

# The Sensation of Making Sense

## Motivational Properties of the "Fringe"

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ABSTRACT: In a commentary on Mangan's (2001) article about fringe feelings in consciousness, we argue that labeling these experiences as "non-sensory" leads to a problematic conception of consciousness as divorceable from sensation. We then compare and contrast Mangan's development of William James' ideas about fringe experiences with Damasio's (1994, 1999) development of James' ideas about the body-relatedness of emotion and feeling. We propose that fringe feelings have essential motivational properties that stem from their evolutionary origins in various problems of survival. Finally, we contrast Mangan's notion of the feeling of rightness with our own conception of yedasentience, and we discuss how experiment and clinical investigation of psychopathology can inform our understanding of fringe feelings.

## **1. Introduction**

In our own recent research on hallucinations and obsessive-compulsive disorder (Woody & Szechtman, 2000a, b; Szechtman & Woody, 2002), we have wandered into a strange world, in which we ascribe great significance to elusive feeling states, even inventing a neologism, "yedasentience," to try to pin some of them down. Thus it was a welcome surprise to discover a kindred spirit, as revealed in Mangan's (2001) article, "Sensation's ghost: The non-sensory 'fringe' of consciousness."

In particular, much of Mangan's discussion of the feeling of knowing, which he calls the feeling of "rightness," is quite congenial to our own position. Like him, we have struggled to more clearly define what the feeling of knowing consists of. We definitely agree with him that it is not simply reducible to familiarity, and indeed, that it is something much more important than familiarity.

Nonetheless, there are other intriguing issues on which we find ourselves less aligned with Mangan's views, and this article will discuss several of these points of apparent disagreement. In addition, given that Mangan's treatment of the fringe artfully expanded on the ideas of William James, we, too, embed some other contributions of James to support our alternative perspective.

## **2. In What Sense is James' Notion of the "Fringe" of Consciousness Non-Sensory?**

To begin, we believe an important possible source of confusion is Mangan's (2001) frequent use of the term "non-sensory" to label experiences such as the feeling of knowing; this term does not seem to us quite as "neutral" or "pre-theoretical" (p. 25) as he claims. Its centrality in his article is indicated in his comment that "I myself take the 'fringe' in James sense and 'non-sensory experience' to be synonyms, and the phrase 'non-sensory fringe' to be, strictly speaking, redundant" (p. 7). We believe this language directs the reader's thinking, perhaps subtly, in particular ways: Calling these phenomena "non-sensory" points us away from looking for peripheral inputs, whose importance is perhaps James' best known contribution to psychology. Mangan mentions that James himself never applied the term non-sensory to fringe experiences. For reasons that will soon become clear, we believe James himself might have cause to be unhappy with this interpretation of his ideas.

Mangan (2001) notes, "Any experience that is not a sensation is non-sensory" (p. 5). But the word "sensation" is somewhat elastic in meaning. In a relatively restricted sense, it refers to signals from the classic sense organs which may become the focus of attention. In a broader sense, it refers to a "state of consciousness consequent on and related to a particular condition of some portion of the bodily organism" (*Oxford English Dictionary*, 2nd edition). Although Mangan seems to have assumed that readers will have the

restricted meaning in mind, we believe that most enthusiasts for James' work will want to have the broader meaning in mind, partly because it has much more interesting implications, as we shall see.

To illustrate this distinction, consider Mangan's (2001) claim that free-floating anxiety is non-sensory because it is an "experience that is not a sensation" (p. 5). In the restricted sense, free-floating anxiety may be regarded as non-sensory because it does not come from a classic sense organ, but in the broader sense, what makes it fascinating is that it is *nothing but* sensation -- it is strongly felt, yet seems to have no object or source. Perhaps the important underlying delineation is between mental events triggered directly by external events -- that is, related to representation of the external physical world -- versus mental events that do not map onto stimuli in the physical environment, but rather are triggered spontaneously by internal processes, such as bodily states and computations of various sorts.

Because the information for the experience of "rightness" does not reside directly in the external world, it may seem self-evident that the experience could be called "non-sensory." However, when Mangan later openly uses the term "feelings" to describe these states (e.g., "gut feelings"), there is the potential for confusion, because feelings are by definition "felt" or sensed experiences (e.g., Buck, 2000). In any case, here we will consider fringe experiences as sensations in the broad sense, even if they are sensations that do not directly map onto stimuli in the external world. To anticipate our argument, we believe, following James, that fringe experiences are based in an essential way on bodily sensations -- for example, the fringe sense of rightness and wrongness may perhaps be rooted in the antigravity systems involved in the maintenance of upright posture and equilibrium, as suggested by everyday language such as making a "solid" versus a "shaky" argument, and having "no leg to stand on."

### 3. How Separable is Consciousness from Sensation?

Mangan's emphasis on the non-sensory nature of fringe phenomena leads him to portray consciousness in a manner that is fully separable from sensation, and not dependent on it. This depiction raises a deeper question: Can one be conscious at all without sensation? Mangan implies that the answer is yes; in contrast, we suspect the answer may be no.

Kolb and Whishaw (2001) discuss this issue as the fallacy of the "brain in the bottle": Imagine a brain taken out of its body and kept alive (see also Putnam, 1981). There is considerable reason to believe that without the sensations provided by the brain's connections to the body, it would not sustain normal consciousness. For example, Jacobson (1929/1938, 1931) showed that profound relaxation of the speech muscles produced a disappearance of inner thought. Likewise, Malmo and Malmo (2000) discuss the EMG gradients that pervasively accompany cognitive tasks, even in the absence of any requirement for motor output, and suggest that muscle contractions produce afferent signals needed for the maintenance of thought. (For the early origins of this idea, see

Dunlap, 1914; Thomas, 1989; and Washburn, 1916.) More generally, Damasio (1994) noted about the disembodied brain in a bottle:

The absence of stimuli going *out* into the body ... would result in suspending the triggering and modulation of body states that, when represented back to the brain, constitute what I see as the bedrock of the sense of being alive. (p. 228)

A fascinating illustration of the role of sensation in fringe experiences comes from the philosopher Rousseau. In *The reveries of the solitary walker*, he wrote eloquently of turning completely away from the external world and enjoying the pure "sentiment of existence": "As long as this state lasts, we are sufficient unto ourselves, like God" (Rousseau, 1979, p. 69). But he found that what stimulated this state was certain kinds of sensory input, such as lying in his boat as he let it drift on a lake. There are very similar ideas in James himself, such as passages in which he talks about "the spell of this mysterious sensorial life" -- what appear to be "meaningless and vacant tracts of time," yet hold an "inner secret" and "tingle with an importance that unutterably vouches for itself" (James, 1899/1977, p. 644). Such ideas also suggest that fringe experiences, in and of themselves, can have intense motivational properties, an idea to which we shall return later.

In conclusion, sensory experience may be necessary for consciousness. The brain's computations may require periodic anchoring in bodily sensations; in a sense, a pure calculator may not be sustainable. Therefore, let's now turn to putting such sensation back into the center of the picture.

## 4. Where Do Fringe Experiences Come From?

Mangan's effort to expand and apply William James' ideas about fringe experiences to our current understanding of the mind has an extremely important parallel in other recent advances. In particular, Damasio (1994, 1999) has recently developed James' ideas about emotion into what Damasio calls the "somatic marker hypothesis." Although Mangan does not mention this hypothesis, it may be of central relevance to the processes he is attempting to elucidate.

James (1890/1950) proposed that feelings are mediated by body-state changes. That is, during an emotion the brain directs the body to change, and the feeling of emotion is the result of feedback of the body's change. Damasio develops this argument by specifying that not only the viscera, which James focused on, but also the muscles and internal milieu, as well as other factors, mediate feelings. More importantly, he advances the theory that the brain uses the "warm" indicators derived from the body to assist crucially with "cool" reason. These body-derived signals, called "somatic markers," denote felt significance or value, which are exactly the qualities Mangan notes that James assigned to the fringe. Damasio (1999) has further argued that the ebb and flow of internal bodily

states is the foundation for consciousness and the sense of self. In short, emotion, feeling, and consciousness are all sensory experiences, and their theater is the body.

Damasio leaves open the possibility that with practice the brain could itself sometimes simulate somatic markers via its working model of the body, without the body feedback loop. But as with other kinds of modeling, such as that of the external world via the senses, it is likely that this simulation process would deteriorate without the periodic recalibration of input from the body.

Mangan and Damasio's theories draw attention to some of the same aspects of fringe phenomena. For example, both direct attention to the elusiveness, fleetingness, and intangibility of important feeling states. Likewise, Mangan (2001) notes that fringe phenomena "finesse the limited capacity of consciousness by using just a few wisps of vague experience to represent summary facts about states of non-conscious information that are otherwise far too complex for direct conscious representation" (p. 17). This conception is intriguingly close to Damasio's (1994) speculations that somatic-marker phenomena help overcome the limited capacity of attention and working memory, which would otherwise be readily overwhelmed by a purely rational computative approach.

However, the two theories also develop quite different inferences about these phenomena, contrasting "cool" versus "warm" cognition. Mangan emphasizes that fringe phenomena perform a call function, like the menu bars and status bars on a computer screen: They indicate the potential availability of a great range of other specific information that may be accessed if needed for the problem at hand, and they provide a momentary target of attention that may be focused on to bring this information into consciousness. In contrast, Damasio (1994) emphasizes that somatic markers provide subjectively evaluative input that shapes thought implicitly, like an "automated alarm system" (p. 173): The person knows at a gut level, without necessarily having any access to the underlying information on which such knowing may be based. This idea is closer to Mangan's (2001) notion that fringe experience of rightness "indicates the degree to which a content in consciousness is compatible with vast amounts of context information not in consciousness ... radically condensing a mass of parallel information into a single index of integration" (p. 24). Note, however, that this contextualizing function of fringe experience is fully separable from Mangan's call function: The former does not imply the latter, nor even seem particularly consistent with it (that is, why should one be able to unpack such a globally computed goodness-of-fit index?).

To clarify the contrast between Mangan's theory and theories such as Damasio's, it is illuminating to consider certain cases of pathology. First, consider Damasio's (1994) description of a frontal patient:

I was discussing with the ... patient when his next visit to the laboratory should take place. I suggested two alternative dates, both in the coming month and just a few days apart from each other. The patient pulled out his appointment book and began consulting the calendar. ... For the better part of a half-hour, the patient enumerated reasons for and against each of

the two dates: previous engagements, proximity to other engagements, possible meteorological conditions, virtually anything that one could reasonably think about concerning a simple date. ... he was now walking us through a tiresome cost-benefit analysis, an endless outlining and fruitless comparison of options and possible consequences. (p. 193)

In one sense, this patient clearly has no problem with accessing potentially relevant, specific information -- quite the opposite. Indeed, perhaps we could think of his behavior as indicating that the call function of the fringe is running amok. However, the problem with this idea is that there is nonetheless a particular kind of information he is crucially lacking: subjectively evaluative input. Damasio (1994) makes the following comments:

This behavior is a good example of the limits of pure reason. It is also a good example of the calamitous consequence of not having automated mechanisms of decision making. ... None of us would have spent the amount of time the patient took with this issue, because an automated somatic-marker device would have helped us detect the useless and indulgent nature of the exercise. If nothing else, we would have realized how ridiculous the effort was. At another level, sensing the potentially wasteful approach, we would have opted for one of the alternative dates with the equivalent of tossing a coin or relying on some kind of gut feeling for one or the other date. Or we might have simply turned the decision over to the person asking the question and replied that it really did not matter, that he should choose. (p. 194)

In a rather literal sense, this patient's behavior is "senseless." That is, Damasio views it in terms of a failure of somatically mediated feeling to inform thought, rather than as some kind of colder information-processing defect.

As a second example, consider the rare but fascinating disorder called Capgras' syndrome, which Mangan discusses. How can we explain why some patients would come to believe that familiar people have been replaced by identical imposters? Mangan (2001) proposes that the disorder represents a dissociation between sensory and non-sensory levels of experience: "Someone suffering from Capgras' does not feel that anything has changed in what we might call the sensory information, but nevertheless believes that an absolutely fundamental change has occurred overall" (p. 22). Mangan speculates that the fringe experience of rightness has "reversed its polarity" (p. 22) and become a feeling of wrongness. This explanation suffers from vagueness about what the "non-sensory" realm is and how it could come to have reversed polarity. It also does not explain some relevant details of the disorder, such as why the delusion typically concerns only people very close to the patient, such as his or her parents.

In contrast, Ramachandran and Blakeslee (1998), developing the ideas of Ellis and Young (1990), explain Capgras' syndrome as a loss of the normal input of emotion and feeling to thought:

When any normal person ... encounters someone who is emotionally very close to him ... he expects an emotional 'glow,' a warm fuzzy feeling, to arise even though it may sometimes be experienced only very dimly. The absence of this glow is therefore surprising and [the patient's] only recourse then is to generate an absurd delusion -- to rationalize or explain it away. (Ramachandran & Blakeslee, 1998, p. 166)

The fact that this absence of expected emotion would not be so striking with less familiar people explains why the delusion applies only to those close to the patient.

In a case of a young man who thought his parents were imposters, Ramachandran was able to show that the patient lacked galvanic skin responses to pictures of his parents, quite unlike normal undergraduates. In addition, the centrality of emotional input to normal self-consciousness is indicated by this patient's difficulty with experiencing duplicates of himself, and wondering at times whether he was the "real Arthur" or "the other Arthur." Indeed, Ramachandran and Blakeslee (1998) explain Cotard's syndrome, a condition in which the patient claims he or she is dead, as an exaggerated form of Capgras' syndrome, in which virtually all stimuli evoke no feeling of emotional response.

In summary, as other realms of James' theorizing suggest, fringe feelings, as well as consciousness more generally, seem to have their roots in the sensations of the body and its mental representations. In a phrase that would have pleased James, Damasio (1999) notes, "The inescapable and remarkable fact about these three phenomena -- emotion, feeling, consciousness -- is their body relatedness" (p. 284).

## **5. What is the Nature and Function of Fringe Experiences?**

Mangan eventually focuses almost exclusively on the feeling of coherence or rightness, which he argues, following James, is by far the most important fringe phenomenon. However, earlier in his article he emphasizes the very wide range of different fringe experiences. We believe this more multifaceted emphasis is insightful and points in interesting directions.

Specifically, the overarching mission of the organism is not internally consistent (or coherent) computation; it is survival. What can it mean, in the long run, for thought to be in a "right" or a "wrong" direction? As Mangan (2001) notes, "Survival depends on finding the right response" (p. 20). Accordingly, we would direct attention to the evolutionary origins of fringe feelings: These are feelings that were originally intimately connected with various problems of survival and their solutions in the environment, and only later may have become more abstract. In addition, because there are many essential problems of survival, there are many kinds of fringe feelings. Different fringe feelings refer to different processes rooted in different underlying problems of survival.

According to this account, the role of fringe phenomena is not just the representation of information; it is motivation. Fringe feelings are not passive indicators, or as Mangan suggests, place markers awaiting the roving cursor of attention. Instead, they are dynamic forces, pushing thought in one direction or another. Recall the predicament of Damasio's frontal patient deciding between two dates: What he was missing is the normal motivation to move on to other things (e.g., feelings of frustration, effortfulness, or boredom). Protracted indecision, as well as devoting too much time to the inessential, is not trivial in terms of survival; rather, in the long run it would exact a considerable toll.

We can draw a very interesting parallel between Mangan's conception of fringe phenomena and Damasio's (1994, 1999) notion of "background feelings" -- feelings that although sometimes intense, tend to stay out of the foreground of the mind, and reflect the momentary inner states of the organism. Among such background feelings, Damasio (1999) specifically notes the feelings of harmony and discord, which James cited as the most important fringe feelings and which form the core of Mangan's notion of the feeling of rightness. In addition, belying the implication of the term "background," Damasio (1999) attributes an essential motivational role to background feelings:

Prominent background feelings include: fatigue; energy; excitement; wellness; sickness; tension; relaxation; surging; dragging; stability; instability; balance; imbalance; harmony; discord. The relation between background feelings and drives and motivations is intimate: drives express themselves directly in background emotions and we eventually become aware of their existence by means of background feelings. (p. 286)

This multiplicity of fringe feelings and the diversity of motivations that may be associated with them shed some light on Mangan's suggestion that what we have called "yedasentience" (Szechtman & Woody, 2002; Woody & Szechtman, 2000) may be the same thing as what he calls the feeling of rightness. In our own work, we were originally struck with the pervasive importance of the general phenomenon of feelings of knowing. For example, consider the apparently diverse pathological conditions of schizophrenic hallucinations and obsessive-compulsive disorder. These conditions seem to be the obverse of one another: In hallucinations, the perceived external stimulus is absent, yet the feeling of knowing is present; whereas in obsessive-compulsive behavior, the external stimulus (e.g., a locked door) is present, yet the feeling of knowing is absent (motivating repeated checking). The common underlying problem seemed to us to be difficulties in the feeling of what is real, or subjectively convincing.

More recently, we have become more concerned with delineating the motivational underpinnings of such phenomena. In particular, in our model of obsessive-compulsive disorder (OCD) (Szechtman & Woody, 2002), we define yedasentience as a particular type of feeling of knowing -- namely, "a phenomenological sign of goal-attainment [that] terminates thoughts, ideas or actions motivated by concerns of harm to self or others" (p. 19). Furthermore, our hypothesis is that failure to generate or experience this feeling produces the symptoms of OCD. Hence, although there is an important sense in which yedasentience may be generically related to Mangan's notion of the feeling of rightness,

they are not the same. There are different kinds of feeling to provide "our basal 'all is well' signal" (Mangan, 2001, p. 17): The feeling of rightness is about coherence versus incoherence of thought, whereas yedasentience is about security versus danger in one's environment.

Finally, in terms of brain regions, Mangan speculates that the feeling of rightness is frontally mediated. In keeping with our greater emphasis on the role of emotion, we have hypothesized that such processes are frontal-limbic (Szechtman et al., 1998). In this connection, a further indication that fringe feelings are diverse is that different regions of the prefrontal cortex seem to subserve quite different domains of behavior (Damasio, 1999). For example, the ventromedial areas are closely associated with emotionally guided control of social behavior, whereas the dorsolateral areas may be more closely associated with executive control of non-social problem solving, such as Mangan tends to focus on. In short, such localization of function provides additional evidence of several distinct motivational systems that nonetheless may operate with similar dynamics in consciousness.

## 6. How Can We Use Experiment and Clinical Pathologies to Investigate the Fringe?

As self-evident as fringe experiences may seem intuitively, there is still the considerable problem of how to investigate them empirically. How can we go about testing Mangan's ideas, or related ones such as Damasio's somatic marker hypothesis, and evaluating whether they are correct?

Here we focus on two major kinds of possibilities, using the feeling of rightness as an illustration. First, there may be manipulations that make it possible to dissociate this feeling from its normally precipitating events. For example, rather than the results of computation stimulating the system subserving the feeling of rightness, it is possible that a drug might turn on this system. Marijuana seems to have this kind of effect, with users reporting, for instance, "I think about things that seem intuitively correct, but which do not follow the rules of logic" (Tart, 1970, p. 703). We have argued that hypnosis may be another powerful way to isolate and manipulate fringe experiences (Szechtman et al., 1998; Woody & Szechtman, 2000a, b; see also Raz & Shapiro, 2002).

Mangan's citation of our work on obsessive-compulsive disorder and his discussion of Capgras' syndrome points to a second general strategy. We can look for pathologies that may be attributable to the dysfunction of the feeling of rightness. As Jaspers (1963) noted, "Conceptual reality carries conviction only if a kind of presence is experienced," but the nature of this feeling of presence tends to be obscure until it is "disturbed pathologically and so we appreciate that it exists" (pp. 93-94).

One might suggest that some pathologies are associated with an excess of the feeling of rightness (that is, its being turned on when not appropriate), and others with a deficit in it (that is, its failing to turn on when appropriate). At least some psychotic conditions have the quality of an excess of the feeling of rightness, in which a train of thought that others find pedestrian or even silly strikes the patient as wonderfully penetrating. After the Nobel-prize-winning mathematician John Nash became psychotic and believed that aliens from outer space were trying to communicate with him, a colleague asked him how such a powerful thinker, devoted to reason and logic, could believe such nonsense (Nasar, 1998). Nash replied that both kinds of idea had come to him in the same way -- with, one presumes, the same fringe feeling of rightness, the same sensation of making sense. By contrast, in other psychotic conditions and in depersonalization (and derealization) disorder, there is a persistent lack of the sense of rightness, such that people and things that were once very familiar come to feel strange, wrong, and unreal.

Likewise, a deficit in the feeling of rightness would seem to fit the epistemic struggles that Rapoport (1989) describes in some sufferers of OCD:

Obsessives have lost their ability to "know" certain simple things that we all constantly check for by some mechanism of which we are unaware, except when it doesn't work. This mechanism is not working for these patients at a level that astonishes me, for they are asking "How do you know" about things that we find ourselves hard put to explain: Is the grass really green? Are my eyes blue? "Why," I say, "we just *know*, that's all." (p. 96; emphasis in original)

Another possible effect of a deficit in the feeling of rightness might be lack of binding, or failure to use the sense of rightness to organize the flow of thoughts or the content of speech. Perhaps a condition such as Wernicke's aphasia, in which there is considerable fluency but no connecting thread at all, might be viewed in this way.

As mentioned earlier, our own current research is focusing not on feelings of rightness or coherence, but rather on the inner sense of security versus danger. We are using hypnosis to manipulate these feelings and thereby explore their relation to obsessive-compulsive behaviors.

## 7. Conclusion

Mangan is surely right that the elusiveness of our inner world of feeling tends to conceal its importance from us. We close with a passage from James' (1902/1977) conclusions in *The varieties of religious experience*, written more than a decade after he wrestled with fringe experience in *The principles of psychology*. Concerning the inner and outer world, he reverses the usual figure and ground:

Individuality is founded in feeling; and the recesses of feeling, the darker, blinder strata of character, are the only places in the world where we catch real fact in the making, and directly perceive how events happen, and how work is actually done. Compared with this world of living individualized feelings, the world of generalized objects which the intellect contemplates is without solidity or life. (p. 770)

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## References

- Buck, R. W. (2000). The epistemology of reason and affect. In J. C. Borad (Ed.), *The neuropsychology of emotion* (pp. 31-55). Oxford: Oxford University Press.
- Damasio, A. R. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York: Grosset/Putnam.
- Damasio, A. R. (1999). *The feeling of what happens: Body and emotion in the making of consciousness*. New York: Harcourt Brace.
- Dunlap, K. (1914). Images and ideas. *Johns Hopkins Circular*, 3, 25-41.
- Ellis, H. D., & Young, A. W. (1990). Accounting for delusional misidentifications. *British Journal of Psychiatry*, 157, 239-248.
- Jacobson, E. (1929/1938). *Progressive relaxation* (1st & 2nd editions). Chicago: University of Chicago Press.
- Jacobson, E. (1931). Electrical measurements of neuromuscular states during mental activities. VII. Imagination, recollection, and abstract thinking involving the speech musculature. *American Journal of Physiology*, 97, 200-207.
- James, W. (1890/1950). *The principles of psychology*. New York: Dover.
- James, W. (1899/1977). On a certain blindness in human beings. Reprinted in J. J. McDermott (Ed.), *The writings of William James: A comprehensive edition*. Chicago: University of Chicago Press.

James, W. (1902/1977). *The varieties of religious experience*. Reprinted in J. J. McDermott (Ed.), *The writings of William James: A comprehensive edition*. Chicago: University of Chicago Press.

Jaspers, K. (1963). *General psychopathology* (translated from the German by J. Henig and M. W. Hamilton). Chicago: University of Chicago Press.

Kolb, B., & Whishaw, I. Q. (2001). *An introduction to brain and behavior*. New York: Worth.

Mangan, B. (2001). Sensation's ghost: The non-sensory "fringe" of consciousness. *PSYCHE*, 7(18). <http://psyche.cs.monash.edu.au/v7/psyche-7-18-mangan.html>

Malmo, R. B., & Malmo, H. P. (2000). On electromyographic (EMG) gradients and movement-related brain activity: Significance for motor control, cognitive functions, and certain psychopathologies. *International Journal of Psychophysiology*, 38, 145-209.

Nasar, S. (1998). *A beautiful mind: A biography of John Forbes Nash, Jr., winner of the Nobel Prize in Economics, 1994*. New York: Touchstone/Simon & Schuster.

Putnam, H. (1981). *Reason, truth, and history*. Cambridge, England: Cambridge University Press.

Ramachandran, V. S., & Blakeslee, S. (1998). *Phantoms in the brain: Probing the mysteries of the human mind*. New York: William Morrow.

Raz, A., & Shapiro, T. (2002). Hypnosis and neuroscience: A cross talk between clinical and cognitive research. *Archives of General Psychiatry*, 59, 85-90.

Rousseau, J.-J. (1979). *The reveries of the solitary walker* (translated by C. E. Butterworth). New York: New York University Press.

Szechtman, H., & Woody, E. (2002). *Obsessive-compulsive disorder as a disturbance of security motivation*. Unpublished manuscript, McMaster University, Hamilton, Ontario, Canada.

Szechtman, H., Woody, E., Bowers, K. S., & Nahmias, D. (1998). Where the imaginal appears real: A positron emission tomography study of auditory hallucinations. *Proceedings of the National Academy of Sciences*, 95, 1956-1960.

Tart, C. T. (1970). Marijuana intoxication: Common experiences. *Nature*, 226, 701-704.

Thomas, N. J. T. (1989). Experience and theory as determinants of attitudes toward mental representation: The case of Knight Dunlap and the vanishing images of J. B. Watson. *American Journal of Psychology*, 102, 395-412.

- Washburn, M. F. (1916). *Movement and mental imagery*. Boston: Houghton Mifflin.
- Woody, E., & Szechtman, H. (2000a). Hypnotic hallucinations: Toward a biology of epistemology. *Contemporary Hypnosis*, 17, 4-14.
- Woody, E., & Szechtman, H. (2000b). Hypnotic hallucinations and yedasentience. *Contemporary Hypnosis*, 17, 26-31.