Research indicates that there is a specially adapted, hard-wired brain circuit, the security motivation system, which evolved to manage potential threats, such as the possibility of contamination or predation. The existence of this system may have important implications for policy-making related to security. The system is sensitive to partial, uncertain cues of potential danger, detection of which activates a persistent, potent motivational state of wariness or anxiety. This state motivates behaviors to probe the potential danger, such as checking, and to correct for it, such as washing. Engagement in these behaviors serves as the terminating feedback for the activation of the system. Because security motivation theory makes predictions about what kinds of stimuli activate security motivation and what conditions terminate it, the theory may have applications both in understanding how policy-makers can best influence others, such as the public, and also in understanding the behavior of policy-makers themselves.

**INTRODUCTION**

The world in which we currently live confronts people responsible for making decisions about security with very challenging issues. These issues call for sophisticated logical and statistical analysis, detection and forecasting systems, cost-benefit analysis, and the like. However, the crux of security is the necessity of dealing with the prospect of potential danger. Because potential dangers have had very substantial consequences for reproductive fitness for many thousands of years, evolution has shaped brain systems specially adapted for managing them. Thus, in addition to the logical armamentarium that present-day decision-makers bring to issues of security, they inevitably bring the intuitions and motivations that are generated by a biologically ancient, “hard-wired” system.

This potential-threat system in the brain has been termed the defense system (Trower et al., 1990) and the hazard-precaution system (Boyer and Lienard, 2006). In our own work, we have called it the security motivation system (Szechtman and Woody, 2004). Our research investigating this system has focused on its role in everyday circumstances, such as behavior to manage threats of contagion due to dirt and germs, and in pathological variants of these behaviors, such as the compulsive hand-washing seen in obsessive-compulsive disorder (OCD). However, it is likely that the influence of the security motivation system extends well beyond such relatively mundane circumstances. The purpose of this perspective article is to explain briefly what we know about the security motivation system and to advance the following question: Does this biological system affect policy-making about security in important ways? We hope to stimulate the thinking of researchers who investigate security-related decision-making, in particular by sketching some of the kinds of hypotheses that could be examined in such research.

**PROPERTIES OF THE SECURITY MOTIVATION SYSTEM**

The security motivation system is hypothesized to be a reasonably distinct module in the brain, which evolved to be specially adapted for handling potential threats (Tooby and Cosmides, 1990, 1992, 2006; Trower et al., 1990; Pinker, 1997). Such a module has several key characteristics. First, it is dedicated to the detection of particular types of stimuli as input, rapidly processing a special class of information of particular relevance for survival. Second, when activated, it functions as a motivational system, driving relevant responses (Kavaliers and Choleris, 2001). Third, its output consists of a characteristic set of species-typical behaviors, and engagement in these behaviors plays a crucial role in terminating the activation of the module.

**TYPE OF STIMULI THAT ACTIVATE THE SYSTEM**

Research on how animals manage the threat of predation illuminates the kinds of stimuli that activate the security motivation system. Animals use subtle, indirect cues of uncertain significance as indicators of potential danger (Blanchard and Blanchard, 1988; Lima and Bednekoff, 1999). Evaluating these indirect cues of potential danger is quite different from recognizing imminent danger, such as the actual presence of a predator, and has been characterized in terms of “labile perturbation factors” (Wingfield et al., 1998) and “hidden-risk mechanisms” (Curio, 1993). In short, the security motivation system is tuned to partial, uncertain cues of potential threat, rather than the recognition of imminent danger.

**NATURE OF ACTIVATION OF THE SYSTEM**

Studies of the threat of predation show that relatively weak cues readily activate vigilance and wariness (Brown et al., 1999). In addition, this activation ebbs only slowly (Wingfield et al., 1998),...
even if no further, confirming cues follow (Masterson and Crawford, 1982; Curio, 1993; Marks and Nesse, 1994). This protracted activation motivates security-related behaviors. In short, weak cues can readily activate the security motivation system, and once activated, it has a protracted half-life and drives behavior.

**OUTPUT BEHAVIORS AND TERMINATION OF ACTIVATION OF THE SYSTEM**

The resulting acts consist of precautionary behaviors, which include probing the environment, checking, and surveillance to gather further information about any potential risks (Blanchard and Blanchard, 1988; Curio, 1993). They also include corrective or prophylactic behaviors, such as washing, that would lessen the effects of the danger if it were to eventuate. Of particular importance, we have characterized security-related behavior as “open-ended,” meaning that the environment does not normally provide a clear terminating stimulus to signal goal attainment (Szechtman and Woody, 2004). For example, if checking does not reveal the presence of a predator, this is not a clear indication of reduced risk (Curio, 1993); that is, the success of precautionary behavior is a non-event. Consequently, we proposed that it is the engagement in security-related behavior in itself that terminates security motivation. In short, activation of the security motivation system elicits precautionary behavior, and the system uses these actions themselves as the terminator of the motivation.

**NEURAL AND PHYSIOLOGICAL BASIS AND EMPIRICAL EVIDENCE FOR THE SECURITY MOTIVATION SYSTEM**

We have proposed a fairly detailed neuroanatomical-circuit model for the security motivation system, which is based on functional loops consisting of cascades of cortico-striato-pallido-thalamo-cortical connections (Alexander et al., 1986; Brown and Pluck, 2000), with feedback connections from the brainstem to terminate activity in these loops (Szechtman and Woody, 2004; Woody and Szechtman, 2011). We have also described the proposed physiological mechanisms of the security motivation system, which involve regulation of the parasympathetic nervous system and activation of the hypothalamic-pituitary-adrenocortical (HPA) axis (Woody and Szechtman, 2011).

We have demonstrated that activation and subsequent deactivation of the security motivation system can be tracked both with subjective ratings (e.g., anxiety and urge to engage in precautionary behavior) and also physiological changes, especially with subjective ratings (e.g., anxiety and urge to engage in preventive behaviors). We have also shown that corrective behavior, such as hand washing in response to uncertain cues for contamination, deactivates the system (Hinds et al., 2010, Experiment 1). In contrast to the deactivating effect of corrective behavior, the security motivation system, once it has been activated by uncertain cues, is relatively unresponsive to clear cognitive information that disconfirms the potential threat (Hinds et al., 2010, Experiment 3). This finding supports the hypothesis that the system is action-oriented, and engagement in some kind of precautionary behavior plays a crucial role in turning it off.

In a somewhat parallel series of experiments, we have tested our hypothesis that OCD represents a dysfunction of the security motivation system (Szechtman and Woody, 2004; Woody and Szechtman, 2005). It is well known that the content of OCD revolves around issues of potential danger, such as the threat of contamination or physical harm to oneself or close others (e.g., Reed, 1985; Wise and Rapoport, 1989). We hypothesized that in OCD patients, security motivation is activated in a manner that is reasonably similar to how it is activated in non-patients; however, in OCD patients, subsequent precautionary behaviors fail to turn this activation off in the usual fashion. Thus, once activated, OCD patients remain preoccupied with issues of potential danger for a protracted period of time and repeat the precautionary behaviors over and over again, in an attempt to deactivate the concerns. Our experimental data support this hypothesis that OCD is a stopping, rather than a starting, problem (Hinds et al., 2012). In particular, exposure to uncertain cues for contamination activates the security motivation system similarly in OCD patients and control non-patients, as indexed by both subjective measures and RSA. However, a subsequent fixed period of hand-washing, which returns the non-patients to baseline, has no significant effect on the activation levels of the OCD patients.

**IMPLICATIONS OF THE SECURITY MOTIVATION SYSTEM**

The security motivation system would be expected to have some important characteristics that are common to evolved, special-purpose modules. One important characteristic of such modules is that they tend to be encapsulated, operating relatively automatically and autonomously, and their internal computations are not accessible to introspection (Fodor, 1983). That is, they operate largely in the background, apart from the realm of volitionally directed formal logic, and their outputs become evident to the individual intuitively as feelings.

This distinction between a feeling-based system and rational analysis may not always be readily evident in everyday circumstances, because normally the two kinds of output are reasonably well aligned. However, the distinction becomes extremely striking in OCD. OCD patients feel driven to continue their obsessive concerns about potential danger and to repeat precautionary behaviors, such as checking or washing, even though at a rational level they find these concerns and behaviors to be excessive, illogical, and even absurd (Hollander et al., 1996). Indeed, OCD demonstrates that an intuitive, feeling-based module like the security motivation system is very powerful and can override the rational control of behavior.

The relatively automatic, intuitive, feeling-based operation of the security motivation system corresponds with what Kahneman (2011) has termed System 1, in contrast to the formal logic of System 2. What is important to appreciate is that even though the intuitive feelings generated by the security motivation system are vivid, immediate, and phenomenologically compelling
to the individual, they are not the same as objective reality, nor are they necessarily closely aligned to conclusions derivable from formal logic. They are, in essence, intuitions that worked well in our remote past but may have limited applicability to any specific, current set of circumstances.

**DOES THIS BIOLOGICAL SYSTEM INFLUENCE POLICY-MAKING ABOUT SECURITY IN IMPORTANT WAYS?**

The nature of the security motivation system may have important implications for policy makers wishing to involve others, such as the public, in the detection and appraisal of potential threat, as well as to shape their perceptions and get their support for policy initiatives. Even though the security motivation system is sensitive to the detection of slight, partial, uncertain cues, it evolved in such a way that it is tuned more to certain types of stimuli, but not others. It seems clear that the security motivation system is particularly sensitive to concrete and surprising or novel changes in the environment, and relatively insensitive to relatively abstract and gradual changes (which can become familiar and therefore lack novelty). Thus, for example, hearing some details of the latest terrorist attack, even if it occurred at a distant location, is likely to much more readily elicit activation of the security motivation system than is information about global warming, which is relatively abstract and involv...
of the security motivation system is based not on cognitive closure, but instead on concrete action, and those setting policy may not be involved in protective and corrective action at all (e.g., searching and evaluating records).

There are also other implications of the idea that the precautionary behaviors are crucial for turning off security motivation. The security motivation system operates according to what Kahneman (2011) terms System 1 processes. Unfortunately, as Kahneman has very convincingly demonstrated, System 1 is prone to substituting something that has only the form or appearance of a solution in place of a real solution, especially if the better solution would be more difficult. Thus, although turning off the anxiety of security motivation requires action, the details of what is done may not matter as much to the system. Possibly for this reason, policy-making responses to potential threats often seem only to be reactive, rather than proactive. For example, to prevent another shoe-bombing attempt, it is decided that all passengers’ shoes must be inspected. Such a prescribed set of actions may be effective in calming security motivation for both policy-makers and the public. However, such a solution seems to ignore the fact that biological agents (even germs) change strategies, so that what would have worked against them in the past may not do so in the future.

CONCLUSION

The foregoing hypotheses illustrate just a few of the ways in which the security motivation system theory could be used to generate interesting hypotheses for research on the psychology of security-related policy-making. Although these hypotheses need to be evaluated in future research, we hope they provide a convincing case that the security motivation system theory offers a novel, generative framework for advancing our understanding of policy-making processes related to security and potential danger.

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