A theory of mind and brain that solves the “hard problem”

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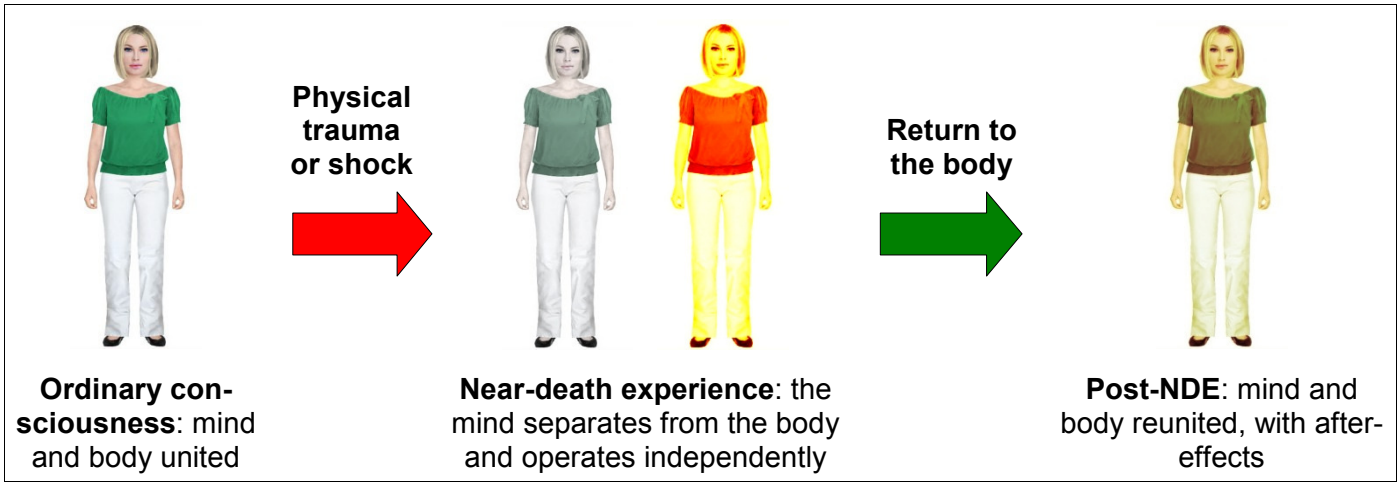
The theory and the evidence

A The human being consists of (1) an energetic, spatially extended, non-material "mind" that is united with (2) a material brain and body

1. The mind is a separate entity, a "field of consciousness"

Evidence: (1) Near-death experiences (Moody, 1975; Greyson, 2000; Mays & Mays, 2008a)



In NDE:

- **Locus of consciousness** appears to separate from and operate independent of the brain, has a particular position in space and a particular visual perspective, retains all cognitive faculties.
- **Heightened, lucid awareness**, logical thought processes, and vivid perceptions including veridical perceptions of the surroundings.

Evidence: (2) Phantom limbs

Phantom limbs appear as fields of sensation extending beyond the body in the space:

- When phantom is "touched", amputee can feel sensations; when phantom "touches" another person, that person experiences sensations, including visual (Mays & Mays, 2008b)
- Amputees generally can feel "touch" during Therapeutic Touch therapy of phantom and the therapist can generally "feel" the presence of phantom limb (Leskowitz, 2000 and 2001).
- Phantom limb subjects report being able to "see" their phantom limbs as faint glow against a dark background (Mays & Mays, unpublished report, 2009; Brugger, et al., 2000).

2. The mind is non-material, like a structured energy field that interacts with physical processes, and thus has physical attributes

- The out-of-body mind appears to **pass readily through solid objects** and is **invisible** to ordinary sight
- But also appears to **interact in subtle ways with physical processes**: physical objects, light, sound, and other persons' bodies; the out-of-body mind entity can apparently be "seen" by animals.
- The mind appears to be **a field (region of space),** which entails interaction with physical processes, itself has physical attributes, although it is not like any currently known physical fields.

3. The mind is united with the brain and interacts directly with it, probably via electrical interactions with cortical and other dendritic structures

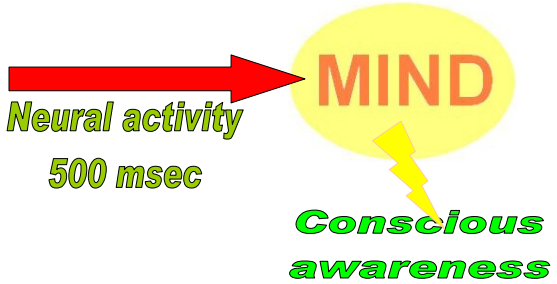
- People generally feel that their locus of consciousness extends throughout their physical body
- Electrical brain activity is correlated with conscious experiences
- Some NDE accounts include a report of **the NDEr "merging" with an in-body person** in order to see and hear through them (Mays & Mays, 2008a)
- Some NDEs suggest an **electrical nature to the NDEr's "body"** (e.g., interaction with fog)
- One aftereffect of NDE is **abnormally high electrostatic charges** around the person's body, which can interfere with watches and electronic equipment.

B The mind is the seat of conscious experience

1. All cognitive faculties reside in the non-material mind entity, but ordinarily need neural activity for conscious awareness

- During NDE, the locus of consciousness retains all cognitive faculties while apparently operating independent of the brain
- In the ordinary case, if a person loses brain electrical activity, they become unconscious.

2. Consciousness requires sufficient electrical brain activity, else sensations remain subliminal



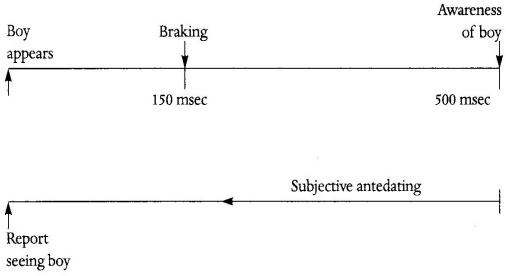
- Sensations become conscious **only after a sufficient duration of electrical brain activity** – "time on" principle (Libet, 1973; Libet, et al., 1975; Libet, et al., 1991)
- **Lower than liminal stimuli do not rise to conscious awareness** but forced-choice responses are accurate (e.g., Libet, 2004, cases of blindsight, etc.).

3. The mind as a mental agent can initiate electrical brain activity

- People sense that **"their" volitional activity** results in their physical movement, speech acts, etc.
- **Cognitive behavioral therapy** for obsessive-compulsive disorder overcomes the symptoms (Schwartz, 1999)
- **"Plastic" changes in neural structures** can occur rapidly when motor movements are practiced mentally (e.g., Pascual-Leone, et al., 1995)
- **Implies an *agent*** that generates a purely endogenous **"mental force"** which causes neural changes.

4. The mind's agency serves as the unified phenomenal field

- **Subjective backward referral of sensation**: person appears to **"antedate" the time of a stimulus** even though awareness of the sensation comes 500 msec later (Libet, 1973; Libet, et al., 1975), implies an agency that "holds together" the time and location until the sensation comes to consciousness



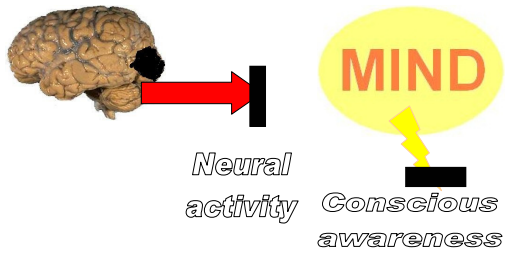
Libet's "time-on" principle and "antedating

- About 1/2 sec (500 msec) of brain electrical activity is required before we can become aware of a sensation, regardless of content
- We adjust for this delay by "antedating" our subjective sensations back to their actual time
- Example: while driving a car, the driver sees a boy dart out into the road and reacts, initially subliminally

Libet, B., *Mind Time: the temporal factor in consciousness.* Harvard University Press, 2004.

C When brain structures are damaged, mental faculties dependent on them are partially or totally impaired

1. Brain damage causes mental impairment, by interfering with the neural interface to the mind and the mind's interface with neurons

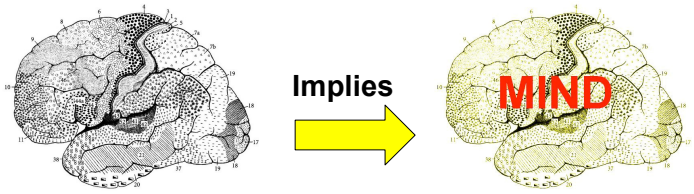


- There are numerous examples **connecting brain damage to cognitive and memory impairments**
- Damage to neurons implies that the **neural interface to the mind is impaired** such that sensory, motor, affective and thought processes may be altered or impaired
- During anesthesia, the anesthetic agent suffuses the brain and the patient loses consciousness, implying that the **anesthetic agent interferes with the neural interface with the mind**

2. The field of the mind has an internal structure corresponding to neural structures in the brain and throughout the body

- In at least some NDErs, the out-of-body "body" appears to have **an intricate, luminous structure** (e.g., Moody & Perry, 1988, p. 10)
- Interaction of mind with the body is probably **via electrical interactions** with neurons (previous point)
- In order to selectively interact with specific neural activity, the mind **needs to be in close proximity with specific neurons**
- Some NDE accounts include a report of the **NDEr "merging" with an in-body person** in order to see and hear through them (Mays & Mays, 2008a). Implies that **the mind's internal structure can interface with the brain similarly from person to person** and mind's internal structure is similar person to person
- Relationship between **phantom limb sensations and neural activity in the stump** implies a **connection between stump neurons and mind structures in the phantom**. Sensations can be modulated by stump manipulations, temporarily abolished by local stump anesthesia, altered by changes in stump blood flow, etc. (Nikolajsen & Jensen, 2001).

3. Interaction of the mind's field with the brain occurs in particular cortical locations

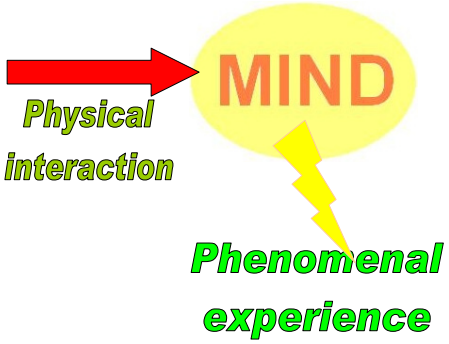


Neural functional areas — **Corresponding mind functional areas**

- **Brodmann areas** have distinctive cytoarchitectures (Brodmann, 1909), generally mapping to cognitive functional areas
- Implies that **particular mind structures** interact with particular cortical and other neural structures in the brain

D The theory solves the "hard problem"

Conscious phenomenal experience can't be explained solely from physical phenomena (Chalmers, 1996)



Conscious experience depends on a *second entity* with physical attributes, namely, the conscious mind, which interacts with the brain and has phenomenal experiences.

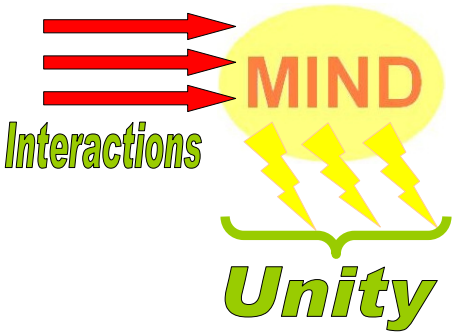
- **Interaction of the field of the mind** in a variety of ways **always entails phenomenal experience**, including interaction of the mind with the brain
- Phenomenal experience occurs: in ordinary **sensory stimuli** with the electrical brain activity interacting with the mind's field, and in direct cortical **electrical stimulation** (Penfield & Rasmussen, 1950) or equivalent transcranial magnetic stimulation.
- Phenomenal experience also occurs during physical interactions in **NDE** and in **phantom limb "touch"** (see Evidence of physical interaction of the mind, below)

Subjective experiences of qualia are an effect *in the mind* resulting from neural electrical activity in specific regions of the brain.

- **Interaction of the mind with the brain produces phenomenal experience** (previous point)
- Interaction of the mind's field with the brain occurs in particular cortical locations (previous point)
- **Particular cortical locations are associated with phenomenal experience of particular qualia**. Implies that electrical activity in a particular location **affects the mind's field in that location and produces that specific associated quale**.

A philosophical zombie duplicate of a person is impossible because **a physical duplicate would *necessarily include a conscious mind*** as well as a physical body and thus would entail conscious experience.

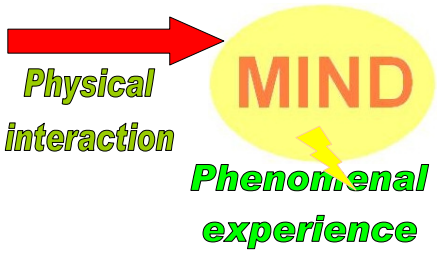
- The mind has **physical attributes** (previous point)
- A **physical duplicate** would necessarily include a conscious mind as well as a physical body
- All cognitive faculties reside in the mind, but ordinarily need the brain's neural activity for conscious awareness (previous point), implying that **the duplicate would have phenomenal experiences**.



The unity of consciousness (Bayne & Chalmers, 2003) **results from the *unity of the mind's "field of consciousness"*.** The mind *is* the subject in whom phenomenal states are unified.

- During NDE, the locus of consciousness appears to be in a single location with a particular visual perspective
- During NDE, the out-of-body "body" appears to be a single field which is never divided, implying that **the mind's "field of consciousness" is a singular entity**.
- During NDE, **the mind "field of consciousness" is the locus of all phenomenal states and is felt to be the person's self.**

E All physical interactions in the mind have two sides: they entail *both* phenomenal experience *and* physical causality



Physical interactions in the mind always entail phenomenal experience

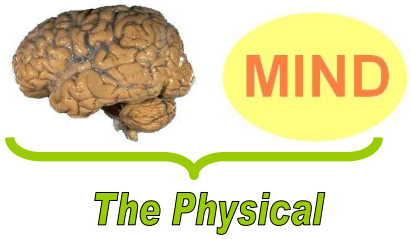
- **Phenomenal experience** occurs during ordinary sensory stimuli, electrical or magnetic brain stimulation, during NDE, and during phantom limb "touch", **each involving interactions with the mind** (previous pt)
- There are no known interactions with the mind which do not entail phenomenal experience.

Interactions in the mind always entail physical causality

- The interactions in the mind include a physical causal role by **physical stimuli or endogenous mental activity** leading to neural activity, electrical or magnetic pulses to the brain, and by **direct physical processes in NDE and phantom limbs** (light, sound, objects, another person) (previous point)
- There are no known interactions with the mind which do not entail physical causality, except possibly telepathy, which may still require neural activity to be received.

Causal closure of the physical is maintained

- The mind has physical attributes, whose **structures act causally on neural processes** (previous point)
- **At some level, the field of the mind becomes a physically causal entity**.



The domain of "the physical" must necessarily be expanded

- When phenomena are discovered which imply **new physical entities or forces**, the domain of **what constitutes physical reality** has historically been expanded.
- The case of **the mind as a new aspect of reality** is no different.

The mind is a *fundamental aspect of reality* with new properties and is a person's seat of consciousness

- **Conscious experience is a fundamental aspect** of human beings and (we can infer) some animals
- The mind is non-material, but has the character of a structured energy field and interacts with physical processes, implying that it has **properties that are unique** (previous point)
- All cognitive faculties reside in the non-material mind, implying that the **mind is the seat of the person's consciousness** (previous point)

Evidence of physical interaction of the mind

Evidence from NDEs: (Mays & Mays, 2008a)

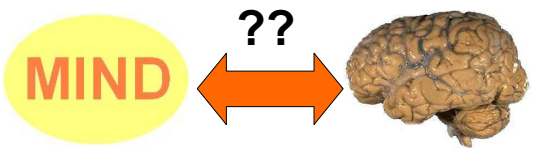
- Apparent **interaction with physical processes such as light and sound**, because the NDEr reports veridical visual and auditory perceptions
- Apparent **interaction with physical objects**, because NDEr can bob on the ceiling, and feels **slight resistance when passing through objects** such as walls.
- NDEr's "body" apparently **interacted with fog** on a cold night. The NDEr jumped up and down and the "jumping fog" was seen by another man (1 case)
- Can be **"seen" by animals** (1 case) **and fellow NDErs** (several cases)
- NDEr "body" can **interact with another person's body**: NDEr's hand went through doctor's arm, which felt "gelatinous" (1 case)
- NDEr could **tickle the nose of another patient** until she sneezed, repeated 3x (1 case)
- NDErs report **"merging" with another person** to see and feel what they were seeing, feeling and thinking (3 cases). Implies that the mind readily joins with and interacts with the brain, even another person's brain.

Evidence from phantom limbs: The phantom limb appears to be a "**field of sensation and touch**" and **exhibits subtle interactions with physical processes**

- **Interactions with subject M.G.**, born without fingers of the left hand (Mays & Mays, 2008b)
  - **"Touching" physical objects evokes physiological sensations** and physiological reactions (increased skin color, twitching of the finger buds)
  - **"Touching" other subjects,** especially in region of the brain, **evokes distinct, unusual inner visual images** and subtle but definite physiological sensations (warmth, pressure, etc.)
  - M.G. also reports **"massage" of phantom fingers** (therapist passing her hand over the finger area) **evokes tickling sensations**.
  - M.G. reports she sometimes **can "see" her phantom fingers** as a faint whitish or bluish light when held up against a dark background (see also Brugger, et al., 2000).
- **Therapeutic Touch treatment of amputee phantom limb** (e.g., Leskowitz, 2000 and 2001; Sheldrake, 1995, pp. 152-153)
  - Therapist usually **feels the phantom limb as "present"** in the expected location, sometimes having a distinctive "energy"
  - Patient usually **feels the presence of the therapist's hand** in the phantom limb area the therapist is working in, despite patient cannot see what the therapist is doing (eyes are closed, patient is looking away or patient's eyes are bandaged)
  - Patient experiences **immediate and dramatic reduction in the subjective pain**; the pain reduction is usually long-lasting after several sessions.

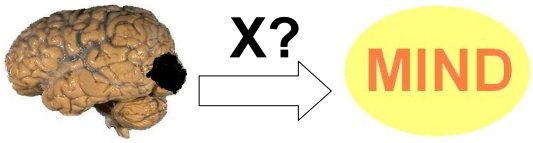
The usual objections to dualism don't hold

Our theory is a **form of *interactionist dualism***, which posits the mind and the body and a mechanism for the interaction between them. The **main objections to dualism** and our responses are:



How can mind-brain interaction possibly occur?

The mind is **a structured energy field that interacts with physical processes**. Supporting evidence includes phenomena indicating subtle physical interactions from NDEs and phantom limbs (see previous section).



How does brain injury also impair the non-physical mind? (Churchland, 1988)

The mind's energy field is coextensive with and interacts directly with neurons. **Brain injury interferes with the interface between the neurons and the corresponding structures of the mind,** resulting in impairment.

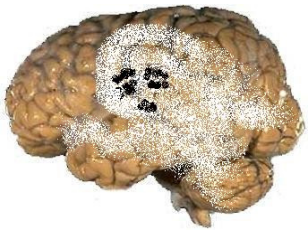
How can the mechanism for interaction between the brain and mind explain phenomenal experience? (Chalmers, 1996)

The mind is itself the locus of phenomenal experience. All interactions with the mind entail phenomenal experience.

???

How does this view avoid the Cartesian Theater in the brain? (Dennett, 1991)

The mind's structures unite directly with neural structures **without an intermediate stage of "interpretation"**. All neural activity interacts directly with the mind, **resulting directly in phenomenal experience**.



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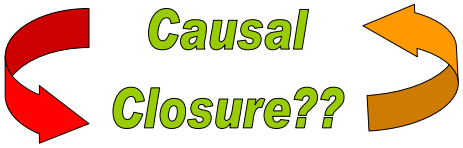
How is this view not a category-mistake? How is this not just a "ghost in the machine"? (Ryle, 1949).

Both the mind and the material body are objective, spatially extended entities, one a non-material field and the other a material object, which unite together to form a cohesive unity. There is no category-mistake of relating entities belonging to different logical categories.



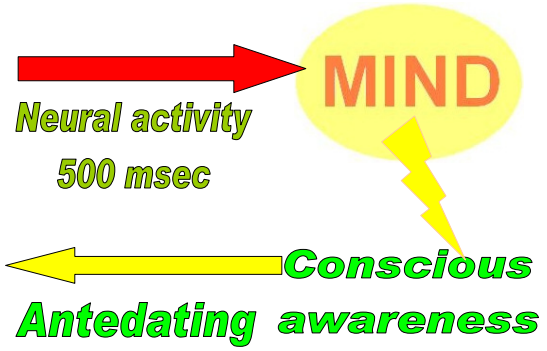
Doesn't this view violate causal closure of the physical?

The mind is **an energetic field that interacts with physical processes** and **acts causally on neural processes**.

As a consequence, **the domain of what constitutes "the physical" must necessarily be expanded to include minds**. Causal closure of the physical world is maintained.

How does the mind work?

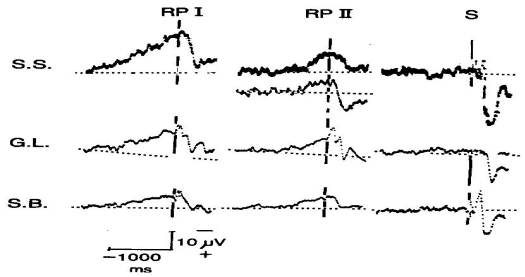
1. Coming to awareness



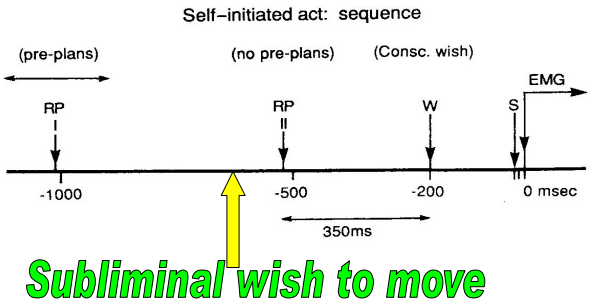
- **Libet's "time-on" principle** (Libet, et al., 1991): about ½ **sec (500 msec) of brain electrical activity is required** before a person becomes aware of a sensation, regardless of its content.
- Person adjusts for this delay by "**antedating" the subjective sensations** back to their actual time.
- Sensations are first subliminal. Visual stimuli that are presented too quickly for conscious awareness are nevertheless "seen" and "interpreted" in forced choice tests, with greater accuracy for longer presentation times.
- Implies that there is **subliminal cognitive processing** (detection, recognition) occurring prior to awareness.
- We propose: ***all* conscious experience requires at least 500 msec of electrical activity to come to consciousness, including endogenous mental acts** (thoughts, images, decisions) (see also Libet, 1993, p. 385). **Endogenous mental acts are *not* antedated to their time origin.**

2. Libet's delayed awareness of willed action

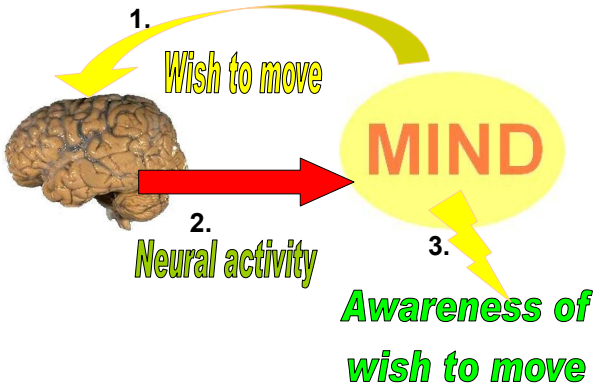
Benjamin Libet timed the relationship between the **subjective sense of willing to move** and the **actual movement**. Subjects flexed their wrist at a time freely chosen, *without pre-planning* (Libet, 1985; Libet, et al., 1983). The neural response to the subject's wish to move was measured at the top of the head and is called a "readiness potential" (RP). The decision appeared to be "made" subconsciously before the awareness of the decision (see also Haggard, 2005; 2008).



- RP typically started 550 msec before the actual muscle movement measured at the wrist by electromyogram (EMG).
- **Subject's first awareness of the intention or wish to move (W)** was on average **about 350 msec *after* the onset of the readiness potential.**
- This delay makes it appear that **the brain has decided to move prior to the subject's actual conscious intention to move.**



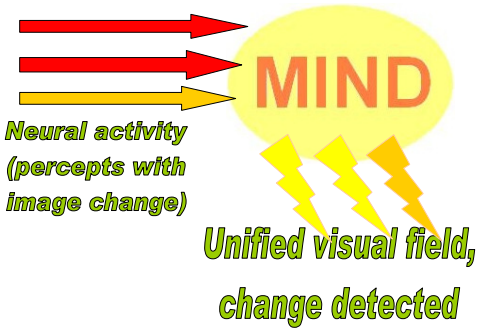
- The apparent "decision" by the brain to act prior to the actual awareness of the intention to act **implies that people do not act out of free will**…
- If awareness of endogenous mental acts is delayed (see previous section), the **initially subliminal wish to move requires a time-on of about 500 msec before the awareness of the wish to move (W).**
- Thus, the **wish occurs some 150 msec prior to the onset of the readiness potential**.



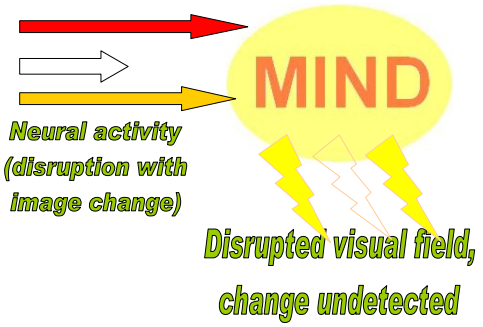
- How can one subconsciously intend something and ½ second later become aware of the intention?
- **A freewill decision originates in the conscious agency of the mind**, but the **neural activity reflecting this mental act must meet the 500-msec time-on requirement** before there can be awareness of the decision.
- People's subjective experience that their decisions are purely their own and arise from the conscious context they are in.
- See also William James's (1890) introspection of the process of getting out of bed on a freezing morning.
- We are organized in an unusual way: **a non-material mind interfaces through the relatively slow electrical activity of the brain.**

3. Change blindness

Change blindness occurs when a person viewing a scene fails to detect changes in the scene. The change usually coincides with a visual disruption, such as eye movement (saccade), blinking or brief obscuring of the scene.



- **Interpretation of visual percepts occurs in the mind**, which structures the unstructured percepts with semantic interpretation and concepts. We see things *"as"* something (cf. ambiguous images, binocular rivalry).
- **The mind adopts a *mental context*** (note: this is *not* a representation or image). Within the mental context, the person can direct and focus attention on any part of the visual scene.
- **The visual field is experienced as unified and continuous through time, but the visual percepts are at first subliminal.** When a visual change occurs, it is detected at once because the change is carried "continuously" from subliminal to liminal awareness against the visual field.



- **Any visual disruption also begins subliminally** (and may end subliminally and go undetected). **When the disruption ends, the previous visual percepts are presented again and the mental context is resumed.**
- If a visual change occurs during the disruption, **the mind recovers from the disruption and resumes the mental context**.
- But **the change does not go from subliminal to liminal awareness *against the visual field* and is not detected …**
- ***… unless* the attention is specifically focused on the area of change**; then the change is detected by comparison with memory.

4. The mind plays an active role in brain development:

In postnatal brain development, there are two main processes: "regressive events" and gradual myelination of neurons. The mind is involved in both processes.

- **Significant "regressive events" occur during infancy in which many neurons die off**.
- **There is gradual "myelination" of neurons** (myelin is an electrically insulating sheath that covers the axon so the neuron can efficiently transfer neural impulses)
  - The first brain areas to be myelinated (infancy) are: motor, olfactory, somatosensory
  - Last areas (teen and adult years) are: complex visual functions, executive functions, working memory
- **The mind's activity**, especially during infancy and childhood**, influences which neurons are retained and myelinated**, and are available for use
- **Implications for child development and education**:
  - Child development entails the child's mind integrating with and re-forming the brain and body
  - Educational programs should use age-appropriate mental and physical activities to enhance mind, brain and physical development at each developmental stage.

5. Memory content resides in the mind, not in the brain

Brain structures and pathways, especially in the hippocampus are needed to form, consolidate and recall memories, but memory content resides in the mind, not the brain (Mays & Mays, 2008a).

- **Memories formed during the NDE are accessible afterward**, are vivid, long-lasting and not subject to embellishment over time. Implies that memories can be formed and "stored" without the brain
- **Memories prior to NDE are accessible during the NDE**. Implies that memory content is accessible without the brain
- **Therefore, memory content resides in the mind, not the brain**
  - Suggests that **profound loss of long-term memory**, such as in dementia, is probably due to the **destruction of brain structures that mediate memory recall rather than destruction of memory content itself.**
  - **Existing memories would return** with even a slight reversal of certain cortical deterioration. Rather than lose the past, people with Alzheimer's disease gradually become blind to it.

Just what is the mind?

1. The mind presents itself as a field, i.e., a region of space with specific properties

An energetic field = an individual's consciousness

- The **essential property of the mind is consciousness**; more precisely **the mind is the locus of conscious experience of a particular individual.**
- The mind has **energetic attributes** in that it appears to **interact with physical processes**, **especially with neurons**, and appears to exhibit **electrical effects and luminosity**.
- The mind appears to have a **complex internal structure that probably directly maps to the neural structure** throughout the brain and body.
- **All cognitive functions reside in the mind.** The brain appears to function **as the interface for the mind** with material existence.

2. Is the mind a subtle substance? An energetic field, *not* a substance…

- The mind **does not appear to have properties of a substance**, because it appears to be **unitary and indivisible**, although it has extension and location in space.
- The mind **readily interpenetrates ordinary matter** and, thus, is not **material in any ordinary sense**.
- Rather than a subtle substance, the mind appears to be more **an energetic field** which is the **seat of consciousness** and the **essential selfhood** of the person.

3. Can the non-material mind be studied scientifically? Yes!

What the mind is and how it functions with the brain are **ultimately empirical questions**. Objective, non-material entities **can be studied scientifically through their effects on other entities**. For example:

Phantom limb phenomena:
- **Direct access to a "mind limb" field**, its inherent internal structure and **how that structure interacts with the body and brain**, in particular with the neurons in the stump.
- **Phantom limb sensations and phantom limb pain** are directly reportable, as are interactions of the phantom limb field with other subjects.
- **Direct physical interaction of the limb field** in measurement devices may also be possible.
- Potential to develop **effective treatment modalities for phantom limb pain**, hitherto intractable.

NDE phenomena:
- Additional cases and data about **interactions with physical processes and "merging" of the NDEr** with in-body persons
- Additional information about the **nature of the mind "body" in its out-of-body state**.
- More detailed evidence of **veridical NDE perceptions** will strengthen the case for the non-material mind.

NDE physiological aftereffects:
- Following NDE, there generally are **striking physiological aftereffects** (heightened sensitivities, electrical effects, etc.), **probably resulting from the incomplete reintegration of the mind** with the physical body.
- Study of **unusual physiological aftereffects**, especially just following NDE, should provide further insight about the mind in relation to the body (Mays & Mays, 2009).

Other neurological phenomena:
- In principle, **all neurological phenomena should be explainable in terms of the mind** interacting with the brain.
- **Particular phenomena** might provide interesting insights / confirmation of this theory, such as large-scale gamma synchrony, binocular rivalry, cutaneous rabbit, blindsight and split brain phenomena.

The mind is a fundamental entity

The mind as conceived in this theory does not fit other known physical phenomena or known physical laws.

- Thus, **mind must be a fundamental entity, a new dimension of reality**, and the domain of what constitutes "the physical" must necessarily be expanded to include minds.
- The proposition that a non-material mind interacts with electrical brain processes means that **there must be some sort of force** which brings about the interaction.
- We expect that this force **must ultimately induce or translate into electrical effects in the neurons**.

The essential property of the mind is the conscious experience of a particular individual.

- The mind is the seat of **the essential selfhood of the person**; it *is* the person.
- **Conscious experience arises necessarily** within the mind's field of phenomenal experience, through the direct interaction of the mind with the person's brain.

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