological Review, 84*, 1-66.
- Sellen, A.J. & Norman, D.A. (1992). The psychology of slips'. in B. J. Baars (Ed). *Experimental slips and human error: exploring the architecture of volition*, New York: Plenum Press.
- Smith, K., Taylor, P. & Elkin, M. (2013). *Crimes detected in England and Wales 2012/13*. HOSB: 02/13. Home Office Statistical Bulletin. London: Home Office.
- Shaffer, L. H. (1975). Multiple attention in continuous verbal tasks. In P. M. A. Rabbitt & S. Dornic (Eds.), *Attention and performance V* (pp.157–167). New York: Academic Press.
- Shanteau, J. (1992). How much information does an expert use? Is it relevant? *Acta Psychologica, 81*, 75-86.
- Shiffrin, R. M., & Schneider, W. (1977). Controlled and automatic human information processing: II. Perceptual learning, automatic attending, and a general theory. *Psychological Review, 84*, 127-190.
- Shover, N. & Honaker, D. (1992). The socially bounded decision making of persistent property offenders. *Howard Journal of Criminal Justice, 31*: 276–293.
- Simon, H. (1957). *Models of man: Social and rational*. New York: Wiley.
- Skinner, B. F. (1953). *Science and human behaviour*. New York: Macmillan.
- Stanovich, K., & West, R. (2000). Individual differences in reasoning: implications for the rationality debate? *Behavioral and Brain Sciences, 23*, 645-65.
- Todd, P. (2002). Fast and frugal heuristics for environmentally bound minds. In G. Gigerenzer, & R. Selten, (Eds.) *Bounded Rationality: The Adaptive Toolbox*. (pp.51-70). Cambridge, MA: MIT Press.
- Topalli, V. (2005). Criminal expertise and offender decision-making: an experimental analysis of how offenders and non-offenders differentially perceive social stimuli. *British Journal of Criminology, 45*: 269-295. 10.1093/bjc/azh086
- Treisman, A.M. (1969). Strategies and models of selective attention. *Psychological Review, 76*, 282-299.

GENERAL IMPLICATIONS OF EXPERTISE FOR CORRECTIONAL SETTINGS

- Treisman, A., & Gelade, G. (1980). A feature-integration theory of attention. *Cognitive Psychology*, 12, 97-136.
- Tversky, A.; Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*. 185, 1124–1131. 10.1126/science.185.4157.1124.
- Van Gelder, J. L. (2012). Beyond rational choice: the hot/cool perspective of criminal decision making. *Psychology, Crime & Law*, 19, 745-763.
- Van Gelder, J. L., Ellfers, H., Reynaud, D. & Nagin, D. (2013). *Affect and Cognition in Criminal Decision Making*. Oxford: Routledge.
- Vaughan, M. (1987). Rule governed behaviour and higher mental processes. In S. Modgil & C. Modgil. (Eds). *BF Skinner: consensus and controversy*. New York: Palmer Press.
- Vicente, K., & Wang, J. (1998). An ecological theory of expertise effects in memory recall. *Psychological Review*, 105: 33-57.
- Ward, T. & Keenan, T. (1999). Child molesters implicit theories. *Journal of Interpersonal Violence*, 14, 821-838.
- Ward, T. (2000). Sexual offenders' cognitive distortions as implicit theories. *Aggression and Violent Behavior*, 5, 491-507.
- Ward, T. (2014). The Explanation of Sexual Offending: From Single Factor Theories to Integrative Pluralism. *Journal of Sexual Aggression*, 20, 130-141
- Ward, T. & Hudson, S. M. (2000), Sexual offenders' implicit planning: a conceptual model. *Sexual Abuse: a Journal of Research and Treatment*, 12, 189-202.
- Weick, K. 1995. Sensemaking in organizations. Thousand Oaks, CA: Sage.
- Woollett, K. & Maguire, E. (2010). The effect of navigational expertise on wayfinding in new environments. *Journal of Environmental Psychology*, 30, 565-573.
- Wortley, R. (2014). Rational choice and offender decision-making: lessons from the cognitive sciences. In Leclerc, B. & Wortley, R. (Eds). *Cognition and crime: offender decision-making and script analysis*. Oxford: Routledge.
- Wright, R.T. & Decker, S. (1994). *Burglars on the job: Streetlife and residential break-ins*. Boston: Northeastern University Press.
- Wright, R.T. & Decker, S. (1997). *Armed robbers in action: Stick-ups and street culture*. Boston: Northeastern University Press.
- Wright, R.T., Logie, R.H. & Decker, S.H. (1995). Criminal expertise and offender decision making: an experimental study of the target selection process in residential burglary. *Journal of Research in Crime and Delinquency*, 32, 39-53. 10.1177/0022427895032001002
- Yates, P., Prescott, D., & Ward, T. (2010). *Applying the good lives model to sex offender treatment: A practical handbook for clinicians* Brandon, Vermont: Safer Society Press.
- Ye, N., & Salvendy, G. (1994). Quantitative and qualitative differences between experts and novices in chunking computer software knowledge. *International Journal of Human-Computer Interaction*. 6, 105-118.