

PHANTOM LIMB PHENOMENON:
THE EXPECTATION FACTOR OF SENSATION
Sandra Moorhouse

In a society that believes it has achieved through science a relatively objective view of the body and mind, it is telling to take a second look at the phenomena that surprise us. According to Thomas Aquinas, a philosopher and theologian of the thirteenth century, one of the unifying characteristics of mankind is the "*libido sciendi*," or the "urge to know," which, according to Jacques Schlanger in "Wanting to Know What Cannot Be Known," is still apparent and very applicable today (167). Researchers currently seek out relationships between the body and mind that are mainly cause-and-effect relationships, and because the *libido sciendi* is so motivated to see these relationships, it may even create them. To give a few examples, these findings imply that chemical imbalances in the brain influence a person's mental health, that medicine directly affects the way the body works, and that topics that cannot be understood without a cause-and-effect relationship are not truly a part of science. The mind works in much more complex ways, however. Our health most likely involves many factors, some biogenic but some psychogenic, some that we may delve into and understand completely and others that might never be understood. The phantom limb phenomenon—sensation occurring in amputated, absent limbs—is one such ambiguity that is surprising, confusing and a bit jarring to the current understanding of how sensation works. Sensation is usually thought to come from direct contact between the body and some sort of stimulus. However, phantom limb phenomenon of sensation in the absence of stimulus disrupts the current view of sensation by introducing the unexpected role of expectation in sensation, a dissonance that hinders the *libido sciendi* in its ability to accurately pursue an understanding of sensation.

The phantom limb phenomenon, as Lawrence Coleman Kolb explains in *The Painful Phantom*, occurs when a patient has experienced amputation of a limb, usually the arm or the leg, but also rarely of the genitalia, breasts and the nose (12). Sometimes amputees experience a phantom limb "sensation," tingling or awareness in the space of the missing limb that causes them to feel as if the limb is actually there. There is also "phantom limb pain," which is painful sensation coming from the area of the missing limb (6). Phantom limb sensation is reported in up to ninety-

five percent of amputees, whereas phantom limb pain only occurs in sixty to eighty percent, which is actually a large number if one considers how amazing it is that it happens at all (Jones 3 and Woodhouse 1). The *libido sciendi* has adopted a one-variable, cause-effect view of sensation which infers that one ought to be able to sense an object that is in direct contact with his body, and one ought not to be able to feel an object that has not touched him. Moreover, an arm that is attached to the body should be constantly sending the brain low-priority signals about its presence and position even when it is not in use, but a limb that is amputated—if the process of sensation is a one-way path of stimulation toward the brain—surely cannot signal its presence to the brain. This is the seamless yet improper understanding of sensation that the mind wishes to uphold. However, the fact that the *vast majority* of amputees experience sensation in their phantom limbs provides a convincing argument that something is very misunderstood about the relationship between the body and mind.

Because phantom limb phenomenon challenges preconceptions concerning sensation, it has not been fully integrated into the common view of the body and mind. Unfortunately, it is a human tendency to push away evidence that does not cooperate with one's present views rather than revising these views or getting rid of them all together. According to Elliott Valenstein in *Blaming the Brain*, "Kuhn maintains that a scientific theory or 'paradigm' tends to be accepted despite much contradictory data unless there is another theoretical paradigm to replace it." In one case, "all kinds of 'accessory' explanations [were] dug up in order to explain away the contradictory data, rather than admitting that the theory is probably wrong" (121). Don Mitchell's "stall theory," elaborated in the article "Stall Theory: The Mindsets that Stall Civilization's Progress," builds on Kuhn's ideas, claiming that it will take a very long time for new ideas to prevail even if they are more correct (1). In the past, according to Mitchell, "Delays, or 'Civilization Stalls' existed because people were used to doing things the way they had always done them and were bound by certain ways of thinking," which retarded the progress of new incoming information (1). In the same way, the phantom limb phenomenon does not cooperate well with society's current view of the relationship between the body and mind. Society dismisses new information that it cannot integrate into current understandings because the *libido sciendi* desires to have a theory—even an outdated theory—as long as that theory satisfies the desire to feel informed.

It is enlightening to analyze the nature of the phantom limb phenomenon, especially because it highlights the central roles of stimulation *and* expectation in sensation in both intact and amputated limbs. In a recent experiment done by the Department of Nuclear Medicine and Neurology at the Munich University of Technology, Dr. Frode Willoch and his colleagues used hypnotism and positron emission tomography to show that the sensation that amputees experience is not at all unreal. After studying the patterns of neuronal firings that occur while hypnotically suggesting movements and positions of the amputee's phantom limbs, these scientists concluded that "in terms of the amputee's judgments, hypnotic suggestions did not produce 'as-if-feelings,' but vivid and real phantom sensations experienced daily" (848). The phantom limb phenomenon is not a myth; it truly is the same feeling that occurs in normal limbs. It is critical to remember that in Willoch's experiment hypnotism, not a physical stimulus, promoted sensations. To say that a physical stimulus must be present is wrong; Willoch's experiment gives a clear example of when sensation occurred solely on the basis of the psychological suggestion that the sensation was occurring.

The ability of amputees to experience sensation through both hypnotic suggestion and regular daily activity originates in the fact that the expectation of a sensation can actually cause that sensation to occur. Usually, expectation comes into play and creates a sensation when momentary visual clues, like watching an object touch the opposite limb in a mirror, combine with a *lasting body image*— a mental image of the body's size and shape. During infancy, humans explore their body parts and connect the sensations they receive from proprioceptors (receptor cells that tell of the body's position in space) and sensory neurons to the visual clues telling them what body part they are simultaneously touching or moving (Kolb 8). Since it would be very inefficient to rediscover the size and shape of the body at every moment as an adult, the mind acquires an ongoing impression of where the body ends and where the rest of the world picks up, relying heavily on this impression for self-awareness. When a person receives a visual or hypnotic clue suggesting that a sensation might occur in the near future, he or she *expects* the sensation to occur, thereby *causing* it to occur. Willoch found that phantom limb sensation occurs through "the same central nervous processes that underlie the experience of the body when it is intact," implying that the way sensation works in phantom limbs is similar to the way sensation works in intact limbs (845). In fact, phantom limb phenomenon is an

example of sensation occurring through expectation alone, whereas sensation in intact limbs occurs through a combination of stimulation and expectation.

The question remains concerning why society finds the combination of expectation and stimulation so difficult to integrate into its image of the body and mind. Part of the reason is that personal body image develops subconsciously and automatically, making people misunderstand its nature. Body image is an ongoing awareness of the body's shape and size, meant to last through distractions, daydreaming, and the sleep cycle. It has enough resilience to last through an amputation for some time as well, since a person may still feel like the missing limb is present even after the amputation. Kolb refers to this as "the patient's enduring concept of his total body image" (8). However, many people misconstrue awareness of the body's size and shape as coming from moment-by-moment incoming signals that must be present in order for an understanding of the body's shape to occur. This is why they expect an amputee to immediately know that his limb is gone and have a new proper understanding of the size and shape of the remaining stump. When they hear of the phantom limb phenomenon occurring, it appears that the amputee's mind is ignoring the body's moment-by-moment signals that tell of the limb's new shape and size. This phenomenon, therefore, threatens the cause-effect view of the body and mind that the *libido sciendi* has already assumed as truth. It is often easier to ignore this phenomenon and "stall" than it is to revise the accepted views of sensation.

Although the phantom limb phenomenon appears to be a fault of the human mind, it actually exposes the "enduring" aspect of body image. Specifically, society as a whole sees the "enduring concept of [an amputee's] total body image" as a contradiction or a lack of communication between body and mind that occurs after amputation (Kolb 8). Really, we must be reminded that *everyone's* body image is "enduring" and that this "enduring" aspect of body image is what makes it useful and efficient on an everyday basis by eliminating the need to relearn the difference between self and non-self at every waking moment (8). The details of phantom limb phenomenon support this idea that body image is "enduring" though adaptable, since those who have built up a sufficient body image before amputation can only gradually and minimally change its nature after amputation. Someone who does not know about or believe in the "enduring" nature of body image, which is still not fully understood, would probably view an amputee's perceptions as illogical or lagging

behind. Strong resistance is met here by the human tendency to prefer an existing faulty view over the acknowledgment of an ambiguous case example that might never be understood. According to an article entitled "Inquiring Minds," "we must never underestimate the human desire to understand the world around us—not merely to acquire better control of the world, but to satisfy our yearning for understanding" (2). This "yearning for understanding," similar to the *libido sciendi's* "urge to know," will compromise its natural inclination to search and inquire when met with the threat of never fully understanding a phenomenon, resulting in the maintenance of the outdated stimulation-only view of sensation.

Tied in with the moment-by-moment model of body image is a lack of value given to the expectation factor involved in sensation in intact limbs, which can be explained by William James' Theory of Practical Realities (7). Those with intact limbs are usually unaware of the role expectation plays in their experience of sensation because the stimulation factor is not usually removed; stimulation is normally given the full credit for a sensation that occurred. Additionally, people tend to use only their own concrete experiences when forming theories about the world. According to James, distant concepts and abstract theories are held at a distance until they can be integrated into one's own "sense" of the world, which rarely happens (7). In James' words,

[e]ach thinker...has dominant habits of attention; and these *practically elect from among the various worlds some one to be for him the world of ultimate realities*. From this world's objects he does not appeal. Whatever...positively contradicts them must get into another world or die. (James 7)

Each person commits himself to one set of ideas that seem to work together, constantly ignoring evidence that contradicts these ideas. That is why, even if people hear of Willoch's experiment, they might still categorize their own type of sensation as relying on stimulation, and, if they even believe that phantom limb sensation occurs, they isolate it as a rare case of relying on expectation. However, *everyone's* mind is so flexible that it can be fully convinced and affected by something that might not even exist, at least in society's terms of being real. If *any* individual is put in conditions where it *seems* that stimulation is occurring on their body, a sensation will occur simply out of expectation. V. S. Ramachandran, M.D., found ways to recreate the phantom limb effect in a non-amputee, using visual suggestions

produced with mirrors and dummy hands to create tactile sensation in body parts that were not being touched. These experiments left even Ramachandran astonished that the knowledge of one's own body "should be negated by just a few seconds of the right kind of sensory stimulation" (1). As James explains, people refuse to integrate such convincing evidence of expectation's role in sensation as a defensive way of upholding the set of ideas about the world to which they are already committed.

Another cause of resistance to the new view of sensation is that people are very reluctant to apply general findings to their own lives. This cognitive fallacy is very similar to that which Neil D. Weinstein terms "optimistic biases about personal risks," meaning that people think they can beat the odds reported by statisticians when faced with risks to their health or success (1232). In the same way, even when one has clearly seen the new discovery of sensation occurring only on the basis of expectation, he or she still tends to return to the stimulation-only view when looking back at the way his or her own body works. The amount of credit given to stimulation in causing a sensation is unreasonably high relative to the amount of credit given to expectation. Very few people whose bodies are intact look at their everyday sensations as relying at least partially on the expectation that a sensation is about to occur. The cause for this resistance in applying scientific findings to oneself comes from a similar motivation as the one causing Weinstein's "optimistic biases about personal risks" (1232). People tend to disbelieve the things that science discovers about their lives because they believe their understanding of their own bodies ought to be at least as good as anything a scientist or statistician can know about them. Phantom limb sensation may help scientists to understand sensation in intact limbs, but most people will resist applying these findings when looking at their own sensations.

Even though the ongoing desire of the *libido sciendi* to research, learn and improve is supposedly one of the unifying characteristics of mankind, many aspects of it divide people from understanding one another and themselves. The human tendency to only pay attention to "practical realities," or the experiences that can be sensed firsthand, makes people less respectful of the significance of others' experiences. This is part of the reason why it is difficult to understand the phantom limb phenomenon; many people can only see expectation happening by stimulation and they undermine any other points of view. They cannot fully *believe* in the phantom limb phenomenon because the "optimistic bias about personal risks" causes

the individual to put his own experiences above that of others. Unfortunately, these faults of the human mind too often amount to people undermining the amputee's complaints of pain. For this reason, it is absolutely necessary to create as much awareness as possible about the phenomenon as a real part of amputation and refute its reputation as a myth. If society can realize its own resistance towards the phantom limb phenomenon, perhaps it can better understand those who experience it every day, and move forward in its understanding of sensation.

By studying the way society thinks about phantom limb phenomenon, one can gain much insight into human nature. The facts clearly show that phantom limb phenomenon is real and occurs by expectation, but people are very resistant to accepting the phenomenon because of multiple faulty tendencies of the human mind. The *libido sciendi* is constantly motivating people to understand the world. It must make compromises, however, because in order to uphold a sensible world it tends to ignore the areas that do not make sense on a superficial level. A case like the phantom limb phenomenon is held at a distance, and people interpret sensation without it if it is not a "practical reality" to them (James 7). One's *libido sciendi* may even admit that expectation works in creating sensation for amputees, but it may be unable to apply scientific conclusions about expectations on a personal level. This explains why, when studies show that sensation occurs by both expectation and stimulation, people still revert to the idea that intact bodies are somehow different, operating by stimulation while phantom limbs operate by expectation. Also, the *libido sciendi* seeks logic. The human mind is set up to make sense of the world, which often tempts it to be satisfied by a superficial view, if that happens to be somewhat logical. While the phantom limb phenomenon is discomforting to those that adhere to the stimulation-only view of sensation, a deeper look reminds them that the "enduring" nature of body image makes phantom limb phenomenon logical. Perhaps the most important influence in society's resistance to the phantom limb phenomenon is that, like Thomas Kuhn claimed, people are more likely to scramble to maintain a faulty theory than to change the theory or have no theory at all. Psychologically, it is very difficult to admit that we do not always know why the world works the way it does.

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COMMENTARY: Elizabeth Varall

While today's society is very aware of how little we know about the human brain, the phenomena that give us the most information are the ones we push away. Moorhouse explains the mind's stubborn and manipulative *urge to know* through the phantom limb phenomenon, exhibiting how the mind we try so hard to understand is actually tricking us in its refusal to accept the unexpected, resulting in what is apparently a very troubling mind-and-body disconnection. We must be aware of this

disjunction and accept that we all experience it, even those of us who know about or even experience this phenomenon ourselves, in order to better understand how the mind works. A general denial of this disconnect makes it difficult, if not impossible, for us to accept that our minds and bodies work differently than we believe.

This denial, however, can also be difficult to accept. Moorhouse argues that people cannot accept what science proves about their minds and bodies to be different from their personal perceptions about themselves, but is this really the case? Does everyone have a hard time believing they have cancer or HIV simply because they don't feel sick? And how does this argument explain hypochondriacs who convince themselves that they will fall ill after having been exposed to another sick person? Doesn't that involve as much expectation as phantom limb sensation?

Moorhouse also argues that, despite accepting surprising scientific findings in terms of others, people have a difficult time applying the same findings to themselves. It would appear that our *urge to know* prevents us from understanding how our minds work in favor of a more rational, stimulation-only perception, but shouldn't this same urge motivate the need for understanding the existence of phenomena like phantom limb sensation in the first place? If society in general really denies the existence of phantom limb phenomenon, how do they explain the multitudes of studies and testimonies from amputees who insist that it is real? Shouldn't the *libido sciendi* have a rational explanation for that, too?

In general, Moorhouse's essay provides a very insightful look into an often overlooked and fascinating phenomenon. She asks some very interesting and difficult questions, forcing us to think about the more uncomfortable details of human mind and acknowledge that even a seemingly simple idea, like the perception of sensation, is a mystery. As she emphasizes, we must be willing to learn more about this area of the brain in order to gain a better understanding of how our minds and bodies work.