How Can We Construct a Science of Consciousness?

David Chalmers

What are the Phenomena?

- Third-person data

  re brain processes and behavior

- First-person data

  re subjective experience

Third-person data

- Wakefulness
- Perceptual discrimination
- Integrated control
- Access & self-monitoring
- Verbal Reports
- Focused attention

- Data re underlying brain processes

"The easy problems"

First-person data

- Visual experiences — e.g. color, depth, …
- Other sensory experiences — e.g. sound, taste, …
- Bodily sensations — e.g. pain, orgasm, …
- Mental imagery — e.g. recalled visual images, …
- Emotional experiences — e.g. happiness, anger, …
- Stream of occurrent thought — e.g. reflection, decision, …

All are states of subjective experience: there is *something it is like* to have these states.

The "hard problem".

Example: Musical Processing

- Third-person data
  - Sound wave patterns
  - Processes in auditory cortex
  - Behavioral reactions
  - Verbal reports (actual and potential)
- First-person data
  - Musical experience

Explaining Third-Person Data

- To explain third-person data, one must explain objective functioning

  e,g. explaining reportability requires explaining the objective process of verbal report

- To explain objective functioning, one specifies a mechanism that performs the function

  e.g. a neural or computational mechanism

Reductive Explanation

- Reductive explanation: explaining a high-level phenomenon wholly in terms of lower-level phenomena
- Most reductive explanation in science works through explanation of functions through mechanisms
- E.g. reductively explaining genetic phenomena:
  - Target: the function of transmitting hereditary characteristics
  - Mechanism: DNA molecules
  - Result: Genetic phenomena are explained.

Explaining First-Person Data

- Unlike third-person data, first-person data are not data re objective functioning
- Given a complete account of objective functions in the vicinity – e.g. discrimination, integration, report – there may still remain a *further question:*
  - Why is all this functioning associated with conscious experience?
    (and why with this conscious experience?)
- So explaining objective functions does not suffice to explain the first-person data

Mutual Irreducibility

- MORAL: First-person data are irreducible to third-person data *as data.*
- The third-person data alone are an *incomplete catalog* of what needs explaining.
- A science of consciousness must admit both kinds of data as mutually irreducible, and build an explanatory connection between them.

Failure of Reductive Explanation

- (1) Third-person data are data about objective structure and dynamics
- (2) (Microscopic) structure and dynamics entails only facts about (macroscopic) structure and dynamics
- (3) Explaining structure and dynamics does not suffice to explain the first-person data.

So:

- (4) First-person data cannot be wholly explained in terms of third-person data.

Nonreductive Explanation

- For a theory of consciousness, we need *nonreductive explanation*
- First-person data are not *reduced* to third-person data, but are associated or correlated with those data
- A theory of consciousness is a theory of the association
  - Systematic covariation in virtue of underlying bridging principles.

Third-person processes

First-person experiences

Constructing a Science of Consciousness

- So: a science of consciousness must (and does) take first-person data seriously.
- Projects for a science of consciousness…

1: Explain the Functions

- Give (eventually reductive) accounts of the third-person data related to consciousness:
  - integration, access, self-monitoring, etc.
- Examples:
  - explanation of binding via neural synchrony
  - explanation of access via neural synchrony

2: Contrast Conscious & Unconscious Processes

- Many cognitive capacities can be instantiated both consciously and unconsciously. E.g.
  - Conscious vs. unconscious perception
  - Explicit vs. implicit memory
  - Explicit vs. implicit learning

- Find third-person features that covary with this distinction
  - Functional/behavioral differences
  - Different neural correlates

3: Find Neural Correlates of Consciousness

- Neural correlate of consciousness (NCC) = a minimal neural system that is directly associated with states of consciousness.
- There probably will be many NCCs, e.g. for
  - Being conscious vs. unconscious
  - Background state of consciousness
  - Contents of visual consciousness, etc
- Much recent work on neural correlates of visual consciousness
  - E.g. Milner/Goodale on dorsal stream
  - Logothetic et al on infererior temporal cortex

4: Systematize the Connection

- Correlate detailed first-person features with third-person features
- Move beyond brute correlation: systematize the connection with principles of increasing generality
- This may be premature right now, but some proposals exist (e.g. Edelman, Hobson, …). 10-20 years?
- Analogous to a general nonfundamental but explanatory macrophysics (e.g. thermodynamics?)

5: Infer Fundamental Principles

- Eventually, we want simple, basic, and universal principles that underlie and explain the higher-level connections.
- These principles will have an explanatory status akin to that of fundamental laws in physics
- Goal: a fundamental theory of consciousness. [50-100 years?]

Obstacles to a Science of Consciousness

- The science of consciousness is currently (relatively) theory-rich but data-poor
- There are bottlenecks in the collection of both
  - Third-person data
  - First-person data

Third-Person Data: Obstacles

- We have rich behavioral data
  - Yielding a rich psychology of conscious/unconscious processes, etc.
- But less rich & useful neural data
- An explanatory connection between third-person data and first-person data needs neural data at level of *content* and *mechanism*
  - Brain imaging: coarse-grained, hard to monitor content
  - Cell-level recording: better, but mostly limited to non-human animals – no verbal report!
- Dream: noninvasive cell-level recording in humans.

First-Person Data: Obstacles

- 1. Privacy of first-person data
- 2. Undeveloped methodologies for gathering first-person data
- 3. Lack of formalisms for representing first-person data.

Obstacle 1: Privacy

- First-person data are not intersubjectively observable
  - No “consciousness meter”
- This is a deep but not paralyzing limitation
  - (1) First-person observation
  - (2) Third-person indicators of first-person data
    - E.g. verbal reports, treated not as third-person data, but as reports of first-person data
    - Requires assumptions (e.g. that others are not zombies), but reasonable assumptions.

Obstacle 2: Methodology

- Methodologies for first-person data-gathering are primitive, compared to third-person methodologies.
- Methods are easy in some cases, but subtler data? E.g.:
  - The structure of a visual field
  - Consciousness outside attention
- It may be worthwhile to examine ideas from
  - Phenomenology (Husserl, …)
  - Eastern traditions (Buddhism, …)
  - Western psychophysics (Wundt, …)

  while using third-person data as a check on first-person data.

Obstacle 3: Formalisms

- We lack good general formalisms for the representation of first-person data.
- Formalisms are needed both for proper data-gathering and for theory construction
- Potential formalisms:
  - Parametric?
  - Geometric?
  - Topological?
  - Informational?
  - Representational?

Reference

- See *The View From Within: First-Person Approaches to the Study of Consciousness*, ed. Francisco Varela. Imprint Academic, 1999.
- [Francisco Varela R.I.P., May 28, 2001]

Conclusions

- There are numerous clear projects for a science of consciousness that takes first-person data seriously.
  - One can recognize the special problems and still do science.

- There are many obstacles, and it is an open question how far we can progress.
- But we are not yet close to the limits of progress
  - The last 10 years have seen many advances
  - The next 50 years will see many more.

- We may, eventually, have a theory of the fundamental principles connecting physical processes to conscious experience.