What Medical Neuroscience Can Learn from Near-Death Experiences

Clinical and Scientific Perspectives

Robert G. Mays, BSc
Suzanne B. Mays, CMP
www.selfconsciousmind.com

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Important aspects of near-death experiences

Many triggers of NDEs

- **No physiological explanation fits all cases**
  - **Hypoxia, hypercarbia, administered drugs, etc.**
  - **Endogenous neurochemical factors: endorphins, DMT, etc.**
  - **Temporal lobe seizure, REM intrusion, etc.**
- **No correlation of NDEs with physiological factors**
  - **Many NDEs occur with no hypoxic condition**
  - **Many people near death with hypoxia do not report an NDE**
  - **If hypoxia were the cause of NDEs there would be a strong correlation**
  - **Same case for all other physiological explanations**

Greyson, B., Kelly, E. W. & Kelly, E. F. (2009). Explanatory models for near-death experiences. In J. M. Holden, B. Greyson & D. James (Eds.), *The Handbook of Near-Death Experiences: Thirty years of investigation* (pp. 213-234). Praeger Publishers.

Many triggers of NDEs…

- **NDEs are not like the experiences reported in proposed physiological factors**
  - **Nearly all NDErs report …**
    - **Hyperreal experience: our experience in this realm is the dream**
    - **The other realm is my "true home"**
    - **Absolute conviction that we do not die, "I'm no longer afraid to die"**
    - **The other realm is permeated by unconditional Love and an all-pervasive Light**
  - **These characteristic aspects are not present in hypoxia, REM intrusion, etc.**
- **Recent study: no difference in the intensity and content between non-life-threatening NDEs and NDEs occurring with coma**

Charland-Verville, V., Jourdan, J.-P., Thonnard, M., Ledoux, D., Donneau, A.-F., Quertemont, E., and Laureys, S. (2014). Near-death experiences in non-life-threatening events and coma of different etiologies. *Frontiers in Human Neuroscience*, *8*(203).

Consistent commonality

- **There appears to be a consistent commonality among NDEs, independent of physiological factors**
  - **Same experience regardless of the precipitating situation**
  - **Physiological causal explanations don't apply**
- **What is common is the state of consciousness relative to the physical body**
  - **Sense of separating from the body**
  - **Experience of being free of physical constraints of the body**
  - **Transcendent elements consistent with separation (e.g. told must return)**
  - **Sense of returning to the body**

Veridical perceptions

- **NDErs report veridical perception of events:**
  - **During cardiac arrest, while unconscious or in coma**
  - **From a perspective outside their body**
  - **Outside the line of physical sight or in a different location**

- **Reports of apparent veridical perception are nearly always accurate**
  - **92% of cases in the NDE literature verified as completely accurate**
  - **6% had some errors**
  - **Only one of the 93 cases was completely inaccurate**

Holden, J. M. (2009). Veridical perception in near-death experiences. In J. M. Holden, B. Greyson & D. James (Eds.), *The Handbook of Near-Death Experiences: Thirty years of investigation* (pp. 185–211). Praeger Publishers.

Veridical perceptions…

- **Numerous cases with third-party verification**
  - **Maria's shoe: tennis shoe observed on a window ledge during cardiac arrest**
  - **Al Sullivan case: cardiac surgeon "flapping" his arms**
  - **Dr. Lloyd Rudy case: patient observed several unique things while pronounced dead at least 20 minutes**
  - **78 verified cases documented in a recent book from NDE researchers in the Netherlands**

- **Consciousness appears to operate outside the body with no apparent supporting brain function**

Rivas, T., Dirven, A., & Smit, R. (2013). *Wat een stervend brein niet kan: aanwijzingen voor parapsychologische verschijnselen rond bijna-doodervaringen; de harde kern van bevestigde casussen*. Elikser.

Shared-death experiences

- **A person attending a dying loved one experiences the dying process along with the loved one**
  - **Unusual, heavenly light and music in room, seeing the person's spirit leave the body**
  - **Out-of-body, witnessing the dying person's life review, tunnel opens, deceased relatives come escort the person**
  - **Elements very similar to NDEs, including veridical information**

Deathbed scene – 1800s

Painting – Louise Vernet on her deathbed

- Moody, Jr., R. A., & Perry, P. (2010). *Glimpses of Eternity: Sharing a loved one's passage from this life into the next.* New York: Guideposts.
- Fenwick, P., & Fenwick, E. (2008). *The Art of Dying: A journey to elsewhere.* (chapter 9). New York: Continuum.

Shared-death experiences…

- **The SDEr appears to be an objective witness of the process of dying**
  - **The SDE itself is very similar to the content of NDEs**
  - **The observed process of the dying person is also very similar to the content of NDEs**
  - **Is the content of an SDE actually "shared" by the dying person?**
    - **Note cases of "shared near-death experiences"**

Victor Hugo on his deathbed

Mutual corroboration

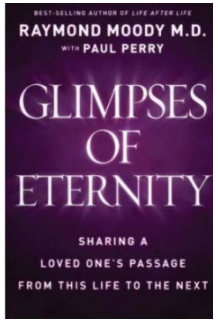
- **NDEs and SDEs are mutually corroborative**
  - **The SDEr observes the dying person going through the same experiences as an NDEr does — the main difference is that the NDEr returns to life, the dying person dies**
  - **The SDEr herself also experiences many of the same elements as an NDEr – the main difference is that the SDEr is perfectly healthy, the NDEr may be "near death"**

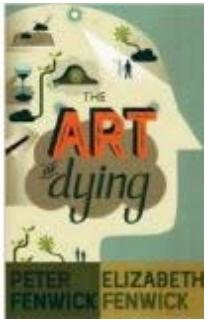
- **Other phenomena around death such as "terminal lucidity" are also mutually corroborative with NDEs and SDEs**
  - **TL occurs in dementia and schizophrenia patients, shortly before death**
  - **Memory and other mental faculties are suddenly restored and the patient becomes lucid again**

- Nahm, M. (2009). Terminal Lucidity in People with Mental Illness and Other Mental Disability: An Overview and Implications for Possible Explanatory Models . *Journal of Near-Death Studies*, *28*(2) 87-106.
- Nahm, M., Greyson, B., Kelly, E. W., Haraldsson, E. (2012). Terminal lucidity: A review and a case collection. *Archives of Gerontology and Geriatrics, 55,* 148-152.

Mutual corroboration…

- **Raymond Moody and Peter Fenwick both have commented:**
  - **The phenomena around death appear to be part of a common picture of the mind and brain during the dying process**





- **We assert: NDEs, SDEs and related phenomena <u>are objectively</u> what they appear to be—they are objective realities**

A new hypothesis about the brain and mind

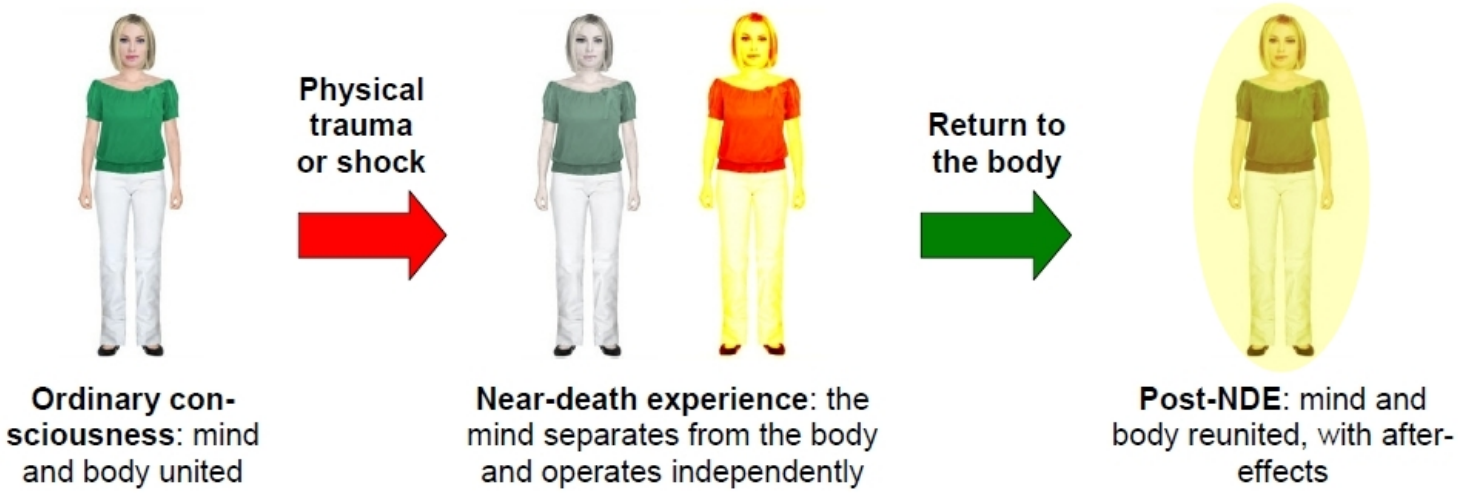
Motivations for a new hypothesis

1. **No causal connection between NDEs and physiological or psychological factors**
2. **Profound, vivid experiences and memory while no brain activity**
3. **Sense of separating from and returning to the physical body**
4. **Sense of independence from the constraints of the physical body (no pain, vivid senses and thoughts, no disabilities)**
5. **Veridical perceptions outside of physical body**
6. **Corroborative phenomena implying NDEs are objective realities**

➔ **Consciousness appears in certain circumstances to separate from and to operate independent of the brain**

➔ **Consciousness <u>is</u> an objective entity in itself**

A new hypothesis



Mind-entity hypothesis – based on NDE phenomena

- **The "mind" is an objective, autonomous entity that can separate from and operate independent of the brain**
- **NDE evidence suggests:**
  - **The mind-entity can interact energetically with physical processes**
  - **The mind-entity is the seat of all cognitive faculties including memory**

A new hypothesis…

How the mind works

- **Ordinarily the mind-entity is united with and dependent on the brain**
- **In an NDE, the mind-entity separates from the body and brain**

- Mays, R. G. & Mays, S. B. (2008). The phenomenology of the self-conscious mind. *Journal of Near-Death Studies, 27* (1), 5-45. Reprint at www.selfconsciousmind.com/papers.html
- Mays, R. G. & Mays, S. B. (2011). A Theory of Mind and Brain that Solves the 'Hard Problem' of Consciousness. Reprint at www.selfconsciousmind.com/papers.html

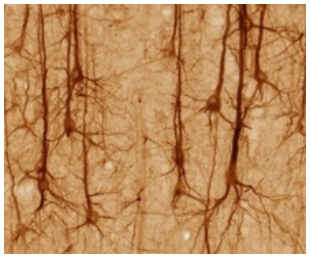
The current paradigm

- **Brain-production hypothesis**
  - **Neural electrical activity produces consciousness**
- **Supporting evidence**
  - **Neural correlates of consciousness**
  - **Cognitive impairment with brain impairment**
- **Deterministic, reductive materialism**
  - **We are biological robots, determined by the activity of neurons**
  - **Free will is an illusion**
- **Fails to account for many anomalous phenomena (e.g. *Irreducible Mind*)**

- Churchland, P. S. (2013). *Touching a Nerve: The Self as Brain*. New York: W. W. Norton & Co.
- Dennett, D. C. (1991). *Consciousness Explained.* New York: Little, Brown & Company.
- Kelly, E. F., Kelly, E. W., Crabtree, A., Gauld, A., Grosso, M., & Greyson, B. (2007). *Irreducible Mind: Toward a psychology for the 21st century.* Lanham, Maryland: Rowman & Littlefield publishers.

Five enigmas of consciousness

- **Phenomenal experience (qualia) generated by neural action potentials**
- **Unified phenomenal experience coming from disparate regions of the brain**
- **Memory is apparently encoded throughout the cortex**
- **Sense of agency without a "center of the self" in the brain**
- **Unitary mind or "whole person" despite severe brain dysfunction**



Pyramidal cells in the cortex

Brodmann Areas of the cortex

Two competing hypotheses

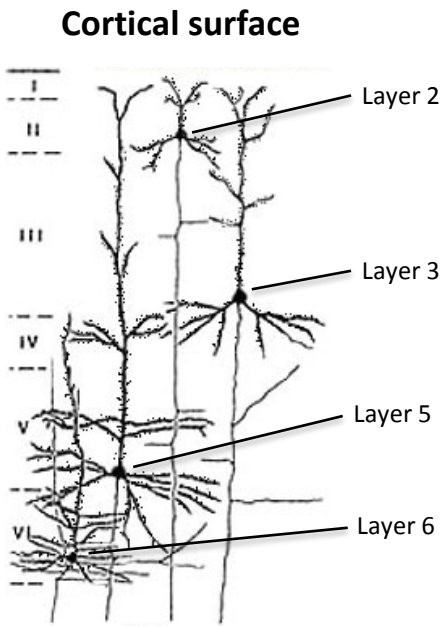
- **Both can explain most phenomena of cognition and the "easy problems" of consciousness**
- **The new hypothesis can begin to explain the five enigmas of consciousness**
  - **Phenomenal experience (qualia) from action potentials**
  - **Unified phenomenal experience**
  - **Memory apparently encoded throughout the cortex**
  - **Sense of agency**
  - **Unitary mind or "whole person" despite severe brain dysfunction**

Implications of the mind-entity hypothesis

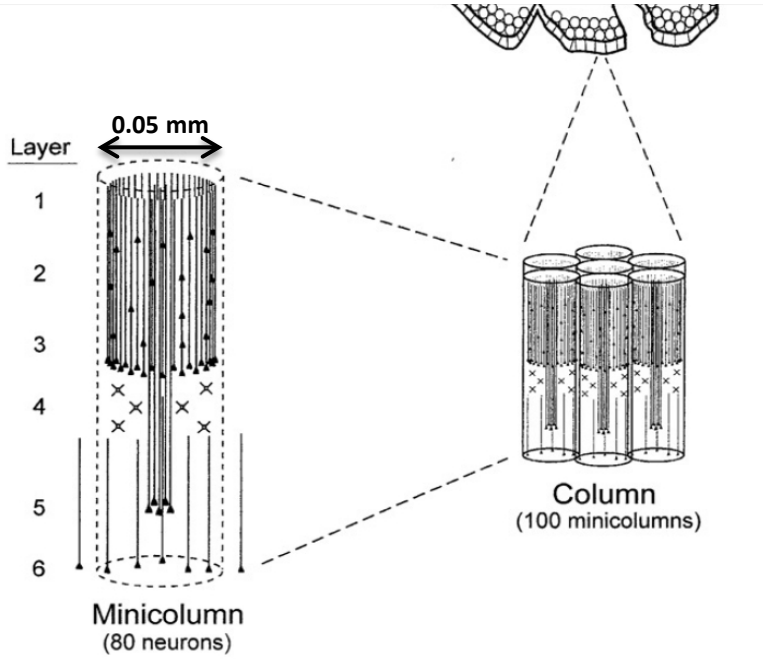
- **The human being is a physical body united with a non-material mind**
- **All cognitive functions (perception, thinking, feeling, volition and memory) occur in the mind**
- **The mind (or psyche, soul, spirit) is the seat of a person's consciousness – the "essence" of the person, the "noëtic person"**
- **The mind interacts with the brain when united with the body**
  - **Sensory neural activity becomes phenomenal sensations**
  - **Volitional acts in the mind (to move, to speak, to direct attention) induce neural electrical activity**

What can medical neuroscience learn from near-death experiences?

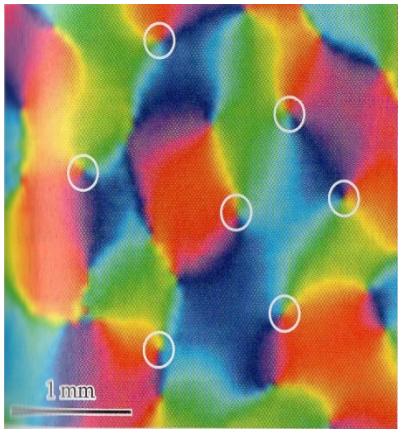
Possible neural mechanisms



Vertical organization of neurons into 6 layers (2.5 mm). Cells in layers 2,3 and 5 have projections reaching to the surface of the cortex



Neurons are arranged in "minicolumns": layer 5 cells are arranged in a central column surrounded by layer 2/3 cells. 80-100 minicolumns make up a "column". Each column has a specific function in that region of the cortex.

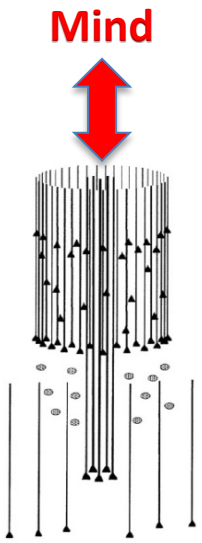


Functional columns (0.5 mm) on visual cortex surface, sensitive to different line orientations (color coded)

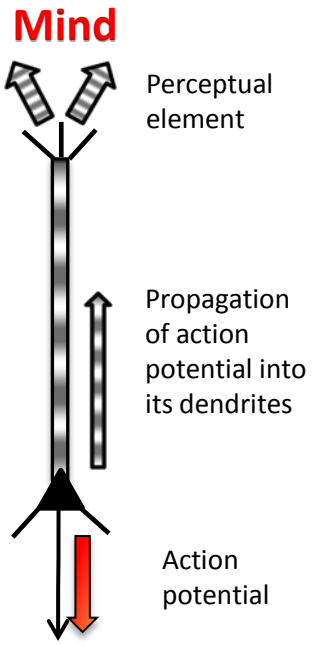
- Mountcastle, V. B. (1998). *Perceptual neuroscience: The cerebral cortex*. Cambridge, MA: Harvard University Press.
- LaBerge, D. & Kasevich, R. (2007). The apical dendrite theory of consciousness. *Neural Networks*, **20**, 1004–1020.

Possible neural mechanisms…

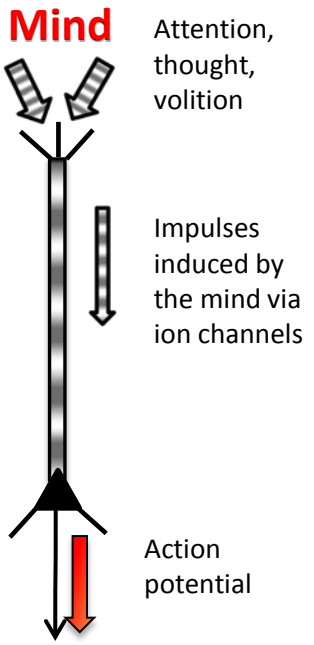
- **Mind-brain interface occurs in the surface of the neocortex**
  - **Via the apical dendrite projections of pyramidal neurons**
  - **L2/L3 neurons – brain-to-mind interface (sensory)**
  - **L5 neurons – mind-to-brain interface (volition, attention)**



Brain to mind
Layers 2/3

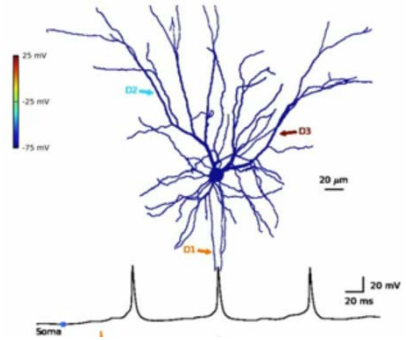


Mind to brain
Layer 5

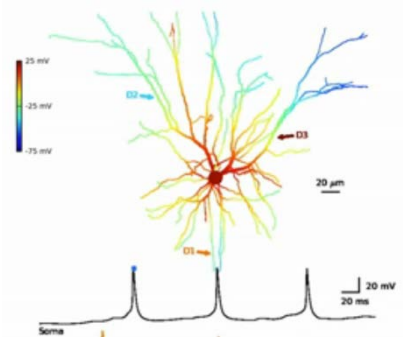


Possible neural mechanisms…

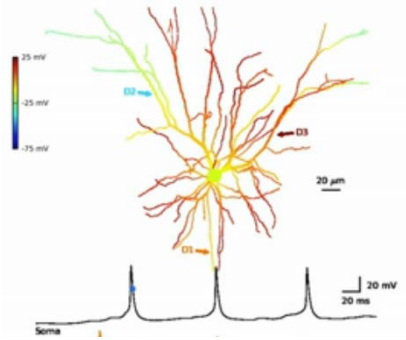
- **Brain-to-mind interface probably occurs via the propagation of action potentials back through the Layer 2/3 dendrites**



L2 pyramidal neuron at rest

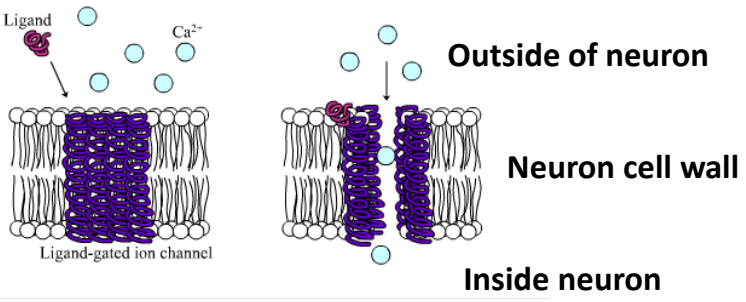


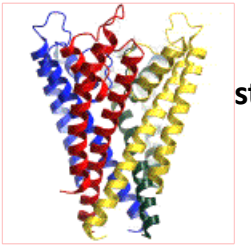
Peak of action potential



Action potential propagates through dendritic arbor

- **Mind-to-brain interface probably occurs by ion channel openings in Layer 5 dendrites, induced by the mind**





Molecular structure of an ion channel

Smith, S. L., Smith, I. T., Branco, T., & Häusser, M. (2013). Dendritic spikes enhance stimulus selectivity in cortical neurons *in vivo*. *Nature,* **503**:115-120.

Implications for neuroscience

- **Brain neurons provide an interface between the mind and the body rather than producing consciousness**
- **When united with the brain, the mind is intimately connected with and dependent on the brain**
  - **Coming to awareness – Libet: awareness doesn't happen instantly**
  - **Coming to decision: volition doesn't happen instantly**
  - **The brain holds back consciousness: brain provides resistance to consciousness**
- **Memory not stored in the brain but in the mind**
  - **Two-way process: formation and consolidation in the mind, recall – different neural pathways in the hippocampus**

Benjamin Libet

Libet, B. (2004). *Mind time: the temporal factor in consciousness*. Cambridge, MA: Harvard University Press.

Relevance to medical neuroscience

Jeffrey M. Schwartz

- **The patient's mind is whole despite brain dysfunction**
  - **The mind can be engaged to apply "mental force" to effect brain plasticity**
- **Dysfunction in internal neural circuitry: the mind can't exert its normal influence or receive its normal inputs**
  - **Example: Parkinson's disease**
  - **Example: damage to sensory pathways**
- **Dysfunction of the mind-brain interface: the mind can't interface with the cortex**
  - **Example: inhalation anesthesia (e.g. isoflurane)**
  - **Example: Alzheimer's disease (cf. "terminal lucidity")**

- Schwartz, J. M. (1999). A role for volitional attention in the generation of new brain circuits: Toward a neurobiology of mental force. In Libet, B., et al. (Eds.). *Volitional Brain: Toward a neuroscience of free will.* Imprint Academic.
- Schwartz, J. M. & Begley, S. (2002). *The Mind and the Brain: Neuroplasticity and the power of mental force.* Harper-Collins.

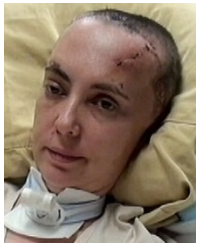
Relevance to medical neuroscience…

- **Applying the concepts of the autonomous mind and mental force to neurophysiotherapy and neurological rehabilitation**
- **Neuroplasticity occurs when alternate brain circuits are activated or are developed**
  - **Reorganization occurs through active experience initiated and directed by the mind**
  - **Carefully selected mental activity driving specific patient actions to activate specific regions and pathways in the brain**
  - **The interface between the mind and brain is a critical aspect to effect neuroplastic changes**

Relevance to medical neuroscience…

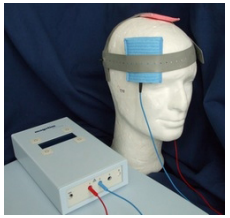
Example: aphasia from damage to left-hemisphere cortical structures

- Speech production and comprehension can be restored by recruiting areas surrounding the damage and contralateral areas
- Recruiting the mind and mental force more effectively could involve:
  - Physical gestures or singing to encourage initiation of speech
  - Exercises that activate contralateral speech regions (via singing, rhythmic pacing, movement)
  - Exercises that activate cerebellar functions (repetitive movements, repetitive speech patterns, repetitive patterns of thought and imagery)
  - Exercises that include observing the therapist making the same movements ("mirror neurons")
- Transcranial direct current stimulation (tDCS)
  - Excitatory stimulation during therapy can assist the mind to use alternate neural pathways




Gabrielle Giffords
2011 & 2012

Contralateral brain regions



tDCS device

Summary

- **NDE, SDE and terminal lucidity phenomena suggest an alternative view of the brain, mind and consciousness**
- **The mind-entity hypothesis proposes that the mind is an autonomous entity that interfaces with the brain to produce consciousness**
- **The mind-entity can be viewed as the psyche, soul or essence of the person**
- **The alternative mind-entity hypothesis may be helpful in…**
  - **Understanding neurological function and dysfunction**
  - **Developing or enhancing neurological treatment and therapies**
  - **Better understanding how consciousness works**