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Cosmological Implications of Near-Death Experiences

Bruce Greyson
University of Virginia, University of Virginia Health System,
210 10th Street, NE, Suite 100, Charlottesville, VA 22902-4754

Abstract

"Near-death experiences" include phenomena that challenge materialist reductionism, such as enhanced mentation and memory during cerebral impairment, accurate perceptions from a perspective outside the body, and reported visions of deceased persons, including those not previously known to be deceased. Complex consciousness, including cognition, perception, and memory, under conditions such as cardiac arrest and general anesthesia, when it cannot be associated with normal brain function, requires a revised cosmology anchored not in 19th-century classical physics but rather in 21st-century quantum physics that includes consciousness in its conceptual formulation. Classical physics, anchored in materialist reductionism, offered adequate descriptions of everyday mechanics but ultimately proved insufficient for describing the mechanics of extremely high speeds or small sizes, and was supplemented a century ago by quantum physics. Materialist psychology, modeled on the reductionism of classical physics, likewise offered adequate descriptions of everyday mental functioning but ultimately proved insufficient for describing mentation under extreme conditions, such as the continuation of mental function when the brain is inactive or impaired, such as occurs near death.

KEY WORDS: materialism, reductionism, near-death experience, mind-body problem, consciousness

1. Introduction to Near-death Experiences

Many but not all neuroscientists, physicists, and psychologists believe the mind and consciousness are produced by, or are subjective concomitants of, brain states (Crick, 1994; Damasio & Meyer, 2009; Searle, 2000). This theory receives considerable support from the correlation between brain changes and mental changes: inhibiting brain activity generally inhibits mental activity (Churchland, 1986; Jeeves & Brown, 2009; Tononi & Laurys, 2009). However, correlation is not the same as causation. For example, it is well established that the frontal lobes control or mediate perceptual and other cognitive activities through inhibition (Joseph 1988, 1999a). It is in this manner that concentration and attention may be maintained, so that the *mind* remains focused. On the other hand, it is also well established that injuries to specific regions of the brain disrupt various aspects of consciousness and mental activity, including thinking, speech, and awareness of the body image (Joseph 1986, 1996, 1999b).

Thus the production model posits that the brain generates the mind (Churchland, 1986; Crick, 1994; Searle, 2000), whereas the filter or transmission model posits that the brain may permit or mediate the mind (Broad, 1953; Burt, 1968; Huxley, 1954; James, 1898; Kelly, 2007; Schiller, 1891). By contrast, the evidence compiled by Joseph (1996, 1999b, 2001) could be said to support both views. Likewise, it is the opinion of this author that the observed correlation between brain states and mind states is compatible with the "production" theory that mind is produced by the brain, but it is also compatible with the "filter" or "transmission" theory that the mind is filtered, focused, limited, constrained, or received by the brain; i.e. that the brain may be a vehicle which receives, transports, and transmits, but is not synonymous with the mind. These and other models of the brain-mind relationship have been debated for centuries, with discussions appearing even in the Platonic dialogues (Kelly, 2007).

One major clue to the nature of the mind-brain relationship may be found in descriptions of near-death, or after death experiences. If the mind, if *consciousness* is retained during clinical death, this would indicate the mind may only be dependent on the brain much as a radio transmission is dependent upon a receiver and broadcast unit.

Dozens of case reports in the medical literature spanning centuries have documented the phenomenon of "terminal lucidity," the unexplained return of mental clarity and memory shortly before death in patients who had suffered years of chronic schizophrenia or dementia (Brierre de Boismont, 1862; Burdach, 1826; Marshall, 1815; Nahm & Greyson, 2009; Turetskaia & Romanenko, 1975). Beyond this paradoxical enhanced mental clarity while brain function deteriorates, considerable

research in the past several decades has delineated parameters of what have come to be called "near-death experiences", where those who appear to have *died* report dissociative experiences where they are separate from their bodies and can observe and are conscious of their surroundings. These profound subjective experiences that many people report when they are near death pose challenges to the materialist mind-brain production model (Greyson, 2003; Parnia et al., 2001; Schwartz et al., 2005; van Lommel et al., 2001).

Experiences of heightened or mystical consciousness on the threshold of death have been described sporadically in the Western medical literature since the 19th century and have been studied systematically for the past 30 years (Holden et al., 2009). Recent research suggests that near-death experiences (NDEs) are reported by 12% to 18% of cardiac arrest survivors (Parnia et al., 2001; Greyson, 2003; van Lommel et al., 2001). These near-death experiences include feelings of peace and joy; a sense of being out of one's physical body and watching events from an out-of-body perspective; a cessation of pain; seeing an unusually bright light, sometimes experienced as a "Being of Light" that radiates love and may speak or otherwise communicate with the person; encountering other beings, often deceased people; experiencing a revival of memories or even a full life review, seeing some "other realm," often of great beauty; sensing a barrier or border beyond which the person cannot go; and returning to the physical body, often reluctantly.

A number of hypotheses have been proposed to explain NDEs within the mind-brain production theory, attributing them to psychopathology (Noyes & Kletti, 1976; Pfister, 1930), unique personality traits (Gow, Lane, & Chant, 2003; Lynn & Rhue, 1988), altered blood gases (Whinnery, 1997), neurotoxic metabolic reactions (Carr, 1982; Jansen, 1997), or alterations in brain activity (Morse, Venecia, & Milstein, 1989; Saavedra-Aguilar & Gómez-Jeria, 1989).

Joseph (1996, 1999b, 2001), for example, has provided considerable data of near-death like dissociative experiences following abnormal activation or electrode stimulation of temporal lobe structures which include the amygdala and the hippocampus. According to Joseph, these latter structures play important roles in emotional and cognitive memory, and may explain the "life review"; the phenomenon where victims see their "life flash before their eyes." He also argues that since the hippocampus and overlying temporal lobe structures are involved in vision, the cognitive mapping of the visual environment, and the processing of the upper visual field, they may contribute to the

dissociative experience of floating above the body during near death and when these structures are activated by electrode. Although he raises the possibility these are hallucinations, he also reports on those who died and who were able to correctly described their surroundings including doctors and nurses who attended to them while they were dead.

Although the theories and evidence provided by Joseph (1996, 1999b, 2001a) and others is intriguing, they only provide empirical support and address only selected aspects of the phenomena (Greyson et al., 2009). The most important objection to the adequacy of all such reductionistic hypotheses is that mental clarity, vivid sensory imagery, a clear memory of the experience, and a conviction that the experience seemed more real than ordinary consciousness are the norm for NDEs. They occur even in conditions of drastically altered cerebral physiology under which the production theory would deem consciousness impossible.

2. Physiology of General Anesthesia and Cardiac Arrest

NDEs are typically triggered when patients are clinically near death, such as following catastrophic physical traumas, or during cardiac arrest or some other, usually sudden, loss of vital functions. In one study of 1595 consecutive admissions to a cardiac care unit, NDEs were reported 10 times more often by patients who had survived definite cardiac arrest than by patients with other serious cardiac incidents (Greyson, 2003). The incompatibility of NDEs with the mind-brain production theory is particularly evident in connection with experiences that occur under two conditions, namely, general anesthesia and cardiac arrest.

In our collection at the University of Virginia, 22% of our NDE cases occurred under anesthesia, and they include the same features as other NDEs, such as out-of-body experiences that involved watching medical personnel working on the body, an unusually bright or vivid light, meeting deceased persons, and thoughts, memories, and sensations that were clearer than usual.

John et al. (2001) identified reliable electroencephalographic (EEG) correlates of loss and recovery of consciousness during general anesthesia. Their results confirmed the standard thinking about anesthesia and EEG, namely, that unconsciousness is associated with a profound reduction in brain activity under anesthesia. Additional results supportive of this conclusion derive from other recent functional imaging

studies that have looked at blood flow, glucose metabolism, or other indicators of cerebral activity under general anesthesia (Alkire, 1998; Alkire et al., 2000; Shulman et al., 2003; White & Alkire, 2003). In these studies, brain areas essential to the global workspace are consistently greatly reduced in activity individually and may be decoupled functionally, thereby providing considerable evidence against the possibility that the anesthetized brain could produce clear thinking, perception, or memory.

The situation is even more dramatic with regard to NDEs occurring during cardiac arrest, many of which in fact occur also in conjunction with major surgical procedures involving general anesthesia. In four published studies alone, more than 100 cases of NDEs occurring during cardiac arrest were reported (Greyson, 2003; Parnia et al., 2001; Sabom, 1982; van Lommel et al., 2001). Like NDEs that occur with general anesthesia, those that occur in connection with cardiac arrest include the typical features associated with NDEs, including enhanced sensation and mentation, out-of-body experiences, and visions of deceased acquaintances.

However, in cardiac arrest, cerebral functioning shuts down within a few seconds. With circulatory arrest, blood flow and oxygen uptake in the brain plunge to near-zero levels. EEG signs of cerebral ischemia are detectable within 6-10 seconds, and progress to isoelectricity (flat-line EEGs) within 10-20 seconds (DeVries et al., 1998; Vriens et al., 1996). In sum, full arrest leads rapidly to the three major clinical signs of death: absence of cardiac output, absence of respiration, and absence of brainstem reflexes (Parnia & Fenwick, 2002; van Lommel et al., 2001).

Defenders of the mind-brain production theory might object that even in the presence of a flat-lined EEG there still could be undetected brain activity going on; current scalp-EEG technology detects only activity common to large populations of neurons, mainly in the cerebral cortex. However, the issue is not whether there is brain activity of *any* kind whatsoever, but whether there is brain activity of the specific form agreed upon by contemporary neuroscientists as the necessary condition of conscious experience. Activity of this form *is* eminently detectable by current EEG technology, and it is abolished either by general anesthesia or by cardiac arrest.

In cardiac arrest, even neuronal action-potentials, the ultimate physical basis for coordination of neural activity between widely separated brain regions, are rapidly abolished (Kelly et al., 2007). Moreover, cells in the hippocampus, the region thought to be essential for memory formation, are especially vulnerable to the effects of anoxia

(Vriens et al., 1996). In short, it is not credible to suppose that NDEs occurring under conditions of general anesthesia, let alone cardiac arrest, can be accounted for in terms of some hypothetical residual capacity of the brain to process and store complex information under those conditions.

A second defense of the mind-brain production theory for NDEs is to suggest that these experiences do not occur during the actual episodes of brain insult, but before or just after the insult, when the brain is more or less functional (Augustine, 2007; Rodabaugh, 1985).

However, unconsciousness produced by cardiac arrest characteristically leaves patients amnesic and confused for events immediately preceding and following these episodes (Aminoff et al., 1988; Parnia & Fenwick, 2002; van Lommel et al., 2001). Furthermore, a substantial number of NDEs contain apparent time "anchors" in the form of verifiable reports of events occurring during the period of insult itself. For example, a cardiac-arrest victim described by van Lommel et al. (2001) had been discovered lying in a meadow 30 minutes or more prior to his arrival at the emergency room, comatose and cyanotic, and yet days later, having recovered, he was able to describe accurately various circumstances occurring in conjunction with the ensuing resuscitation procedures in the hospital.

3. Relevance of Near-Death Experiences to Cosmology

Until the early 20th century, it was plausible to base a scientific cosmology on materialist reductionism, the idea that any complex phenomenon could be understood by reducing it to its individual components, and eventually down to elementary material particles. This worldview implied that all complex psychological phenomena could ultimately be understood in material terms. This materialist cosmology influenced psychology as it did other sciences, even though this reductionism required mainstream academic psychologists to ignore consciousness as the subject was viewed as "not scientific." Materialist psychology was epitomized by Watson, who asserted: "Psychology, as the behaviorist views it, is a purely objective, experimental branch of natural science which needs consciousness as little as do the sciences of chemistry and physics" (1914, p. 27). However, while Watson was aligning behaviorist psychology with classical mechanics, physicists were already moving beyond that model with a quantum physics that could not be formulated without reference to consciousness.

Classical dynamics adequately described the motion of macroscopic objects moving at everyday speeds; it was only the investigation of extraordinary circumstances, involving objects moving with velocities approaching the speed of light or the behavior of microscopic wave-particles, that revealed the limits of the classical model and the need for additional explanatory paradigms. So too with the question of the mind-brain relationship: it is the exploration of extraordinary circumstances of mental function that reveal the limitations of the production theory and the need for a more comprehensive theory of mind-brain interaction.

4. Near-Death Experiences and the Mind-Brain Production Theory

Although many 20th-century physicists, psychologists and neuroscientists accepted the reductionistic model that brain produces mind, or indeed is the mind (Churchland, 1986; Crick, 1994; Damasio, 1999; Pinker, 1997), several features of NDEs call into question whether materialist reductionism will ever provide a full explanation of *mind*, including and most notably enhanced mental processes, accurate out-of-body perception, and visions of deceased relatives and close friends (Greyson, 2010a).

Perhaps the most important of these features, because it is so commonly reported in NDEs, is the occurrence of enhanced mental activity at times when, according to the mind-brain production model, such activity should be diminishing, if not impossible. Individuals reporting NDEs often describe their mental processes during the NDE as remarkably clear and lucid and their sensory experiences as unusually vivid, surpassing those of their normal waking state.

A recent analysis of several hundred NDE cases showed that 80% of experiencers described their thinking during the NDE as "clearer than usual" or "as clear as usual" (Kelly et al., 2007, p. 386). An analysis of the medical records of people reporting NDEs showed that, in fact, people reported enhanced mental functioning significantly more often when they were actually physiologically close to death than when they were not (Owens et al., 1990).

An example of enhanced mental functioning during an NDE is a rapid revival of memories that sometimes extends over the person’s entire life. An analysis of several hundred NDEs showed that in 24% of them there was a revival of memories during the NDE (Kelly et al., 2007, p. 386). Moreover, in contrast to the isolated and often just single brief memories evoked during cortical stimulation, memories revived during an

NDE are frequently described as an almost instantaneous "panoramic" review of the person’s entire life (Noyes & Kletti, 1977; Stevenson & Cook, 1995).

Another important feature of NDEs that the mind-brain production theory cannot adequately account for is the experience of being out of the body and perceiving events that one could not ordinarily have perceived. A recent analysis of several hundred cases showed that 48% of near-death experiencers reported seeing their physical bodies from a different visual perspective. Many of them also reported witnessing events going on in the vicinity of their body, such as the attempts of medical personnel to resuscitate them (Kelly et al., 2007). The mind-brain production theory could attribute the belief that one has witnessed events going on around one’s body to a retrospective imaginative reconstruction based on a persisting ability to hear, even when unconscious, or to the memory of objects or events that one might have glimpsed just before losing consciousness or while regaining consciousness, or to expectations about what was likely to have occurred (Saavedra-Aguilar & Gómez-Jeria, 1989; Woerlee, 2004).

Such explanations are inadequate, however, for several reasons. First, memory of events occurring just before or after loss of consciousness is usually confused or completely absent (Aminoff et al., 1988; Parnia & Fenwick, 2002; van Lommel et al., 2001). Second, anecdotal reports that adequately anesthetized patients retain a significant capacity to be aware of or respond to their environment in more than rudimentary ways—let alone to hear and understand—have not been substantiated by controlled studies (Ghoneim & Block, 1992, 1997).

The phenomenology of awakenings under anesthesia is altogether different from that of NDEs, and often extremely unpleasant, frightening, and even painful, typically brief and fragmentary, and primarily auditory or tactile, but not visual (Osterman et al., 2001; Spitellie et al., 2002). There is no convincing evidence that memories of complex sensory experiences occurring during general anesthesia could have been acquired by the impaired brain itself during the period of unconsciousness.

Furthermore, any such explanatory claims are even less credible when, as commonly happens, the specific sensory channels involved in the reported experience have been blocked as part of the surgical routine—for example, when visual experiences are reported by patients whose eyes were taped shut during the relevant period of time.

Sabom (1982) carried out a study specifically to examine whether claims of out-of-body perceptions could be attributed to retrospective reconstruction. He interviewed patients who reported NDEs in which they seemed to be watching what was going on around their body, most of them cardiac patients who were undergoing cardiopulmonary resuscitation (CPR) at the time of their NDE. He also interviewed "seasoned cardiac patients" who had not had an NDE during their cardiac-related crises, and asked them to describe a cardiac resuscitation procedure as if they were watching from a third-person perspective. He found that 80% of the comparison patients made at least one major error in their descriptions, whereas none of the NDE patients made any (pp. 87–115). Sartori (2008) recently replicated Sabom's findings in a five-year study of hospitalized intensive care patients, in which patients who reported leaving their bodies during cardiac arrests described their resuscitations accurately, whereas every cardiac arrest survivor who had not reported leaving the body described incorrect equipment and procedures when asked to describe their resuscitation.

An even more difficult challenge to the mind-brain production theory comes from NDEs in which experiencers report that, while out of the body, they became aware of events occurring at a distance or that in some other way would have been beyond the reach of their ordinary senses even if they had been fully and normally conscious. Clark (1984) and Owens (1995) each published a case of this type, and we have reported on 15 cases, including seven cases previously published by others and eight from our own collection (Cook et al., 1998; Kelly et al., 2000), including accurate perceptions of highly unexpected or unlikely details. Additionally, Ring and Cooper (1997, 1999) reported 31 cases of blind individuals, nearly half of them blind from birth, who experienced during their NDEs quasi-visual and sometimes veridical perceptions of objects and events. One criticism of these reports of perception of events at a distance from the body is that they often depend on the experiencer's testimony alone. However, many cases have in fact been corroborated by independent witnesses (Clark, 1984; Hart, 1954; Ring & Lawrence, 1993; van Lommel et al., 2001; Cook et al., 1998).

In a recent review of 93 published reports of potentially verifiable out-of-body perceptions during NDEs, Holden (2009) found that 43% had been corroborated to the investigator by an independent informant, an additional 43% had been reported by the experiencer to have been corroborated by an independent informant who was no longer available to be interviewed by the investigator, and only 14% relied solely on the experiencer's report. Of these out-of-body perceptions, 92% were completely accurate,

6% contained some error, and only 1% was completely erroneous. Even among those cases corroborated to the investigator by an independent informant, 88% were completely accurate, 10% contained some error, and 3% were completely erroneous. The cumulative weight of these cases is inconsistent with the conception that purported out-of-body perceptions are nothing more than hallucinations.

Many people who approach death and recover report that, during the time they seemed to be dying, they met deceased relatives and friends (Cook et al., 1998; Kelly et al, 2000; Osis & Haraldsson, 1977). In a recent analysis of several hundred NDEs, 42% of experiencers reported meeting one or more recognizable deceased acquaintances during the NDE (Kelly, 2001). In the mind-brain production theory, such experiences are widely viewed as being hallucinations, caused by drugs or other physiological conditions or by the person's expectations or wishes to be reunited with deceased loved ones at the time of death. However, a closer examination of these experiences indicates that such explanations are not adequate.

People close to death are more likely to perceive deceased persons than are people who are not close to death: the latter, when they have waking hallucinations, are more likely to report seeing *living* persons (Osis & Haraldsson, 1977). For example, Whinnery (1997) reported that healthy fighter pilots exposed to acceleration-induced anoxia to the point of loss of consciousness (G-LOC) typically report hallucinations of living friends and family. One 20-year-old pilot reported his G-LOC experience: "I was home . . . saw my mom and my brother. . . . I got to go home [by dreaming] without taking [military] leave!" (Whinnery, 1997, p. 245; brackets in original). Near-death experiencers whose medical records show that they really were close to death also were more likely to perceive deceased persons than experiencers who were ill but not close to death, even though many of the latter thought they were dying (Kelly, 2001).

People more often perceive deceased individuals with whom they were emotionally close, but in one-third of the cases the deceased person was either someone with whom the experiencer had a distant or even poor relationship or someone whom the experiencer had never met, such as a relative who died long before the experiencer's birth (Kelly, 2001). Van Lommel (2004, p. 122) reported the case of a man who had an NDE during cardiac arrest in which he saw his deceased grandmother and an unknown man. Later shown a picture of his biological father, whom he had never known and who had died years ago, he immediately recognized him as the man he had seen in his NDE.

There is one particular kind of vision of the deceased that calls into question even more directly their dismissal as subjective hallucinations: cases in which the dying person apparently sees, and often expresses surprise at seeing, a person whom he or she thought was living, who had in fact recently died. Reports of such cases were published in the 19th century (Cobbe, 1882; Gurney & Myers, 1889; Johnson, 1899; Sidgwick, 1885) and have continued to be reported in recent years (Greyson, 2010b; Osis & Haraldsson, 1977; Sartori, 2008; van Lommel, 2004). In one recent case, a 9-year-old boy with meningitis, upon awakening from a 36-hour coma, told his parents he had been with his deceased grandfather, aunt, and uncle, and also with his 19-year-old sister who was, as far as his family knew, alive and well at college 500 miles away. Later that day, his parents received news from the college that their daughter had died in an automobile accident early that morning (Greyson, 2010b). Because in these cases the experiencers had no knowledge of the death of recently deceased person, the vision cannot plausibly be attributed to the experiencer's expectations.

5. Conclusion

In sum, the challenge of NDEs to the mind-brain production theory lies in asking how complex consciousness, including mentation, sensory perception, and memory, can occur under conditions in which current neurophysiological models deem it impossible. This conflict between a materialist model of brain producing mind and the occurrence of NDEs under conditions of general anesthesia and/or cardiac arrest is profound and inescapable. Only when we expand models of mind to accommodate extraordinary experiences such as NDEs will we progress in our understanding of consciousness and its relation to brain. The predominant contemporary models of consciousness are based on principles of classical physics that were shown to be incomplete in the early decades of the 20th century. However, the development of post-classical physics over the past century offers empirical support for a new scientific conceptualization of the interface between mind and brain compatible with a cosmology in which consciousness is a fundamental element (Schwartz et al., 2005; Stapp, 2007).

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