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Emerging Paradigms of Rationality

\*117 Embodied Rationality

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*Standard law and economics theory relies on the assumption that human beings act as ideal rational decision makers. However, significant psychological research has undermined the view that individuals act completely rationally. The authors detail a recent approach to the human mind known as “embodied cognition”, which maintains that mental processes are grounded in actual bodily states. This link between the mind and body is not captured in the standard view of the rational human. Studying the mind in relation to the body can help us better understand and predict seemingly irrational actions.*

*The authors describe the precursors to the embodied cognition movement, and note that although embodied cognition is similar to earlier approaches that considered heuristics, it offers a more complete theory of human behaviour. They use embodied cognition as the basis for an expanded notion of embodied rationality that goes beyond the domain of affect and actions into the domain of judgments. The concept of embodied rationality can be applied to reasoning and decision-making processes central to Behavioural Law and Economics. In particular, the authors suggest that it can enhance our understanding of decisions involving risk and time, decisions about oneself, and judgments about others.*

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**Introduction**

The rational human is neither rational nor human. Law, economics, and law and economics must come to terms with these two important qualities of this celebrated figure. The first quality has already been acknowledged: the rational human is, by many standard definitions, not **\*119** rational. It is well-established that people fail to reason according to the formal rules of probability, statistics and logic. [FN1] The second quality is just now being acknowledged, or rather, re-acknowledged, in the psychology literature: the rational human is, in fact, not human. The way the human mind thinks and reasons is not independent of the human body in which it resides.

In this paper, we describe an approach to Behavioural Law and Economics that we call “embodied rationality”. The term is borrowed from the current movement in cognitive science called “embodied cognition”. Embodied cognition reminds us that human cognitive processes take place in the human body; more specifically it points out (a) that many cognitive processes serve the broader goal of facilitating action in a specific environment and (b) that cognition is grounded in actual bodily states.

Research supporting the notion of embodied cognition comes from cognitive psychologists studying perception, cognition, action and language, from social psychologists studying emotion, from comparative psychologists studying animal behaviour, and from neuroscientists studying the human brain. Here are some brief illustrations:

- \*120 • People perceive hills to be steeper when wearing heavy backpacks than when wearing lighter ones; [FN2]
- People who are asked to describe an animated cartoon and are prevented from gesturing have more difficulty in describing spatial elements than people who are allowed to gesture; [FN3]
- When responding to words on screen, people are faster to indicate that the word is positive by pulling a lever toward them and negative by pushing a lever away from them than when they use the opposite response pattern; [FN4]
- When holding a cup containing a hot drink, people are more likely to rate another person as warm and friendly than when holding a cup containing a cold drink. [FN5]

Each of these findings suggests that there is a tie between the body and the brain--the physical and the mental--that is not captured in the standard view of the rational human. Part I of the paper gives a rough history of various movements in psychology that are relevant to the development of this view. Part II visits the modern history of “rationality” and then situates embodied cognition in relation to other recent movements in psychology, economics and law. Part III describes some of the findings of embodied cognition in more depth. Part IV expands the notion of “embodied cognition” to “embodied rationality” and describes some preliminary ideas about how embodied rationality could be relevant to law. Part V concludes.

### **\*121 I. A Selective History of Psychology**

The notion of embodied cognition has roots that go way back into the (mercifully short) history of scientific psychology. However, its current incarnation is rightly viewed as revolutionary because it stands in sharp contrast to cognitivism--the current dominant paradigm. The story that follows is a selective and somewhat idiosyncratic history of scientific psychology-- focusing on research in thinking, reasoning, judgment and decision making--that is designed to highlight themes and issues that help situate the embodied cognition movement. A rough timeline of these developments is provided as an Appendix.

#### *A. Physiological Psychology*

The history of scientific psychology often begins with an important bit of pre-history: the work of the physiological psychologists in Europe in the mid-1800s. These researchers systematically studied human physiological responses to various types of stimuli. Most important for our purposes, Ernst Heinrich Weber discovered the idea of the “just-noticeable-difference”--the minimum difference between two stimuli that humans can detect. For example, if you

hold your hands out with the palms up and someone places a 25 gram envelope on one hand and a 50 gram envelope on the other, you will be able to detect which envelope needs extra postage. However, if someone places a 2000 gram package on one hand and a 2025 gram package on the other, you will not be able to discern which is heavier. Weber found that this discriminable difference, the “just-noticeable-difference”, was a function of the size of the smaller stimulus (or “standard”). As the standard gets heavier, you need a bigger difference between the weights to discriminate between them. Weber found that this function held for many judgments involving physiological processes (judgments of weight, brightness, loudness, distance, size, etc.). [FN6] Later in the 19th century, \*122 Gustav Fechner, first independently and then jointly with Weber, expanded and refined the idea. Fechner recognized that there was not a one-to-one relationship between the objective increase in the intensity of a stimulus and the subjective increase in the sensation caused by that stimulus. So, for example, one car horn is loud and two are louder--but together they do not seem twice as loud as a single horn--and the twentieth horn adds very little to our sensation of the noise that was produced by a mere nineteen. The Weber-Fechner law describes the logarithmic relationship between the intensity of a sensation and the intensity of the stimulus, and it holds across many types of stimuli. [FN7]

### *B. Introspectionism and Behaviourism*

If the work of the physiological psychologists is thought of as prehistory, the title of founder of “The First Scientific Psychology Laboratory” usually goes to Wilhelm Wundt. [FN8] Wundt and others wanted to examine the contents of consciousness and the building blocks of experience. In one line of experimentation, trained observers would be shown a stimulus--an object, colour or word--and respond with a single word. Later experimentalists in the Wurzburg school asked their subjects to report what thought processes they had had between the presentation of a stimulus and their word response. [FN9] In subsequent years, different laboratories, with experimental subjects instructed in different ways, concluded different things about the form and contents of thought and conscious experience.

These conflicting and non-replicable results reached by various laboratories led to the rise of a new school of psychology in the United States. John B. Watson, [FN10] one of the founders of the behaviourist school, called for a more “objective” psychology, the elimination of theorizing about unobservable responses like the experience of a “mental image”, and an understanding of human behaviour in terms of learning and \*123 conditioning. [FN11] For the behaviourists, the data upon which science stood needed to be publicly observable and verifiable. When current cognitive psychology textbooks characterize (or, perhaps, caricature) the behaviourist movement, they state that it banished any theorizing about how the mind works and relegated mental processing to a black box. One could observe the stimulus (for example, a mother calling a name) and the response (for example, the child running towards her), but all this would mean is that such a stimulus-response pairing had been rewarded in the past and so the actions would continue to be paired in the future. One should make no guesses as to the thoughts, motivations, knowledge or beliefs of the actors.

Behaviourism proved very successful at some things but failed greatly at explaining complex human behaviour. As the World War II and postwar generations of psychologists wanted to understand and explain why humans behaved as they did (and how to change or optimize it), they were forced to re-examine the prohibition on theorizing about the unobservable human mind. [FN12]

### *C. The Cognitive Revolution*

Thus, many psychologists from the mid-to-late twentieth century celebrated the “cognitive revolution” that overturned behaviourism. As described below, the cognitive revolution freed researchers to say that they were studying the human mind--not just human physiology and not just human behaviour. An important component of the revolution was

the computer metaphor of mind. Just as in a computer it makes sense to study the hardware and software independently, so too in \*124 humans it makes sense to study the brain (hardware) and mind (software) independently.

An important framework for guiding what cognitive science was doing was provided by David Marr. He argued that understanding a complex system, cognitive or otherwise, took three levels of analysis. At the computational level are the goals of the system and the constraints on that system; at the algorithmic level are the strategies that are used; and at the implementation/hardware level is the physical embodiment of that system. Consider a commonly used example: to understand the game of chess you need to understand the goals (computational), the moves (algorithmic) and what piece each object in front of you represents (implementation). But we all know that a game of chess is the “same” whether the chessmen are carved of ebony and ivory, are Renaissance actors donned in bishops robes and astride horses, or are mere thoughts in an expert's head. And we all know that a computer's software is fair game for study and analysis. Thus, researchers were free to study (unobservable) cognitive processes--the algorithmic level (or software)-- without worrying whether those algorithms were instantiated in a computer's hardware or the brain's wetware. [FN13] Some even thought that if a computer were “fed” an enormous number of facts comparable to the number of facts that the human brain contains, it would eventually “cross over” and think and understand like a human brain.

But not everyone agreed with that characterization. For example, in his famous “Chinese Room” thought experiment, [FN14] the philosopher-turned-cognitive-scientist\*125 John Searle argued that what computers do while computing is not a good analogy for what humans do while thinking because computers do not “understand”. And researchers in memory have long noted that “human memory is not like a computer memory”, citing the many differences in what happens to information as it is stored and retrieved from those very different memories. [FN15]

However, the computer/information processing metaphor not only dominated thinking about thinking for many years, but has also been embraced by current popular culture and appears in common phrases such as: “I need more input”; “I can't process all of that information”; and “doesn't compute”.

#### *D. Embodied Cognition*

Embodied cognition is partly a reaction to this movement. It is a recognition that understanding the human cognitive system requires understanding that the mind/software is embodied not only in the brain/hardware but also is functioning in concert with the rest of the human body. It has been a struggle to move theorizing about thinking “backwards” from the realm of pure disembodied thought of guillotinstyle cognitivism back to grappling with its physical instantiation. To even more fully appreciate the emergence of the embodied cognition framework, we next position it within what we might call the \*126 “rationality wars” and the resulting panoply of recent intellectual movements in psychology.

## **II. The Rationality Wars**

### *A. Classic Rationality and Classic Irrationality*

In retrospect, cognitive (or social) psychologists of the mid-twentieth century seem to have been very optimistic. Venturing into new lines of psychological inquiry, they discovered the “rational” person and claimed that humans were intuitive statisticians [FN16] and intuitive scientists. [FN17]

The celebration of human rationality, however, was not long-lived. The 1970s brought the publication of the early classic irrationality findings. In their influential *Science* article, [FN18] Amos Tversky and Daniel Kahneman docu-

mented many types of human reasoning errors--deviations from normative reasoning in probability, statistics and logic. Tversky and Kahneman described many of these systematic errors as resulting from built-in reasoning biases and from the use of heuristics, which typically allow people to easily reach the correct answer but provide a potentially error-prone process. Tversky and Kahneman christened the “big three heuristics”-- representativeness, availability and anchoring--and pointed out several others. The 1970s gave us some other classic big ones, such as the hindsight bias. [FN19] In general, Tversky \*127 and Kahneman were not pessimistic about errors generated by heuristics, but they did have a pessimistic tone about what people eventually come to know:

It is not surprising that useful heuristics such as availability are retained, even though they occasionally lead to errors in prediction or estimation. What is perhaps surprising is the failure of people to infer from lifelong experience such fundamental statistical rules as regression toward the mean, or the effect of sample size on sampling variability. [FN20]

#### *B. The Reign of Heuristics and Biases*

But then came the deluge. In the 1980s and 1990s, finding new heuristics and biases became a cottage industry. Every cognitive and social psychologist worth his or her salt discovered and named a new one. Furthermore, most of these discoveries did not come with the comforting words that they were useful and “usually” got people to the right answer; rather, the spirit of many articles and chapters seemed to be that “people are dumb” [FN21] and “I’m just clever enough to show you another way that people are dumb.” [FN22]

#### *\*128 C. The Rational Resurgence*

With strands coming from many directions, major challenges to the irrationality findings came to a head in the mid-1990s. One line of criticism attacked the experiments themselves: humans were not irrational, these experiments just made them seem that way. Some researchers pointed out that the experimental stimuli in many studies were odd and unusual, and purposefully designed to trick people, who could get typical problems correct. Other researchers suggested that experimental stimuli are often incomplete or ambiguous, and that experimenters make (incorrect) assumptions about how subjects will fill in the missing information or interpret the ambiguous information. When complete information is provided, people's reasoning is much more rational. [FN23]

The emerging field of evolutionary psychology offered another line of criticism. Psychologists in that field argued that because we know the human body is the product of evolution and has gone through dramatic adaptations over time, we should also accept the idea that the human mind is the product of evolution and has gone through dramatic adaptations over time. In the domain of cognitive psychology, they argued that the problems presented by researchers are current inventions. People might be “bad” at them but they are better at the kinds of reasoning tasks that might have arisen longer ago (giving evolution a chance to optimize performance). [FN24]

For example, although people are not good at a deductive reasoning task called the “Wason Selection Task” when it involves reasoning about abstract entities, they are good at it when the cover story involves detecting cheaters. [FN25] In addition, although people are quite bad at \*129 reasoning using probabilities, they do better when numerical information is presented as frequencies rather than probabilities. [FN26] Gigerenzer and colleagues forcefully argued that some very simple heuristics would be very successful in the simpler environment of the Pleistocene Epoch, [FN27] and probably evolved to deal with the problems presented in that environment. [FN28]

#### *D. Dual Systems*

Another movement that emerged in the 1990s--not explicitly to deal with the problem of (ir)rationality although it can speak to that problem--was the dual systems approach. Researchers in a variety of areas in cognitive and social psychology realized that they could not \*130 explain individual human decision making as if it were the product of one reasoning process. Rather, people sometimes made judgments slowly and other times quickly; sometimes consciously and sometimes unconsciously; sometimes analytically and sometimes by intuition or emotion. Experiments with different contents found different types of dichotomies in reasoning, and researchers began to see patterns. Perhaps human thinking could be thought of as involving two different systems: one quick, unconscious, based on intuition or emotion, and evolutionarily older; the other slow, conscious, based on analytic thought, and evolutionarily more recent. [FN29] Although some researchers are not content with this down-the-line dichotomous view, it has sparked much theorizing and research in the last dozen years. In fact, Kahneman [FN30] now argues that many of the findings from the heuristics and biases research program can be explained by the dual systems approach.

Note that the dual systems approach both grew out of and prompted the re-emergence of the unconscious--or at least unconscious knowledge and learning-- as a proper object of study. [FN31]

#### *E. Affect as Information*

Another type of processing that became a hot topic of study was emotion and affect. Believers in rationality often characterized affect or emotion as something that could disturb or derail rational judgment. \*131 However, a now-classic study showed how a lack of emotion, rather than the presence of emotion, might actually lead to irrational decisions. [FN32]

On a general level, affective feelings provide immediate information about whether something is good (a flower, peace) or bad (a spider, war). When making these automatic evaluative judgments, people attend to their own feelings, as if asking themselves: how do I feel about it? The experience of these felt evaluations serves as information. Thus, people generally like what they feel good about, and dislike what they feel badly about. As a consequence, affective feelings have been shown to influence ratings of life satisfaction, estimates of risk, attitudes and many other judgments. [FN33]

Affective cues, however, are informative not only when interpreted as evaluations of objects and situations. They can also be interpreted as performance feedback when working on a task: positive feelings serve as success feedback and tell us that our current cognitive strategy is adequate; negative feelings serve as failure feedback and tell us that a different cognitive strategy should be pursued. As a result, being in a good mood makes people more likely to use heuristic processing and to \*132 interpret incoming information in relation to already known and easily accessible knowledge. In contrast, being in a bad mood makes people more likely to use analytical processing and to rely on basic perceptions--a sort of "just the facts" approach. [FN34] Thus, contrary to early conceptions of affect, feelings appear to be an important component of what might be considered adaptive or rational thought and behaviour.

#### *F. (Re-)Considering the Brain*

The 1990s also saw the rise of human cognitive neuroscience. Of course, how brains work has been a topic of interest for a long time, but the development and refinement of new methods to examine the workings of alive, intact, functioning human brains led to an explosion of research. Three items are of particular importance for our purposes.

1. Words describing certain actions activate areas of the brain associated with those actions. For example, when one hears the word "hammer", circuits of the primary motor cortex (a part of the brain that is active when

actually using a hammer) also become active. [FN35]

2. Seeing other individuals performing an action not only activates visual areas of the brain, but also activates the same areas of motor cortex that would be involved had the perceiver been doing the action himself. [FN36]

\*133 3. Using novel tools of neuroscience, the new field of neuroeconomics examines what happens in the brain when people make personal choices and decisions. [FN37]

### *G. The Road to Embodied Cognition*

Thus, the last dozen or so years have been filled with reactions to the notion that humans are not rational, and psychologists have embraced (or re-embraced) a wide view of what constitutes proper areas of inquiry. A particularly interesting aspect of this “rational resurgence” is that it considers things previously thought of as irrational--like emotion and the unconscious --as useful parts of human cognition rather than as processes that detract from rationality.

Embodied cognition touches all these movements. It explains human behaviour by pointing out that the mind is “attached” not only to the brain but also to the body. People learn through the actions they produce in the world, and this learning is instantiated in a brain that is wired to store information learned differently through different modalities. Judgments that appear irrational might make sense when made by someone whose body is signaling relevant feedback about its physical state. Affect provides valuable information about the environment and the body's state. The theory of embodied cognition relies on evolutionary psychology in a deep way: it supposes not only that bodies evolved and minds have evolved but also that there must have been co-evolution--that they must have evolved together. And neuroscience can help researchers figure the connections between body, brain and mind.

### *H. The Road to and from Behavioural Law and Economics*

These various ways of thinking about rationality are not only relevant to the history of psychology, but also to the history of economics and law. Standard economic theory relies on the ideal rational decision maker--*homo economicus*--who can make rational \*134 decisions in spite of vast quantities or paucities of information. The law and economics movement, which applies economic methods to the analysis of law, has been around since Adam Smith. Its current incarnation began in the early 1960s [FN38] and it is now a thriving area of scholarship in most law schools. Like standard economic theory on which it relies, it assumes the rational human. [FN39]

Research from the classic irrationality studies began finding its way into economics journals as early as the late 1970s. [FN40] As more economists began thinking about behaviour in terms of the now irrational human, an approach called Behavioural Economics developed. Probably by this route, the irrationality view filtered into law as Behavioral Law and Economics in the mid- to late- 1990s, just as it was coming under serious attack in psychology. [FN41] Since then, scores of law review articles have taken the irrationality view and applied it to law.

Some of the other recent “rational resurgence” movements in psychology are also represented in law. There are a lot of evolutionary analyses of law, many articles applying dual process accounts to law, and the law has embraced (perhaps too quickly) the promises of neuroscience. However, there is little to no acknowledgment of the embodied cognition movement in current legal writing.



### III. Embodied Cognition

The embodied cognition approach proposes that the main purpose of the brain and the mind is to facilitate action in a complex environment. [FN42] Thus, trying to understand the human mind by studying \*135 highly sophisticated yet artificial cognitive skills, such as playing chess or solving problems of formal logic, is misguided. Because the goal of any mental process is to guide specific actions in a specific context, thought processes do not lead to a mirror image of the world, but rather to a partial snapshot of only the relevant information for a given action goal in a given context. A curious illustration of this can be seen in the phenomenon of “change blindness”, where people overlook blatantly bizarre aspects of a scene (such as a woman walking around in a gorilla outfit) when these aspects are unrelated to a current action goal, such as monitoring a group of basketball players. [FN43]

Importantly, context or situational factors do not simply modify what action, and thus, what cognitive process is appropriate, but rather they *define* the action. Consider the example of the frog's visual system. Frogs have several neurologically separate visual pathways, such as one pathway to detect prey, another to monitor predators, and yet another to control visually guided locomotion. [FN44] Thus, frogs do not have a general-purpose visual system that responds differently depending on what input it receives; instead, the input (for example, prey versus predator), and the corresponding action associated with the input (catching a fly versus escaping from a hawk) selects the process of visual perception. Thus the goal of vision is not to see, but to control movements as a response to stimuli in the environment. [FN45] This idea has led to research studying the interactions of vision and action, thus rejecting the notion that vision, and other seemingly basic perceptual processes, are independent of higher-level cognitive processes. [FN46]

#### \*136 A. Embodied Perception

In line with the claim that cognitive processes are action-driven, research has shown that perception is constrained by a person's potential to carry out specific actions in a given context. For example, participants wearing heavy backpacks judge distances to be farther, [FN47] and hills to be steeper [FN48] than participants who do not have a “weight on their shoulders”. Similar overestimation effects occur after exercising heavily. [FN49] Further, fear associated with standing on a wobbly skateboard facing downhill makes the hill slant appear more threatening and therefore more steep, compared to how the same hill appears when standing on a stable surface. [FN50] Such studies suggest that perceptions of environmental characteristics are not “objective”, but are the result of pragmatic and functional demands for specific actions embedded in specific environments.

Recently, studies have also shown that psychosocial resources can moderate the perception of the physical world. For example, social support changed perception such that a steep hill appeared less steep when a friend was physically present (versus not present), or when participants thought of a supportive other (versus a neutral other or non-supportive other). [FN51]

All of these studies--whether about physical resources or psychosocial resources--are based on the assumption that perceptual processes depend on a person's resources in the context of navigating the environment. Thus, these studies were conducted from an embodied \*137 perspective, because the traditional cognitive model would not make different predictions for a person standing in front of an actual hill, versus sitting at a computer and indicating their response using keyboard presses.

Importantly, studies of embodied perception redefine what might be considered an accurate, or rational, response to the questions of “how steep is the hill?” On the one hand, if the hill is actually 5 degrees in incline, any deviation from 5 degrees is incorrect. On the other hand, when wearing a backpack the hill becomes functionally steeper, and an answer of

20 degrees might be a more useful and adaptive answer. [FN52] Overall, studies on embodied perception suggest that even seemingly objective aspects of the physical environment, such as the distance to a target, or the steepness of an incline, involve the subjective experience of the body that perceives the environment.

### *B. Embodiment in Affective Science*

Bodily states affect not only perception but also people's feelings, attitudes, thoughts and memories. [FN53]

#### **\*138** (i) Embodied Cues in Affective Experience.

Affective experiences--emotions and moods [FN54]--can be influenced by the bodily state associated with an emotion. Such bodily cues become information that is used to interpret affective cues. Many studies support the idea that feeling states can be initiated, or at least modified, by changes in people's bodily activities. [FN55] Simply put, it is difficult to be angry when your face displays a smile. [FN56]

##### *(a) Facial Expressions*

People who put on facial expressions of various emotions report feeling the corresponding emotions. [FN57] In a typical experiment, \*139 participants were told that facial muscle activity was being measured by electrodes while they were contorting their faces to contract various muscles. On some trials participants pulled up the corners of the mouth, in others they pulled the eyebrows down and together. Although they did not realize that they were actually producing smiles or frowns, participants reported feelings consistent with the expressions. [FN58] Similarly, participants might be asked to hold the end of a pen with either their teeth (facilitating a smile), or with their lips (preventing a smile). When asked to rate the humorousness of cartoons, participants who were in the smile-facilitating condition rated the cartoons as more humorous. [FN59]

Just as voluntarily producing a facial expression can invoke an emotional feeling, being unable to produce an expression can inhibit the feeling: individuals who are unable to smile because of facial neuromuscular disorders tend to suffer from elevated levels of depression. [FN60] Further, when the muscles involved in frowning are temporarily paralyzed, neural activation to angry expressions is reduced. [FN61]

##### **\*140** *(b) Posture*

Posture also influences how people feel, such that standing up tall makes people feel more confident and proud. [FN62] Combinations of facial expressions and postures produce stronger effects on feelings than either one does alone. [FN63] Furthermore, extended manipulations of expressive behaviour have been shown to lead to enduring effects on emotions over time. [FN64] All this empirical evidence suggests that, in the language of self-perception theory, [FN65] people "read" their emotional bodily behaviour and may experience their emotional behaviours as emotional feelings: given an appropriate context, a smile is actually experienced as feeling happy, or a slumped posture actually as feeling sad. In the language of embodied theory, when people "simulate" experiencing an emotion, they end up feeling the emotion. [FN66]

#### (ii) Embodied Cues in Attitude Formation

Embodied cues not only influence feelings, but also have been shown to provide information about the “goodness versus badness” of the \*141 stimulus (that is, the “attitude object”) including cartoons, [FN67] odours, [FN68] pens, [FN69] and food and beverages. [FN70] For instance, Kraut [FN71] asked participants to smell twelve different odours, ranging from very pleasant ones (for example, vanilla) to very unpleasant ones (for example, butyric acid). During the first trial, participants were allowed to produce their natural facial expressions in response to the odours. Subsequently, however, they were instructed to exhibit an expression that would convince another person that they were smelling either a pleasant or an unpleasant odour. Participants' subsequent evaluations of the odours became more positive if they had to act as if it were a pleasant smell, but became more negative if they had to act as if it were a disgusting smell.

*(a) Nodding and Shaking Heads*

Motor behaviours that are associated with agreement or disagreement also influence attitudes. Under the pretext of testing headphones for comfort and sound quality, participants were told to produce a vertical head movement while listening to a communication about increasing tuition fees at their university. This experimental manipulation resulted in participants nodding their heads, as if in agreement with the message. Other participants were asked to produce a horizontal head movement, resulting in head shaking. When asked to specify a dollar amount they would deem appropriate for the tuition increase, participants who had been nodding their heads during the message listed higher amounts than participants who had been shaking \*142 their heads during the message. [FN72] Using the same kind of paradigm, a pen was placed on the desk in front of participants who were told either to shake or nod their heads while listening to neutral music over headphones. Subsequently they used the pen to fill out a questionnaire about the headphones. When participants were later asked which they would prefer to receive as a gift, either the pen they had used or a different one, those who had nodded their heads were more likely to select the pen they had used than those who had shaken their heads. [FN73] Thus, the simple behaviour of agreement coloured participants' perception of the desirability of an otherwise neutral object.

*(b) Approach and Avoidance Behaviours*

Cacioppo and colleagues developed the arm contraction paradigm to study how approach and avoidance behaviours affect liking: participants place the palm of their hand against the bottom of a table and press lightly upward against its surface. This results in arm flexion, an approach behaviour. Alternatively, participants place the palm of their hand against the top surface of a table and press lightly downward. This results in arm extension, an avoidance behaviour. Early studies had participants make those behaviours while looking at neutral Chinese ideographs. Arm flexion (“pulling”) subsequently resulted in greater liking of those stimuli, whereas avoidance behaviour (“pushing”) resulted in less liking. [FN74]

Other studies investigated the effect of approach and avoidance behaviours on attitudes toward specific objects. Approach behaviour resulted in greater liking and a better election prognosis for a political \*143 party than avoidance behaviour. [FN75] Approach and avoidance cues can also affect consumer behaviour. For example, participants performed arm flexion or arm extension behaviours with a bowl of cookies or a pitcher of orange juice in front of them. Participants who were flexing their arm muscles ate almost three times as many cookies or drank more orange juice than participants who were extending their arm muscles, suggesting that they experienced their behaviours as indicative of the desirability of the food. [FN76]

*(c) Other Bodily Feedback Processes*

With the gaining popularity of the embodied cognition approach, researchers have started looking creatively at all kinds of bodily feedback processes. For example, because making a fist brings to mind the concept of power, men feel more assertive when making a fist than when making a neutral gesture. [FN77] Participants holding a cup of hot coffee judged a person as having a “warmer” personality and being more caring compared to participants holding a cup of iced coffee. [FN78] Similarly, people report that being socially excluded and left out made them feel cold, and led to an increased desire for warm beverages. [FN79] Even culturally learned hand gestures can influence judgment processes: when extending one's middle finger in a notoriously rude manner, an ambiguous person is interpreted as more aggressive and hostile. [FN80]

#### \*144 (iii) Embodied Cues in Affective Information Processing

All of the studies reviewed above suggest that bodily expressions and movements can exert important influences on the formation of attitudes. In addition, numerous studies have investigated how manipulating conditions of the human body influences cognitive performance.

One of the earliest studies varied participants' posture as they learned and relearned nonsense syllables. When posture was the same for both trials, participants were significantly better at relearning the stimuli, compared to when posture was different. [FN81] These results are consistent with a number of “context-dependent” learning results, which show that people perform better when physical, environmental or psychological conditions at learning match those conditions at test. [FN82]

Compatibility effects of bodily cues and affective cues have been demonstrated in a variety of contexts. [FN83] After nodding their heads while studying positive and negative words, participants recognized more positive words than after shaking their heads while studying the words. [FN84] Positive stimuli are recalled more easily while performing an approach behaviour, whereas negative stimuli are recalled more easily while performing an avoidance behaviour. [FN85] Further, participants are faster to categorize positive stimuli when pulling a lever toward themselves, whereas they are faster to categorize negative stimuli when pushing a \*145 lever away from themselves. [FN86] Even under the visual illusion of approaching a stimulus, participants are faster at judging positive stimuli, whereas under the illusion of the stimulus moving away, participants are faster at judging negative stimuli. [FN87] Finally, approach and avoidance behaviours also influence creative insight and problem solving. [FN88] These data suggest that engaging in behaviours that are typical for approach and avoidance have an implicit connection to good and bad things, and this connection emerges when the context provides objects and situations for which the affective cues become relevant. [FN89]

#### *C. Embodied Moral Judgment*

In addition to judgments of physical space, which in principle should be “objective” in that a given estimate or judgment is either accurate or not, other judgments that do not seem to involve right or wrong answers might also be shaped by embodied experiences. Theories of moral judgment have long emphasized reasoning and conscious thought while minimizing the role of contextual influences, such as affective processes. However, recent work has found that emotions can change a person's moral judgments. In one experiment, participants made moral judgments while experiencing extraneous feelings of disgust (for example, caused by a bad odour, or because participants sat at a dirty desk). When they then considered how wrong it was to not return a lost wallet or to falsify information on one's curriculum vitae, those experiencing disgust found the transgressions to be more wrong compared to people in a neutral mood. [FN90] It appears that when people experience a gut feeling of disgust in the presence of a moral \*146 transgression, they are more likely to view the transgression as disgusting and therefore wrong. The reverse effect occurs when participants feel clean: they

experience a “clean conscience” when considering a moral transgression. After having thoughts of cleanliness activated, or after washing their hands subsequent to experiencing disgust, participants found moral transgressions to be less wrong than did those who had not been exposed to a cleanliness manipulation. [FN91] These findings suggest that deciding whether something is right or wrong, a process with critical relevance in legal contexts, can be driven by intuitive processes rather than deliberate reasoning. [FN92]

#### *D. Embodied Agency*

The question of whether I am actively performing an action, or whether I am simply doing what I am doing because of external circumstances, has special relevance to the law. Perceiving one's own body in the world usually indicates whether we can assume “authorship” over an action or not--if I have the physical sensation that I did something, I must indeed have done it. Although most of the time it is easy enough to infer whether one was the causal factor behind an action, psychologists have been able to trick people into believing that they are involved in an action. For example, in the “rubber hand illusion”, participants place their hand out of view under a table, and an artificial rubber hand is placed on the table directly above their own hand. Then both the participant's unseen hand and the rubber hand are stroked softly with a brush. Soon enough participants report that they feel as if the rubber hand was their own hand, an experience that could \*147 be interpreted as a misplaced sense of ownership of the hand. [FN93] This phenomenon can be considered similar to the phantom limb phenomenon, where an amputee perceives a lost limb as if it were still in its natural place. In what could be considered nature's perverse sense of irony, while amputees do not benefit from being able to use their lost arm or leg, it can still cause them severe physical pain. [FN94] Healthy participants can be fooled into thinking that another person's arm movements are their own. [FN95] When such illusions are generated, people will insist they “*feel it in their bones or know it in their gut*” [FN96] that they have caused a certain behaviour, especially when it was an action that requires considerable effort. [FN97] This illusion of not being sure where one's own body starts and where it ends can even be taken so far as to induce an out-of-body experience in people with the help of a three-dimensional computer-generated image of one's body. [FN98]

Thus, certain types of physical experiences that are very “real” on a phenomenological level can in fact be illusions, and can lead to incorrect attributions of agency. Similar effects involving people being highly confident in their memory of experiences and actions are well-known \*148 from people's eyewitness testimony; this has become a prime example of misguided confidence in one's own phenomenological experience. [FN99]

#### *E. Metaphors We Live By* [FN100]

In addition to physical action and perception, even abstract language might have an embodied basis. For instance, the basic spatial concept of *verticality* is grounded in the fact that human beings usually function in an upright position and have a clear up-down orientation. Verticality is invoked when people consider good or bad feelings, and use expressions such as “feeling up” or “feeling down.” Even the term “depression” evokes the idea that when people feel bad, they might be physically pushed down, or de-pressed. This close match of physical states and mental concepts is very systematic because it reflects what is going on with the human body when feeling a certain emotion: an upright, relaxed posture when happy versus a slumped, drooping posture when depressed. Thus, spatial metaphors relate abstract concepts, such as feelings, with simple physical concepts, such as the perception of one's own body in space.

In fact, studies show that many of these bodily metaphors capture features of mental processing. For example, people are faster to classify positive words as “good” when they are presented at the top of a computer screen (metaphorically, up is good) and negative words as “bad” when they are presented in the down location. [FN101] People automatically as-

sociate morality and vertical space of up and down (for example, being “high minded” versus “underhanded”). However, verticality and good and bad are not mapped by people who show a general lack of moral concern (that is, psychopaths). [FN102] Furthermore, people who feel “down” because of \*149 an experience of failure perceive the horizon to be lower, whereas participants who feel “up” because of a successful experience perceive the horizon to be higher. [FN103]

#### *F. More Than Just Metaphor?*

Some of the earliest work on embodied cognition came from cognitive linguistics [FN104] and involved embodied metaphors. As reviewed above, experimental psychologists have accumulated a lot of data indicating that embodied metaphors fundamentally penetrate even the most abstract kinds of thought: physical purity is indicative of moral purity, being depressed is bad whereas being a high flyer is good; warmth indicates pleasant social relationships whereas being excluded feels cold.

There are other metaphors we use in judgment and decision-making that rely on the physical--for example, we “weigh” or “balance” our options. In fact, when people use a heavy clipboard when filling out a questionnaire they find the issues under consideration to “carry more weight.” [FN105] If our perceptions, affect and moral judgments are grounded in bodily states, perhaps other reasoning and decision-making processes are also grounded in such states, and perhaps some of the metaphors we use to describe them can provide information about how we actually do them. And perhaps these metaphors that we live by, judge by and decide by should be considered rational in the sense that they provide useful and appropriate decisional input.

#### **\*150 IV. Embodied Cognition, Embodied Rationality and Some Speculations on Implications for Law**

The germ of the idea for this article came from noticing that many of the new popular books on judgment and decision-making, written by serious academic scholars, use analogies to perception of the physical world to illustrate their points. For example, in order to explain context effects in decision making, Dan Ariely's book *Predictably Irrational* [FN106] begins with an analogy to the famous Ebbinghaus illusion shown in Figure 1. Which of the black circles is larger? The one on the right certainly looks larger. [FN107] If you have a pair of scissors handy, feel free to cut out the black circle on the left and move it over the one on the right (or vice versa). If you are less industrious, or less destructive, then just believe us--the two black circles are the same size.

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\*151 Ariely uses this physical illustration of the importance of context as an analogy to the difficulties humans have in making real decisions like choosing jobs and homes and mates. Consider, for example, the classic finding by Kahneman and Tversky. How likely would you be to drive 20 minutes across town to save \$20 on an \$80 digital camera? Compare that to how likely you would be to drive across town to save \$20 on an \$800 television. Kahneman and Tversky found that people were more likely to try to save the money on a cheaper item than on a more expensive one. [FN108] As in the visual illusion: the subjective size of some objective thing (\$20) changes depending on what it is compared to. [FN109]

We believe that the metaphors people use for describing decisionmaking might be more than just metaphors. Perhaps some of the same embodied processes are at work when judging which black circle is bigger and judging which job is better. Thus, in this section we want to begin our speculation about whether the notion of embodied cognition can be useful to legal analysis. Because we are moving from the domain of actions and affect (in the previous section) to the domain of judgments, we now call the theory “embodied rationality”.

We divide this section into three parts: (1) judgments involving risk and time; (2) judgments and decisions for and about oneself; and (3) judgments and decisions for and about others.

#### *A. Judgments Involving Risk and Time*

Two characteristics of decision-making that are common in the legal system are decisions involving risk and decisions involving time. Decisions involving risk include decisions about insurance, investments, entrepreneurship and whether to take the chance of doing something illegal--from things "everyone" does like speeding or cheating on taxes to committing serious crimes. Decisions involving time also include \*152 decisions about investments (like how much to save now and whether to use loans or payday lending) and planning for the future. Some decisions involve both risk and time: for example, a defendant's decision whether to take a plea or risk a longer sentence by going to trial.

##### (i) Small Risks

One of the long-standing puzzles in the study of judgment and decision making is people's infelicity with comprehending very small probabilities and thus misassessing risk. Humans routinely overestimate the probability of very unlikely risks [FN110] and therefore behave in non-optimal ways to protect against them (for example, overinsure, believe driving is safer than flying. [FN111]

What is risk like? Metaphorically it seems like risk is a thing--a scary thing. People want to see it or, more importantly, foresee it, avoid it, manage it, handle it and control it. Why are people overly sensitive to very small risks? Consider Figure 2: are the two pairs of lines on the left the same or different distances from each other? What about the two pairs of lines on the right? It's the Weber-Fechner Law at work: on the \*153 left we can see a difference between small differences; on the right we cannot. The human sensory system is very attuned to noticing the difference between nothing and just-a-little-bit-of-something. Perhaps that sensitivity is analogous to humans' sensitivity to very small risks. [FN112]

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##### (ii) Subjectivity of risk

Another interesting puzzle about risk is that different people perceive the same objective risks as subjectively highly different. For example, Slovic and colleagues have shown that when asked to estimate risks, different types of people are likely to estimate different types of events as more or less risky. In one study, people with low incomes, minorities and women saw bigger risks in 19 possible risk sources than did white men. [FN113] Given the various findings described above showing that people with fewer relevant resources (for example, a heavy backpack, tired, old, alone) perceive hills as steeper, shouldn't we also expect people with fewer relevant resources to perceive risks as larger?

##### \*154 (iii) Time

Time is another dimension about which people seem to make bad judgments. In particular, researchers note people's overly steep temporal discounting--a willingness to accept smaller amounts today in exchange for giving up larger amounts in a not-too-distant future. In addition, people often have long term goals--like saving money--that they fail to implement in the short term--for example, by increasing pension contributions deducted from their paycheques.

What is time like? Metaphorically, time is like distance. The future is ahead; the past is behind; events move closer or

farther away. A quality of real distance is that closer objects look bigger and we can see them in more detail; distant objects are smaller and fuzzier and often we have to make guesses about what they are. Conversely, when we see a small object we often assume that it is small because it is further away. That assumption is the force driving the illusion in Figure 3. The non-parallel lines look as if they are receding into the distance; the top black bar therefore appears farther away than the bottom black bar; the top bar should therefore look smaller; since it does not look smaller, we infer that it must actually be larger than the bottom bar.

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Construal level theory in psychology notes that sometimes people think about objects or events in more abstract ways and sometimes in more concrete ways. Analogous to physical distance, when people think about temporally distant events (for example, the course you will teach next year) they think more abstractly and have more high-level goals (for example, you will learn a lot; it will be exciting); however, when \*155 people think about temporally close events (for example, the course you will begin teaching tomorrow) they have more concrete and detailed concerns (for example, how will you finish the syllabus today). [FN114] Note that, just as in vision, this relation is bi-directional: when people are told to focus on abstract rather than concrete features of an event, they evaluate that event as temporally more distant. [FN115] Thus, perhaps, changing the level of abstraction of discourse could affect whether people will start to implement their long term goals.

*B. Judgments and Decisions For and About Oneself*

Most of the decisions--legal or otherwise--that we make are for and about ourselves. We consult our own preferences, desires and values, and although we assume that they are personal, we also view them as rational--at a minimum, we believe that they are stable and not influenced by random physical qualities or emotional states. Yet our decisions are affected by such factors.

(i) Should we invest?

We often must decide whether to spend more time or money or effort in order to obtain a bigger gain (or avoid a bigger loss). An obvious analogy to the Weber-Fechner Law is the idea of decreasing marginal utility. Figure 4 shows the prototypical subjective utility curve with an objective measure on the x-axis and subjective utility on the y-axis. Notice that in the upper-right quadrant, an increase of 1 unit on the x-axis is worth less than 1 unit on the y-axis--and worth less still the further up the x-axis you go. The shape of this curve is a foundation of the heuristics and biases approach--and it can be used to explain some \*156 human irrationalities. [FN116] We find the analogy interesting: just like our subjective experience of weight or loudness, our sensitivity to the addition of units of intangibles (like money) decreases as more units are added.

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Whether and how people are sensitive to the properties of this curve in real life comes up frequently in debates about taxes (for example, will increasing the marginal tax rate decrease work or investments?), incentives and bonuses, and whether price differentials should be phrased as discounts or surcharges.

(ii) Are Our Goals within Reach?

We often must decide whether a hurdle is too high or a goal is "within reach". For example, can we afford to buy a house or start a family? Can we expand our present business? In Part III, we described \*157 how physical and social re-



sources can affect perceptions of hills. In addition, an individual's own body size may affect her judgments of physical qualities such as size and distance. Might these features also affect metaphorical hurdles and goals?

We factor in our own reach when judging close distances. [FN117] Distance is not standardized: items that are within our reach are treated as being over-close compared to items that are just out of reach. Thus, items at a distance of about two feet seem closer to people who can reach them and further to people who cannot. When people are given an implement to allow them to reach further, the discontinuity in perceived distance now occurs farther away: items within reach of the implement are treated as being over-close. Importantly, however, an identical physical environment can be perceived differently depending on a person's goals and intentions. For example, only when participants intended to use the tool did targets within reach look closer; this was not the case when participants were simply holding the tool without using it to reach. [FN118]

If the metaphors hold, perhaps the success of taller people is due (in part) to them believing they have longer "reaches" and acting accordingly. [FN119] Further, findings that powerful individuals are more likely to initiate actions to change their environment than powerless ones, [FN120] and that powerful individuals are more focused on action-specific information, [FN121] suggest that knowing that one has power, and resources, has profound effects on thought and action. In other words, having power literally implies the ability to act on the world, to the benefit or detriment of oneself and others. Perhaps, therefore, groups \*158 that might benefit from devoting more effort to pursuing distant goals could be helped by programs that metaphorically extend their reach.

### (iii) Should We Stick or Change?

We must often choose whether to stick with the status quo or change things. For example, we can change jobs or residences, marry or divorce, or vote for the new candidate or proposition. It turns out that our moods may affect such decisions. In typical endowment effect studies, people who have received an object (for example, a mug) want more money to sell the mug than people are willing to pay to buy the mug. [FN122] However, when experimental participants watch a movie that makes them feel sad, the effect is reversed: they are willing to pay more for a new mug and ask less for the old. When they watch a movie that makes them feel disgusted, they are willing to pay less and receive less (with no difference between the amounts). The argument goes that sad people wish to change their circumstances--get rid of something old or buy something new--whereas disgusted people wish to not have anything. [FN123]

Granted, a laboratory study using mugs is not the same as real world decisions involving houses, marriages or businesses. But, it is certainly possible that moods (or, more likely, chronic dispositions) would affect this type of decision-making.

### *C. Judgments and Decisions For and About Others*

Sometimes we must make legally relevant decisions for or about others. For example, we could be a medical proxy or hold a power-of-attorney, or we could be on a jury deciding whether someone reasonably believed she was in imminent danger or was still in the "heat of passion" [FN124] \*159 when killing another person. There is often a disparity between the judgments we make for and about ourselves and those we make for and about others. From an embodied perspective that makes sense: in decision-making for ourselves we are gathering information from "inside", such as our bodily cues, from our introspections and from our knowledge of the circumstances; in decision-making for others those cues and that knowledge will be different.

People often make different kinds of causal attributions for their own actions than for the actions of others. The “inside view” results in the fundamental attribution error--we make dispositional attributions about others (for example, he didn't help her because he is mean) whereas we make situational attributions about ourselves (for example, I didn't help her because I was in a rush). This effect may result from us having more information about our own circumstances. [FN125]

Our ability to introspect about our own thoughts leads to various self-serving biases. We view ourselves as kinder and gentler, smarter and more generous than others. [FN126] When participants were asked to predict, for example, how much money they would give to a campus charity flower sale, they predicted that they themselves would give more than the average other student. The actual amounts individuals donated were closer to those estimated for others than for those estimated for themselves. People also view themselves as more independent thinkers than others and less likely to “follow the crowd”. [FN127]

**\*160 (i) Using Perspective-taking**

However, we are not always totally immersed in our own present thoughts and feelings; we can take different perspectives. One way to do so is to imagine ourselves in the future; when students were asked to make judgments about their future selves (for example, how much of a disgusting liquid they would be willing to drink) those judgments were similar to the judgments they made for others. [FN128] Another way is to imagine ourselves in the third person; participants experienced an event and then reported on it either from their own perspective--just as they had seen it (“inside view”)--or as if they were a third person watching the whole event from the outside, with themselves as a participant in it. In their recollections, the two groups were likely to remember some different details and people reporting from the inside reported experiencing more emotion and their memories were coloured by that emotion. [FN129]

Both of those techniques are ways of getting ourselves outside of ourselves. But, of course, another way to make decisions for others that might be similar to the ones we make for ourselves would be to try to imagine ourselves in the “other person's shoes” or to imagine things “from their points of view”. Note the embodied metaphors. One might speculate that given the findings described above on “mirror neurons”, namely that observing an action in another individual appears to activate brain areas involved in doing the action oneself--perhaps the only way to understand another person's experience is to perform a motor simulation with one's own body. In other words, the only way to judge what choices or decisions another person would make might be to simulate one's own response, and draw conclusions from that response.

**\*161 (ii) The Jury's Judgment**

Of course, the quintessential legal judgment that people make about others is the judgment jurors make in the courtroom when deciding whether someone is liable or guilty. The courtroom itself expresses some embodied metaphors--most noticeably that of the judge, representative of truth and justice, sitting higher than everyone else. Embodied rationality suggests that jurors' judgments could depend on many extrinsic factors relating to how the jurors have been treated or how they feel. For example, we have mentioned that when people feel disgust because they are in a dirty environment they judge moral transgressions to be more wrong than if they are in a clean environment. [FN130] In addition, people who have been engaged in synchronous activities (for example, walking in step) later show more cooperation with each other than those who have not. [FN131] And people who have been engaged in an activity involving lots of self-control show increased prejudice and stereotyping compared to people who have not. [FN132] All of these findings have implications for courtroom judgments because jurors may find themselves standing and sitting (or living) in unison, may have to use a lot of self-control to pretend to be engaged in a process that they don't care about or stop themselves from be-

coming overly involved in one they care too much about, and may experience better or worse conditions as they make such judgments (for example, in the courtroom, the bathroom, the juryroom). Whether such factors would affect legal judgments remains an empirical question.

### **\*162 V. Ending and Beginning**

We have attempted to situate the new embodied cognition movement with respect to previous movements in psychology, law and economics. We argue that the “Reign of Heuristics and Biases”--the years when it was fashionable in psychology to document new reasoning errors--is over, and that psychologists are now using a multitude of approaches to help understand and explain human reasoning.

A question that we deliberately have not addressed is this: “what does it mean to be rational?” Certainly one definition of rationality (and the one we have been using) is “performing consistently with the formal rules of probability, logic and statistics”; we agree that humans fail at that. But other definitions of rationality look to whether people perform optimally given the informational, temporal, cognitive, and other constraints under which they act. It is also possible to view rationality in relation to the achievement of goals. Yet one more way of considering whether a cognitive process might be rational is to determine whether it serves the purpose of adaptive action. As we discussed earlier, although people verbally considerably overestimate hill slants, and those judgments might be considered highly inaccurate or irrational, people are still perfectly capable of determining the right course of action when attempting to climb up the hill. Actual behavior is appropriate despite the “incorrect” verbal report, or in fact, *because* of it, because the verbal overestimation reflects the intuition that the body will need certain resources when attempting the specific action.

We have also been asked whether we are not just substituting one label for “irrationality”--embodied cognition--for another--heuristics and biases). The answer is: superficially yes but fundamentally no. The Reign of Heuristics and Biases generated a long list of people's deviations from the normatively rational. And the importation of that information into Behavioural Law and Economics has promoted many thoughts about how to create environments in which such “flawed” humans would make better decisions.

Embodied cognition research has also generated a list of people's deviations from the normatively rational. And it, too, could promote \*163 thoughts about how to create better decision environments. However, the heuristics and biases approach lacked a unifying theory. How are the heuristics similar? Why do we have some biases rather than others? Suggestions from theories of bounded rationality, evolution, emotion and dual processing have all been recruited to unify the findings within the heuristics and biases framework. We believe that embodied rationality may do a better job. We note that although theories of embodied cognition have stimulated intense research interest and theoretical debate, many researchers following more traditional approaches remain critical. While we acknowledge the controversy of the general notion of embodied cognition, the purpose of this paper is to outline its central tenets and to present some of its interesting new findings in order to illustrate its potential relevance to law. [\[FN133\]](#)

Thus, our endeavor here is not to judge normative rationality, but to understand what influences people's judgment and decision-making. We believe that theory and findings from embodied cognition can help us better understand how intelligent and unimpaired human reasoners are likely to behave across a variety of important and legally relevant situations.

### **\*164 Appendix**

**Table 1: A timeline of developments in psychology**

	<b>Psychology Movements</b>	<b>Psychological Perspectives for Studying Mind</b>	<b>Psychology as Related to Law and Economics</b>
<b>19th century</b>	Physiological Psychology	Measure physical judgments, speed of decisions	
<b>1890s</b>	Introspectionism	Introspection, basic elements of thought	
<b>1910s - 1960s</b>	Behaviorism	Black Box	
<b>1950s - 1960s</b>	Cognitivism	Rational Man	
<b>1970s</b>	Cognitive Science; Computer Metaphor of Mind	Classic Irrationality Findings	Current Law & Economics (L&E)
<b>1980s - mid- 1990s</b>	(continued)	“The Reign of Heuristics and Biases”	L&E plus Behavioral Economics
<b>mid 1990s - present</b>	Variety: Emotion, Unconscious, Dual Processes, Evolution/Culture, Neuroscience	“The Rational Resurgence”	L&E plus Behavioral Law & Economics
<b>Present</b>	Plus: Embodied Cognition	Mind, brain, body, environment	

[FN1]. Professor of Psychology and Professor of Law University of Virginia and University Lecturer University of Cambridge, respectively. The authors wish to thank Claire Hill and the University of Minnesota Institute for Law and Rationality for running an excellent conference on Emerging Paradigms of Rationality where these ideas were first presented by BAS. We appreciate the many helpful comments we received from participants in the University of Virginia School of Law Faculty Workshop Series. This paper also benefited from useful conversations with: Larry Barsalou, Jerry Clore, John Darley, Art Glenberg, Jon Haidt, Reid Hastie, Denny Proffitt, Paul Slovic and Dan Wegner.

[FN1]. See the classic collection on human “irrationality”: Daniel Kahneman, Paul Slovic & Amos Tversky, eds., *Judgment Under Uncertainty: Heuristics and Biases* (Cambridge: Cambridge University Press, 1982), and the classic work

summarizing that research: Richard Nisbett & Lee Ross, *Human Inference: Strategies and Shortcomings of Social Judgments* (Englewood Cliffs: Prentice-Hall, 1980). For the importation of these ideas into behavioral law and economics, see the collection of articles in Cass R. Sunstein, ed., *Behavioral Law & Economics* (Cambridge: Cambridge University Press, 2000). Of course, there are other definitions of what it means to be rational. As Keys and Schwartz note: "... the entire field of judgment and decision making has ... to a large degree, answered questions about how well our decisions conform to formal principles of rationality instead of how well our decisions serve substantive rationality ... [T]he field is not confused about the question it is trying to answer. However, it has, at least sometimes, failed to notice that it is not the question that the rest of us want answered." Daniel J. Keys and Barry Schwartz, "'Leaky' Rationality: How Research on Behavioral Decision Making Challenges Normative Standards of Rationality" (2007) 2 *Perspectives on Psych. Sci.* 162 at 178.

[FN2]. Mukul Bhalla & Dennis R. Proffitt, "Visual-Motor Recalibration in Geographical Slant Perception" (1999) 25 *J. Experimental Psych.: Human Perception & Performance* 1076.

[FN3]. Susan Goldin-Meadow, "Talking and Thinking with Our Hands" (2006) 15 *Current Directions in Psych. Sci.* 34.

[FN4]. Mark Chen & John A. Bargh, "Consequences of Automatic Evaluation: Immediate Behavioral Predispositions to Approach or Avoid the Stimulus" (1999) 25 *Personality & Soc. Psych. Bull.* 215.

[FN5]. Lawrence E. Williams & John A. Bargh, "Experiencing Physical Warmth Promotes Interpersonal Warmth" (2008) 322 *Science* 606 at 607.

[FN6]. Gardner Murphy & Joseph K. Kovach, *Historical Introduction to Modern Psychology*, 3d ed. (New York: Harcourt Brace Jovanovich, Inc., 1972) at 78-79; Edwin G. Boring, *A History of Experimental Psychology*, 2d ed. (Englewood Cliffs: Prentice-Hall, Inc., 1950) at 113.

[FN7]. Murphy & Kovach, *ibid.* at 82; Boring, *ibid.* at 113.

[FN8]. Murphy & Kovach, *ibid.* at 160; Boring, *ibid.* at 316-321.

[FN9]. Murray & Kovach, *ibid.* at 224-225; Boring, *ibid.* at 401-404.

[FN10]. John B. Watson, "Psychology as the Behaviorist Views It" (1913) 20 *Psych. Rev.* 158.

[FN11]. Murphy & Kovach, *supra* note 6 at 245-251, 325-329; Boring, *supra* note 6 at 643-645.

[FN12]. The *Gestalt* psychology movement in Germany had already rejected the shortcomings of behaviourism in the 1930s by using introspective methods aimed at understanding mental processes. Part of the reason the *Gestalt* movement did not catch on fully was the forced emigration of most of its members from Nazi Germany. For a historical account, based on the example of Karl Duncker and his method of thought listing during problem solving, see Simone Schnall, "Life as the Problem: Karl Duncker's Context" (1999) 1 *From Past to Future: Papers on the History of Psychology* 13.

[FN13]. See *ibid.* at 298-301 for another description of Marr's levels of analysis. Another important development away from behaviourism was the reacceptance of the use of introspection as data. See K. Anders Ericsson & Herbert A. Simon, "Verbal Reports as Data" (1980) 87 *Psych. Rev.* 215 (justifying--under limited circumstances--the use of verbal protocols as a method of investigating cognitive processes).

[FN14]. John R. Searle, "Minds, Brains and Programs" (1980) 3 *Behav. & Brain Sci.* 417. The basic thought experiment

was as follows. Suppose you know nothing of the Chinese language. You are put in a room and given a batch of Chinese writing. Then you are given another batch that has more Chinese writing but also a list of instructions, in English, which tells you that if you see certain symbols in the first batch you should write down specific symbols on another sheet of paper. Unbeknownst to you, the first batch was a “story”, the second was “questions about the story”, and what you have created are “answers” to those questions. The English instructions you received were “the program”. The notion is that even though it appears to the outside that you must have understood what you were doing, you did not, and what you did was analogous to what a computer program does.

[FN15]. Human memories change in systematic ways over time. We can both forget things that have happened and remember things that have not. Neither of these effects is random. For example, details are forgotten but gist is remembered; schema-consistent events that never occurred are what is likely to be filled in; items that have been retrieved recently, or many times, are retrieved more quickly than those that have not. For excellent examples within these huge areas of research, see: Frederic C. Bartlett, *Remembering: A Study in Experimental and Social Psychology* (New York: The Macmillan Company, 1932); John D. Bransford & Jeffery J. Franks, “The Abstraction of Linguistic Ideas: A Review” (1972) 1 *Cognition* 211; Elizabeth F. Loftus, “Memory for a Past that Never Was” (1997) 6 *Current Directions in Psych. Sci.* 60.

[FN16]. Cameron R. Peterson & Lee R. Beach, “Man as an Intuitive Statistician” (1967) 68 *Psych. Bull.* 29.

[FN17]. The claim about people being intuitive statisticians was with regard to reasoning about causation. Harold H. Kelley, “Attribution Theory in Social Psychology” in David Levine, ed., *Nebraska Symposium on Motivation* (Lincoln: University of Nebraska Press, 1967) 192.

[FN18]. Amos Tversky & Daniel Kahneman, “Judgment Under Uncertainty: Heuristics and Biases” (1974) 185 *Science* 1124 [Tversky & Kahneman, “Judgment Under Uncertainty”], reprinted in Kahneman, Slovic & Tversky, *supra* note 1.

[FN19]. Baruch Fischhoff, “Hindsight Foresight: The Effect of Outcome Knowledge on Judgment Under Uncertainty” (1975) 1 *J. Experimental Psych.: Human Perception and Performance* 288. For the importance of hindsight bias in law, see Kim A. Kamin & Jeffrey J. Rachlinski, “Ex post Ex ante: Determining Liability in Hindsight” (1995) 19 *L. & Human Behav.* 89. The classics are collected in Kahneman, Slovic, & Tversky, *supra* note 1, and described in Nisbett & Ross, *supra* note 1.

[FN20]. Tversky & Kahneman, “Judgment Under Uncertainty”, *supra* note 18 at 1130.

[FN21]. Spellman used to begin talks, then finally began a paper, as follows: “When I attended my first psychology class in the mid-1970s I learned the following two pieces of up-to-the-minute wisdom. The first was that rats were very good reasoners .... The second ... was that humans were very bad reasoners .... I decided that if I ever went into psychology, I would like to show that humans were at least as smart as rats.” **Barbara A. Spellman**, “Conditioning Causality” (1996) 31 *Psych. Learning & Motivation* 167.

[FN22]. Rather than creating a long list of named heuristics and biases, we refer you to Joachim I. Krueger & David C. Funder, “Towards a Balanced Social Psychology: Causes, Consequences, and Cures for the Problem-Seeking Approach to Social Behavior and Cognition” (2004) 27 *Behavioral and Brain Sciences* 313 and Anuj K. Shah and Daniel M. Oppenheimer, “Heuristics Made Easy: An Effort-Reduction Framework” (2008) 134 *Psych. Bull.* 207.

[FN23]. E.g., Patricia W. Cheng & Laura R. Novick, “A Probabilistic Contrast Model of Causal Induction” (1990) 58 *J. Personality & Soc. Psych.* 545, showing that some alleged causal attribution “biases” disappear when participants are

given complete covariation information.

[FN24]. Researchers taking that view include Leda Cosmides and Gerd Gigerenzer (see notes *infra*).

[FN25]. Leda Cosmides, "The Logic of Social Exchange: Has Natural Selection Shaped How Humans Reason? Studies with the Wason Selection Task" (1989) 31 *Cognition* 187. In the abstract version of the Wason Selection task, subjects are shown four cards--two with letters (typically E and K) and two with numbers (typically 4 and 7). They are told: "Each of these cards has a letter on one side and a number on the other. Suppose there is a rule: 'If there is a vowel on one side there is an even number on the other.' Which of the cards must you turn over to check that the rule holds?" People are quite good at (correctly) answering "E" but notoriously bad by not also answering "7". Cheater detection versions of the task involve rules that must be checked to make sure there are no violators (i.e., cheaters). A concrete version of the task involves a rule such as: 'If a person is drinking beer then he must be over 20 years old' with cards indicating people's ages (16 or 25) and what they are drinking (coke or beer). A more abstract version involves a rule like 'If you take the benefit then you pay the cost' with cards indicating whether people accepted a benefit or paid a cost. In these cheater detection versions of the task, people are quite good at choosing both relevant cards (16 and beer; accepted and did not pay). There is continuing debate over whether a "cheating detection" format is a necessary and sufficient condition for good performance on the task. See Patricia W. Cheng & Keith J. Holyoak, "On the Natural Selection of Reasoning Theories" (1989) 33 *Cognition* 285; Leda Cosmides *et al.*, "Detecting Cheaters" (2005) 9 *Trends Cognitive Sci.* 505.

[FN26]. Gerd Gigerenzer, "How to Make Cognitive Illusions Disappear: Beyond 'Heuristics and Biases'" (1991) 2 *Eur. Rev. Soc. Psych.* 83. But see Steven A. Sloman *et al.*, "Frequency Illusions and Other Fallacies" (2003) 91 *Org. Behavior & Human Decision Processes* 296, arguing that benefits of the frequency format are not due to frequencies being more understandable than probabilities *per se*.

[FN27]. This prehistoric period has been referred to as the "environment of evolutionary adaptation" due to its significance in human evolution. John Bowlby, *Attachment and Loss, Volume 1: Attachment* (London: Hogarth Press and Institute of Psycho-Analysis, 1969).

[FN28]. Gerd Gigerenzer, Peter M. Todd & the ABC Research Group, *Simple Heuristics That Make Us Smart* (New York: Oxford University Press, 1999).

[FN29]. Shelly Chaiken & Yaacov Trope, eds., *Dual-process Theories in Social Psychology* (New York: The Guilford Press, 1999); Steven A. Sloman, "The Empirical Case for Two Systems of Reasoning" (1996) 119 *Psych. Bull.* 3; Eliot R. Smith & Jamie DeCoster, "Dual-Process Models in Social and Cognitive Psychology: Conceptual Integration and Links to Underlying Memory Systems" (2000) 4 *Personality & Soc. Psych. Rev.* 108. For a more recent review, see Jonathan St. B. T. Evans, "Dual-Processing Accounts of Reasoning, Judgment, and Social Cognition" (2008) 59 *Ann. Rev. Psych.* 255.

[FN30]. Daniel Kahneman & Shane Frederick, "A Model of Heuristic Judgment" in Keith J. Holyoak & Robert G. Morrison eds., *The Cambridge Handbook of Thinking and Reasoning* (New York: Cambridge University Press, 2005) 267.

[FN31]. John A. Bargh & Tanya L. Chartrand, "The Unbearable Automacity of Being" (1999) 54 *Am. Psychologist* 462; Timothy D. Wilson, *Strangers to Ourselves: Discovering the Adaptive Unconscious* (Cambridge: Belknap Press of Harvard University Press, 2002).

[FN32]. Damasio and colleagues developed the Iowa Gambling Task to capture specific deficits of decision-making of patients with lesions in the ventromedial prefrontal cortex. Compared to normal controls, those patients not only had dif-

faculty learning a decision rule to maximize monetary rewards, but also showed a lack of a physiological response (referred to as a “somatic marker”) in response to risky decisions. Damasio and colleagues concluded that somatic markers play an important role in adaptive decision making. Antoine Bechara *et al.*, “Deciding Advantageously Before Knowing the Advantageous Strategy” (1997) 275 *Science* 1293.

[FN33]. Victoria M. Esses & Mark P. Zanna, “Mood and the Expression of Ethnic Stereotypes” (1995) 69 *J. Personality & Soc. Psych.* 1052; Joseph P. Forgas, Gordon H. Bower & Susan E. Krantz, “The Influence of Mood on Perceptions of Social Interactions” (1984) 20 *J. Experimental Soc. Psych.* 497; Joseph P. Forgas & Stephanie J. Moylan, “Affective Influences on Stereotype Judgments” (1991) 5 *Cognition & Emotion* 379; Dacher Keltner, Kenneth D. Locke & Paul C. Audrain, “The Influence of Attributions on the Relevance of Negative Feelings to Personal Satisfaction” (1993) 19 *Personality & Soc. Psych. Bull.* 21; Victor C. Ottati and Linda M. Isbell, “Effects of Mood During Exposure to Target Information on Subsequently Reported Judgments: An On-line Model of Misattribution and Correction” (1996) 71 *J. Personality & Soc. Psych.* 39; Norbert Schwarz & Gerald L. Clore, “Mood, Misattribution, and Judgments of Well-Being: Informative and Directive Functions of Affective States (1983) 45 *J. Personality & Soc. Psych.* 513.

[FN34]. As psychologists would say, being in a good mood facilitates top-down processing, whereas being in a bad mood facilitates bottom-up processing. For a review, see Gerald L. Clore *et al.*, “Affective Feelings as Feedback: Some Cognitive Consequences” in Leonard L. Martin & Gerald L. Clore, eds., *Theories of Mood and Cognition: A User's Handbook* (Mahwah, N.J.: L. Erlbaum Associates, 2001) 27. Such effects already occur for children as young as six years old. Simone Schnall, Vikram K. Jaswal & Christina Rowe, “A Hidden Cost of Happiness in Children” (2008) 11 *Developmental Sci.* F25.

[FN35]. Friedemann Pulvermuller, “Brain Mechanisms Linking Language and Action” (2005) 6 *Nature Reviews Neuroscience* 576.

[FN36]. The strongest evidence for this effect has been found in monkeys using single-cell recording of motor neurons; such neurons are called “mirror neurons”. Vittorio Gallese *et al.*, “Premotor Cortex and the Recognition of Motor Actions” (1996) 3 *Cognitive Brain Research* 131 at 135. Recent work using functional imaging suggested that similar processes might occur in the human brain. Trevor T.J. Chong *et al.*, “fMRI Adaptation Reveals Mirror Neurons in Human Inferior Parietal Cortex” (2008) 18 *Current Biology* 1576.

[FN37]. George Loewenstein, Scott Rick & Jonathan D. Cohen, “Neuroeconomics” (2008) 59 *Ann. Rev. Psych.* 647.

[FN38]. The start of the current movement is sometimes dated from the publication of R. H. Coase, “The Problem of Social Cost” (1960) 3 *J.L. & Econ.* 1.

[FN39]. This is not to say that economics or law and economics incorporates an empirical belief about the actual existence of rational humans; at a minimum, however, it assumes their existence for methodological purposes.

[FN40]. Daniel Kahneman & Amos Tversky, “Prospect Theory: An Analysis of Decision Under Risk” (1979) 47 *Econometrica* 263 [Kahneman & Tversky, “Prospect Theory”].

[FN41]. Basic articles in Behavioural Law and Economics were collected in Sunstein, *supra* note 1.

[FN42]. The term “embodied cognition” has been used in various ways. For simplicity, we focus on some of the definitional aspects that most researchers in the field agree on. See Margaret Wilson, “Six Views of Embodied Cognition” (2002) 9 *Psychonomic Bull. & Rev.* 625; Alvin Goldman & Frederique de Vignemont, “Is Social Cognition Embodied?”



(2009) 13 Trends Cognitive Sci. 154.

[FN43]. Daniel J. Simons & Christopher F. Chabris, "Gorillas in Our Midst: Sustained Inattentional Blindness for Dynamic Events" (1999) 28 Perception 1059 at 1066.

[FN44]. David Ingle, "Two Visual Systems in the Frog" (1973) 181 Science 1053.

[FN45]. A. D. Milner & Melvyn A. Goodale, *The Visual Brain in Action* (Oxford: Oxford University Press, 1995).

[FN46]. The notion that the mind has encapsulated "modules" that are impervious to information coming from other modules was spelled out in Jerry A. Fodor, *The Modularity of Mind: An Essay on Faculty Psychology* (Cambridge, Mass.: MIT Press, 1983). However, that strict criterion for modularity is not always met. For an example of encapsulation, see the Ebbinghaus illusion in Figure 1 at the beginning of Part IV, illustrating that sometimes vision and higher-order processes do seem to work independently.

[FN47]. Dennis R. Proffitt *et al.*, "The Role of Effort in Perceiving Distance" (2003) 14 Psych. Sci. 106.

[FN48]. Bhalla & Proffitt, *supra* note 2.

[FN49]. Dennis R. Proffitt *et al.*, "Perceiving Geographical Slant" (1995) 2 Psychonomic Bull. & Rev. 409.

[FN50]. Jeanine Stefanucci *et al.*, "Skating Down a Steeper Slope: Fear Influences the Perception of Geographical Slant" (2008) 37 Perception 321.

[FN51]. Simone Schnall *et al.*, "Social Support and the Perception of Geographical Slant" (2008) 44 J. Experimental Soc. Psych. 1246.

[FN52]. At least if the goal is to climb the hill and not to aim a cannon. See Galinsky, Gruenfeld & Magee, *infra* note 120 for discussion about the relevance of goals.

[FN53]. As reviewed in detail by others (see Paula M. Niedenthal *et al.*, "Embodiment in Attitudes, Social Perception, and Emotion" (2005) 9 Personality & Soc. Psych. Rev. 184; Eliot R. Smith & Gun R. Semin, "Socially Situated Cognition: Cognition in its Social Context" (2004) 36 Advances Experimental Soc. Psych. 53.), embodied aspects of functioning have featured prominently in the study of affect for a long time: William James, *The Principles of Psychology*, vol. 1 (New York: Dover Publications, 1950), equated affect with the feelings of relevant bodily changes, and Charles Darwin, *The Expression of the Emotions in Man and Animals*, 3d ed. (New York: Oxford University Press, 1998), noted that emotional expressions often amplify emotional feelings. Several modern accounts also emphasize the causal role of expressive behavior and other bodily processes in emotional feelings, e.g., Antonio Damasio, *Descartes' Error: Emotion, Reason, and the Human Brain* (New York: Putnam, 1994); James D. Laird, *Feelings: The Perception of Self* (New York: Oxford University Press, 2007).; Jesse J. Prinz, *Gut Reactions: A Perceptual Theory of Emotion* (New York: Oxford University Press, 2004).

[FN54]. For definitions of affect, emotion and mood, see Gerald L. Clore & Simone Schnall, "The Influence of Affect on Attitude," in Dolores Albarracín, Blair Johnson, & Mark P. Zanna, eds., *The Handbook of Attitudes* 438 (Mahwah, N.J.: Lawrence Erlbaum, 2005).

[FN55]. See reviews by Pamela K. Adelman & R. B. Zajonc, "Facial Efference and the Experience of Emotion" (1989) 40 Ann. Rev. Psych. 249; James D. Laird & Charles Bresler, "The Process of Emotional Experience: A Self-Perception

Theory” in Margaret S. Clark, ed., *Emotion* (Newbury Park, Calif.: SAGE Publications, 1992) 213; Daniel N. McIntosh, “Facial Feedback Hypotheses: Evidence, Implications, and Directions” (1996) 20 *Motivation & Emotion* 121.

[FN56]. It's difficult to be anxious when your body is relaxed. Certain bodily states are simply incompatible with certain feelings: relaxed muscles are incompatible with feelings of stress or anxiety, and this works in favour of patients undergoing systematic desensitization treatment, when they are taught to produce a relaxation response while thinking of anxiety-provoking stimuli. See Joseph Wolpe, *Psychotherapy by Reciprocal Inhibition* (Stanford: Stanford University Press, 1958). Gradually, the physical relaxation response of such patients replaces feelings of anxiety.

[FN57]. Sandi Duclos *et al.*, “Emotion-Specific Effects of Facial Expressions and Postures on Emotional Experience” (1989) 57 *J. Personality & Soc. Psych.* 100; James D. Laird, “Self-Attribution of Emotion: The Effects of Expressive Behavior on the Quality of Emotional Experience” (1974) 29 *J. Personality & Soc. Psych.* 475; Simone Schnall & James D. Laird, “Keep Smiling: Enduring Effects of Facial Expressions and Postures on Emotional Experience and Memory” (2003) 17 *Cognition & Emotion* 787; Robert Soussignan, “Duchenne Smile, Emotional Experience, and Autonomic Reactivity: A Test of the Facial Feedback Hypothesis” (2002) 2 *Emotion* 52; Fritz Strack, Leonard L. Martin, & Sabine Stepper, “Inhibiting and Facilitating Conditions of the Human Smile: A Nonobtrusive Test of the Facial Feedback Hypothesis” (1988) 54 *J. Personality & Soc. Psych.* 768.

[FN58]. James D. Laird, “Self-Attribution of Emotion: The Effects of Expressive Behavior on the Quality of Emotional Experience,” (1974) 29 *J. Personality & Soc. Psych.* 475.

[FN59]. Strack, Martin & Stepper, *supra* note 57.

[FN60]. Jessie M. VanSwearingen, Jeffrey F. Cohn & Anu Bajaj-Luthra, “Specific Impairment of Smiling Increases the Severity of Depressive Symptoms in Patients with Facial Neuromuscular Disorders” (1999) 23 *Aesthetic Plastic Surgery* 416.

[FN61]. Women's brains were scanned using fMRI before or after receiving Botox injections. When asked to imitate facial expressions, activation in the amygdala was lower for women who had received an injection, relative to those who had not. Andreas Hennenlotter *et al.*, “The Link between Facial Feedback and Neural Activity within Central Circuitries of Emotion -- New Insights from Botulinum Toxin-Induced Denervation of Frown Muscles” (2009) 19 *Cerebral Cortex* 537.

[FN62]. Sabine Stepper & Fritz Strack, “Proprioceptive Determinants of Emotional and Nonemotional Feelings” (1993) 64 *J. Personality & Soc. Psych.* 211.

[FN63]. William F. Flack Jr., James D. Laird & Lorraine A. Cavallaro, “Separate and Combined Effects of Facial Expressions and Bodily Postures on Emotional Feelings” (1999) 29 *Eur. J. Soc. Psych.* 203.

[FN64]. Schnall & Laird, *supra* note 57.

[FN65]. Daryl J. Bern, “Self-Perception Theory” in Leonard Berkowitz, ed., *Advances in Experimental Psychology*, vol. 6 (New York: Academic Press, Inc., 1972) 1; James D. Laird, “Self-Attribution of Emotion: The Effects of Expressive Behavior on the Quality of Emotional Experience” (1974) 29 *J. Personality & Soc. Psych.* 475.

[FN66]. One assumption to which many proponents of embodied cognition subscribe is that information in the brain is represented by re-enacting, or simulating, the perceptual state of the body when this information was encoded. This means that the brain does not need to translate physical sensations into abstract (“amodal”) symbols, but that cognitive

representations are in the same modality that generated the information in the first place (visual, auditory, haptic, etc.). Embodied cognition thus often claims the existence of “modal” representations. Lawrence W. Barsalou, “Perceptual Symbol Systems” (1999) 22 *Behav. & Brain Sci.* 577.

[FN67]. James D. Laird, *Self-Attribution of Emotion: The Effects of Expressive Behavior on the Quality of Emotional Experience*, 29 *J. Personality & Soc. Psych.* 475 (1974); Strack, Martin & Stepper, “Inhibiting and Facilitating Conditions of the Human Smile,” *supra* note 57.

[FN68]. Robert E. Kraut, “Social Presence, Facial Feedback, and Emotion” (1982) 42 *J. Personality & Soc. Psych.* 853.

[FN69]. Gail Tom *et al.*, “The Role of Overt Head Movement in the Formation of Affect” (1991) 12 *Basic & Applied Soc. Psych.* 281.

[FN70]. Jens Forster, “The Influence of Approach and Avoidance Motor Actions on Food Intake” (2003) 33 *Eur. J. Soc. Psych.* 339.

[FN71]. Kraut, *supra* note 68.

[FN72]. Gary L. Wells & Richard E. Petty, “The Effects of Overt Head Movements on Persuasion: Compatibility and Incompatibility of Responses” (1980) 1 *Basic & Applied Soc. Psych.* 219.

[FN73]. Tom *et al.*, *supra* note 69.

[FN74]. John T. Cacioppo, Joseph R. Priester & Gary G. Berntson, “Rudimentary Determinants of Attitudes II: Arm Flexion and Extension Have Differential Effects on Attitudes” (1993) 65 *J. Personality & Soc. Psych.* 5.

[FN75]. Jens Forster & Lioba Werth, “Zur Wechselwirkung von Medien and Motorik: Der Einfluss induzierter Annäherungs- und Vermeidungsverhalten auf die Beurteilung der FDP” (2001) 32 *Zeitschrift fuer Sozialpsychologie* 223.

[FN76]. Forster, *supra* note 70.

[FN77]. Thomas W. Schubert, “The Power in Your Hand: Gender Differences in Bodily Feedback from Making a Fist” (2004) 30 *Personality & Soc. Psych. Bull.* 757; Thomas W. Schubert & Sander L. Koole, “The Embodied Self: Making a Fist Enhances Men's Power-Related Self-Conceptions” (2009) 45 *J. Experimental Soc. Psych.* 828.

[FN78]. Williams & Bargh, *supra* note 5.

[FN79]. Chen-Bo Zhong & Geoffrey J. Leonardelli, “Cold and Lonely: Does Social Exclusion Literally Feel Cold?” (2008) 19 *Psychological Sci.* 838.

[FN80]. Jesse Chandler & Norbert Schwarz, “How Extending Your Middle Finger Affects Your Perception of Others: Learned Movements Influence Concept Accessibility” (2009) 45 *J. Experimental Soc. Psych.* 123.

[FN81]. George Rand & Seymour Wapner, “Postural Status as a Factor in Memory” (1967) 6 *Journal of Verbal Learning and Verbal Behavior* 268; See also Katinka Dijkstra, Michael P. Kaschak & Rolf A. Zwaan, “Body Posture Facilitates Retrieval of Autobiographical Memories” (2007) 102 *Cognition* 139.

[FN82]. Steven M. Smith & Edward Vela, “Environmental Context-Dependent Memory: A Review and Meta-Analysis” (2001) 8 *Psychonomic Bull. & Rev.* 203.

[FN83]. For a review, see Roland Neumann, Jens Forster & Fritz Strack, "Motor Compatibility: The Bidirectional Link Between Behaviour and Evaluation" in Jochen Musch & Karl Christoph Klauer, eds., *The Psychology of Evaluation: Affective Processes in Cognition and Emotion* (Mahwah, N.J.: Lawrence Erlbaum Associates, 2003) 371.

[FN84]. Jens Forster & Fritz Strack, "Influence of Overt Head Movements on Memory for Valenced Words: A Case of Conceptual-Motor Compatibility" (1996) 71 *J. Personality & Soc. Psych.* 421.

[FN85]. Jens Forster & Fritz Strack, "Motor Actions in Retrieval of Valenced Information: A Motor Congruence Effect" (1997) 85 *Perceptual & Motor Skills* 1419.

[FN86]. Chen and Bargh, *supra* note 4.

[FN87]. Neumann, Forster & Strack, *supra* note 83.

[FN88]. Ronald S. Friedman & Jens Forster, "The Effect of Approach and Avoidance Motor Actions on the Elements of Creative Insight" (2000) 79 *J. Personality & Soc. Psych.* 477; Ronald S. Friedman & Jens Forster, "The Influence of Approach and Avoidance Motor Actions on Creative Cognition" (2002) 38 *J. Experimental Soc. Psych.* 41.

[FN89]. Neumann, Forster & Strack, *supra* note 83 at 371-391.

[FN90]. Simone Schnall, *et al.*, "Disgust as Embodied Moral Judgment" (2008) 34 *Personality & Soc. Psych. Bull.* 1096 [Schnall *et al.*, "Disgust as Embodied Moral Judgment"].

[FN91]. Simone Schnall, Jennifer Benton & Sophie Harvey, "With a Clean Conscience: Cleanliness Reduces the Severity of Moral Judgments" (2008) 19 *Psychological Sci.* 1219.

[FN92]. In this context, "intuitive" has been defined as referring to the quick, automatic and effortless cognitive processes discussed earlier in the context of dual systems theories. Jonathan Haidt, "The Emotional Dog and its Rational Tail: A Social Intuitionist Approach to Moral Judgment" (2001) 108 *Psychological Rev.* 814. However, this definition does not entail that intuitions are not based on knowledge.

[FN93]. Matthew Botvinick & Jonathan Cohen, "Rubber Hands 'Feel' Touch That Eyes See" (1998) 39 *Nature* 756.

[FN94]. V. S. Ramachandran & William Hirstein, "The Perception of Phantom Limbs: The D. O. Hebb Lecture" (1998) 121 *Brain* 1603.

[FN95]. Daniel M. Wegner, Betsy Sparrow & Lea Winerman, "Vicarious Agency: Experiencing Control Over the Movements of Others" (2004) 86 *J. Personality & Soc. Psych.* 838.

[FN96]. Jesse Preston & Daniel M. Wegner, "Elbow Grease: When Action Feels Like Work" in Ezequiel Morsella, John A. Bargh & Peter M. Gollwitzer, eds., *Oxford Handbook of Human Action* (New York: Oxford University Press, 2009) 569 at 577.

[FN97]. *Ibid.*

[FN98]. Participants wore a head-mounted display onto which a virtual image of his/her own body was projected to stand immediately in front of the participant. Then participant and virtual image were stroked synchronously, which produced the sensation that participants saw themselves closer to the virtual body and outside of their own body. Bigna Lenggenhager *et al.*, "Video Ergo Sum: Manipulating Bodily Self-Consciousness" (2007) 317 *Science* 1096.

[FN99]. For a critical review see Siegfried Ludwig Sporer *et al.*, “Choosing, Confidence, and Accuracy: A Meta-Analysis of the Confidence-Accuracy Relation in Eyewitness Identification Studies” (1995) 118 *Psychological Bull.* 315.

[FN100]. This is the title of a book: George Lakoff & Mark Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 1980).

[FN101]. Brian P. Meier & Michael D. Robinson, “Why the Sunny Side is Up: Associations Between Affect and Vertical Position” (2004) 15 *Psychological Sci.* 243.

[FN102]. Brian P. Meier, Martin Sellbom & Dustin B. Wygant, “Failing to Take the Moral High Ground: Psychopathy and the Vertical Representation of Morality” (2007) 43 *Personality & Individual Differences* 757.

[FN103]. Seymour Wapner, Heinz Werner & Donald M. Krus, “The Effect of Success and Failure on Space Localization” (1956) 25 *J. Personality* 752 at 756.

[FN104]. Lakoff & Johnson, *supra* note 100.

[FN105]. Nils B. Jostmann, Daniel Lakens & Thomas W. Schubert, “Weight as an Embodiment of Importance” (2009) 20 *Psychological Sci.* 1169.

[FN106]. Dan Ariely, *Predictably Irrational: The Hidden Forces that Shape Our Decisions* (New York: HarperCollins, 2008) at 7.

[FN107]. Amazingly, the one on the right still looks larger even when you already know for sure that they are the same size. That phenomenon is a good example of modularity: information available to one cognitive system (in this case, the declarative knowledge that the two circles are the same size) sometimes cannot override the processing going on in another system (in this case, the visual system).

[FN108]. Amos Tversky & Daniel Kahneman, “The Framing of Decisions and the Psychology of Choice” (1981) 211 *Science* 453 at 457. (Their example used jackets and calculators for either \$15 or \$125 with a potential savings of \$5).

[FN109]. In addition to Ariely, *supra* note 106, analogies to perception are used extensively, for example, by Daniel Gilbert, *Stumbling on Happiness* (New York: Alfred A. Knopf, 2006) at xv, 40, 156, 158.

[FN110]. People tend to overweight the probabilities of unlikely risks when those risks are communicated by descriptions of the risk; people tend to underweight the probabilities of unlikely risks when they learn about them by personal experience (because low probability risks might never be experienced in a limited set of experiences); see Ralph Hertwig, *et al.*, “Decisions from Experience and the Effect of Rare Events in Risky Choice” (2004) 15 *Psychological Sci.* 534. Experts, however, who have a lot of experience with low probability events actually occurring, do not underweight them; see Jonathan J. Koehler, “The Base Rate Fallacy Reconsidered: Descriptive, Normative, and Methodological Challenges” (1996) 19 *Behav. & Brain Sci.* 1.

[FN111]. Gerd Gigerenzer, “Dread Risk, September 11, and Fatal Traffic Accidents” (2004) 15 *Psychological Sci.* 286. This article showed that death rates in the United States from automobile accidents went up in the months after the September 11 terrorist attacks, presumably because people thought getting into an airplane was “too dangerous,” and instead opted to drive. Of course, there are other reasons that people believe driving is safer: one of them might be availability--airplane crashes are broadcast more visibly than car accidents; another might be most peoples' (by necessity) false belief that they themselves are safer-than-average drivers: Leilani Greening & Carla C. Chandler, “Why It Can't Happen

to Me: The Base Rate Matters, But Overestimating Skill Leads to Underestimating Risk” (1997) 27 *J. Applied Soc. Psych.* 760.

[FN112]. The question again arises: to what extent are these superficial analogies and to what extent are they deeper because, for example, the same brain regions are involved?

[FN113]. Terre A. Satterfield, C. K. Mertz & Paul Slovic, “Discrimination, Vulnerability, and Justice in the Face of Risk” (2004) 24 *Risk Analysis* 115; For an alternative explanation (cultural world view) of some of the effects, see Dan M. Kahn *et al.*, “Culture and Identity-Protective Cognition: Explaining the White-Male Effect in Risk Perception” (2007) 4 *J. Empirical Legal Stud.* 465.

[FN114]. Yaacov Trope & Nira Liberman, “Temporal Construal” (2003) 110 *Psychological Rev.* 403.

[FN115]. Cheryl Wakslak & Yaacov Trope, “The Effect of Construal Level on Subjective Probability Estimates” (2009) 20 *Psychological Sci.* 52, interpreting Nira Liberman *et al.*, “The Effect of Level of Construal on the Temporal Distance of Activity Enactment” (2007) 43 *J. Experimental Psych.* 143.

[FN116]. Kahneman & Tversky, “Prospect Theory”, *supra* note 40. The shape of the curve can explain, for example, risk aversion and framing effects.

[FN117]. We also factor in our own “eye height” when judging the height of objects: Maryjane Wraga & Dennis R. Proffitt, “Mapping the Zone of Eye-Height Utility for Seated and Standing Observers” (2000) 29 *Perception* 1361.

[FN118]. Jessica K. Witt, Dennis R. Proffitt & William Epstein, “Tool Use Affects Perceived Distance But Only When You Intend to Use It” (2005) 31 *J. Experimental Psych.: Human Perception and Performance* 880.

[FN119]. Anne Case & Christina Paxson, “Stature and Status: Height, Ability, and Labor Market Outcomes” (2008) 116 *J. Pol. Econ.* 499.

[FN120]. Adam D. Galinsky, Deborah H. Gruenfeld & Joe C. Magee, “From Power to Action” (2003) 85 *J. Personality & Soc. Psych.* 453.

[FN121]. Ana Guinote, “Power and Affordances: When the Situation Has More Power Over Powerful Than Powerless Individuals” (2008) 95 *J. Personality & Soc. Psych.* 237 at 238.

[FN122]. Daniel Kahneman, Jack L. Knetsch & Richard Thaler, “Experimental Tests of the Endowment Effect and the Coase Theorem” (1990) 98 *J. Pol. Econ.* 1325.

[FN123]. Jennifer S. Lerner, Deborah A. Small & George Loewenstein, “Heart Strings and Purse Strings: Carryover Effects of Emotions on Economic Decisions” (2004) 15 *Psychological Sci.* 337.

[FN124]. For a discussion of the embodied “heat of passion” metaphor, see Steven J. Sherman & Joseph L. Hoffman, “The Psychology and Law of Voluntary Manslaughter: What Can Psychology Research Teach Us About the ‘Heat of Passion’ Defense?” (2007) 20 *J. Behavioral Decision Making* 499.

[FN125]. Edward E. Jones & Richard E. Nisbett “The Actor and the Observer: Divergent Perceptions of the Causes of Behavior” in Edward E. Jones *et al.*, eds., *Attribution: Perceiving the Causes of Behavior* (Morristown: General Learning Press, 1972) 79 at 80. That effect can go away when questions are carefully phrased to evoke the same contrasting in-

formation: Ann L. McGill, "Context Effects in Judgments of Causation" (1989) 57 J. Personality & Soc. Psych. 189.

[FN126]. Nicholas Epley & David Dunning, "Feeling 'Holier Than Thou': Are Self-Serving Assessments Produced by Errors in Self- or Social Prediction?" (2000) 79 J. Personality & Soc. Psych. 861.

[FN127]. Emily Pronin, Jonah Berger & Sarah Molouki, "Alone in a Crowd of Sheep: Asymmetric Perceptions of Conformity and Their Roots in an Introspection Illusion" (2007) 92 J. Personality & Soc. Psych. 585.

[FN128]. Emily Pronin, Christopher Y. Olivola & Kathleen A. Kennedy, "Doing Unto Future Selves As You Would Do Unto Others: Psychological Distance and Decision Making" (2008) 34 Personality & Soc. Psych. Bull. 224.

[FN129]. Eric Eich *et al.*, "Neural Systems Mediating Field and Observer Memories" (2009) 47 Neuropsychologia 2239. fMRI also showed differences in brain activation between these tasks.

[FN130]. See Schnall *et al.*, "Disgust as Embodied Moral Judgment", *supra* note 90 and Schnall, Benton & Harvey, *supra* note 91.

[FN131]. Scott S. Wiltermuth & Chip Heath, "Synchrony and Cooperation" (2009) 20 Psychological Sci. 1 at 3.

[FN132]. Matthew T. Galliot *et al.*, "Stereotypes and Prejudice in the Blood: Sucrose Drinks Reduce Prejudice and Stereotyping" (2009) 45 J. Experimental Soc. Psych. 288.

[FN133]. Compared to the "strong" version of embodied cognition described in this paper, some critics propose a more "weak" version involving a possible compromise between embodied and disembodied cognition. See Bradford Z. Mahon & Alfonso Caramazza, "A Critical Look at the Embodied Cognition Hypothesis and a New Proposal for Grounding Conceptual Content" (2008) 102 J. Physiology-Paris 59.

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