Week 2.

Lecture 2. Conscious experience as a construct.

Topic: "Consciousness" as a scientific construct. Comparing "more conscious" versus "less conscious" brain events.

Readings: Chapter 2 in the textbook. Please pay special attention to two points in Chapter 2, the notion of conscious limited capacity and the developing theater metaphor. This week's Phenomenology Lab will focus on evidence for limited capacityy.

A bit more history.

The study of consciousness was the defining question of 19th century and early 20th century psychology. Indeed, Wilhelm Wundt, one of the founders of Western experimental psychology, stated in the first sentence of his 1911 popular book on psychology that: "If psychologists are asked, what the business of psychology is, they generally answer as follows….that this science has to investigate the facts of consciousness…." (p.1). Wundt went on to say that an adequate study of consciousness and its processes required systematic observation of reports under controlled conditions. He argued that introspective analysis of experience was possible only for very simple stimuli, such as light flashes or short auditory segments, presented repeatedly. He very much disdained introspective analysis of ongoing complex thoughts as they emerge in spontaneous thinking; he thought that such analysis changed the very content that was to be studied. Thus, Wundt distinguished introspective analysis of sensory stimuli from introspective reporting of complex intra-psychic activities. "Many psychologists…thought by turning their attention to their own consciousness to be able to explain what happened when we were thinking…. This alleged method of exact introspection ended ultimately at the point from whence it started, i.e. scholastic philosophy" That is, the so-called "exact introspection" uncovered only the biases and beliefs of the reporter. It is very important to realize that Wundt did not support "introspection" in that sense; of the hundred or so empirical studies he published, only three used introspection, and those articles were critical of it.

There were other psychologists who tried to introspect on complex thought processes. Wundt's contemporaries at the University of Wurzburg attempted to study complex thought processes using introspective methods. They obtained extensive retrospective reports of the mental steps that meditated their answers to questions such as how they understood proverbs. Along with details of visual and auditory imagery, the participants also reported "imageless thoughts." Since the 19th century in general found it paradoxical to consider thoughts without consciousness, the very term "imageless thought" seemed to be a provocative oxymoron. Buehler's report (1907) of these findings led to a debate with Wundt (see Wundt, 1907), who argued that so-called imageless thoughts were artifacts. The inability of psychologists to resolve the "Imageless Thought Controversy" empirically led to general distrust of introspection as a valid method among later psychologists. Behaviorists in particular reacted by rejecting not just the method of introspection, but the whole topic of consciousness.

This conclusion was, it now seems, an over-reaction on the part of early 20th century psychologists. What was problematic was the unreliable introspective analysis of complex thought, not the process of reporting conscious contents itself. The validity of introspective reporting of simple sensory stimuli was never at issue. However, distrust of introspection led psychologists to avoid using methods that were labeled as "introspective" for decades, whether they were reliable or not (e.g. Ericsson, 2003).

The paradigm for studying conscious perception of simple stimuli developed by Fechner, Weber, and S.S. Stevens was not abandoned during the ascendancy of behaviorism and has remained standard. Typically, a graded series of simple stimuli is presented to the observer and reports of the observer's conscious perceptions are noted. The Psychophysical Law relating stimulus intensity logarithmically to subjective experience is a product of such well-controlled introspective reports. It could also be called "the law of conscious perception." In fact, classical psychophysics could also be called "experimental phenomenology"!

Introspection, understood as reporting of the contents of consciousness following the presentation of a stimulus, is problematic in a number of situations, one being reports following presentation of near-threshold stimuli. When observers are asked to report the presence or absence of stimuli near the threshold of awareness, their responses are heavily influenced by responses biases, including their own beliefs about what it means to be "conscious" or "aware" of something. Many factors including the wording of instructions can influence response criteria. For example, asking an observer to push a button "whenever something happens" differs from asking them to button press "when they see x" or "whenever they are aware of x." Marcel (1992) reported that the response modality (for example, verbal report, button press, eye blink) for conscious self-report may influence the reaction time for responding to stimuli.

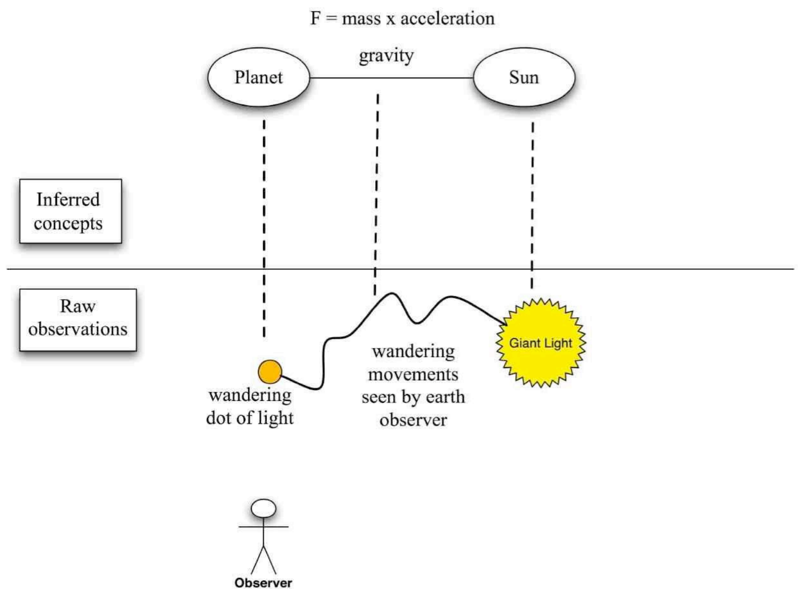
There is a curious asymmetry between the assessment of conscious and unconscious processes. Obtaining verifiable experiential reports works very nicely for specifying conscious representations; but unconscious ones are much more slippery. In many cases of apparently unconscious processes, such as all the things the reader is not paying attention to at this moment, it could be that the "unconscious" representations may be momentarily conscious, but so quickly or vaguely that we cannot recall it even a fraction of a second later. Or suppose people cannot report a word shown for a few milliseconds: does this mean that they are truly unconscious of it? Such questions continue to lead to controversy today. William James understood this problem very well, and suggested, in fact, that there were no unconscious psychological processes at all (1890/1983, p. 162ff.). This has been called this the "zero point" problem (Baars, 1988). It should be emphasized, however, that problems with defining a zero point do not prevent scientists from studying phenomena as variables. Even today, the precise nature of zero temperature points, such as the freezing point of water, continues to lead to debate. But physicists have done extremely productive work on thermodynamics for centuries. Zero points are not the sole criterion for useful empirical variables.

Consciousness as a scientific construct.

What is conscious experience, from a scientific point of view? (Remember, science takes a third-person viewpoint, even if the evidence comes from first-person reports).

We will make the case that consciousness is a construct, that is, a concept that is explicitly tied to many others, like the notion of immediate memory, and also to a large range of empirical observations in the public domain.

One way to look at a scientific construct is like this:



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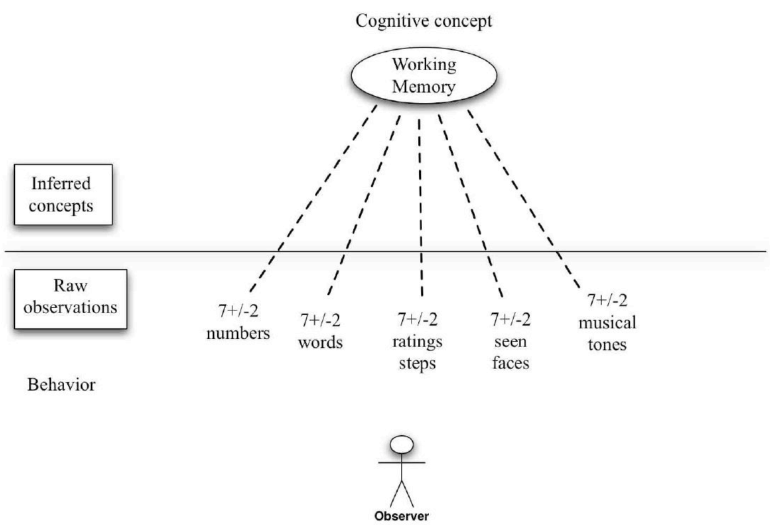
Notice the position of the observer, watching the sky --- including the sun, and (at night) the planets and stars. Early in human history people noticed that the planets behaved differently than the "fixed" stars. The planets looked like wandering lights in the sky (planet means "wanderer"). They were hard to understand because they seemed to move erratically. It was not until the Copernican revolution that astronomers became convinced that the planets seemed to move so weirdly because humans look at them from an odd point of view --- from a moving planet going in its own orbit around the sun.

The observer is looking at the planets from the outside. In the sciences, we do the same thing for human constructs like memory and consciousness. That makes it hard, but it's also important to be able to check on other people's observations. So there is a good reason for using the Third Person perspective even in studying our own minds.

Here is how a mind-brain construct looks:



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This is the well-known idea of Working Memory, which originated from observations made about fifty years ago of “the magical number seven, plus or minus two.” (Miller, 1956). It turns out that many tests of immediate memory come up with that number (it’s actually around four, but 7 is close enough for us). This is a major “capacity limit” --- and it is associated with consciousness, of course. So we have 7 digits in phone numbers, 7 notes on Western musical scales (the 8th is the octave, which is the same note), 7 steps on a judgment rating scale, and so on. The figure shows that we get the same number, approximately, with any series of arbitrary units to keep in immediate memory.

We could just say these are separate observations. But the phenomenon is so general that it is widely supposed that there is a single underlying “construct” --- something about the mind-brain that creates these limits. (There are ways of getting around the limit, but right now we’ll focus on the magic number.) Whatever these observations have in common is therefore attributed to a single idea, called “Working Memory.” In the same way, the odd paths of the lights in the night sky were attributed to a single scientific construct called “planet.” That turned out to be useful idea, though it took centuries to understand why.

So, scientific constructs are inferred from lots of reliable observations.

The current view of consciousness in the mind-brain sciences is that it is also an inferred construct, when we look at it from a Third Person perspective. But it’s a little weird, because we also experience conscious sensations and feelings directly --- or apparently directly. Consciousness can be approached from both a 1P and a 3P point of view. In my view, that’s a good thing. Philosophers in the behavioristic tradition used to argue that it’s a bad thing, and “illegal” and “unscientific” aspect of consciousness. Scientifically, however, there is a lot of evidence that converges between the 1P and 3P perspective. All of human perception and psychophysics is based on such convergences. In fact, it’s hard to find actual cases where 1P and 3P evidence seems to be incompatible.

Nevertheless, when people raise the question, “What is conscious experience from a scientific perspective?” the best answer is that it’s the same as the planets. It’s an inferential construct, based on reliable observations.

Theoretical constructs always fit into networks of other constructs.

There are no free-floating constructs in science. The idea of a “planet” is defined in terms of mass, gravity and the solar system. In philosophy of science this is called a nomological network (“nomological” suggests that the nodes in the network are named concepts). See our Reading for this week at http://www.socialresearchmethods.net/kb/nomonet.htm. All explicit scientific theories can be considered to be nomological networks like this.

From this point of view, conscious thought is not all that different from other scientific constructs like memory, language, meaning, vision, and so on. All these ideas are useful, reasonably well defined, and empirically testable in our shared world (3P). Over the last thirty years an enormous amount has been learned about human memory. As a results, the links between different kinds of memory and other concepts, like “vision,” have been greatly clarified. New empirical measures have been developed. The fact that consciousness, defined in this way, also corresponds to our own experience is not an obstacle– it is a big bonus.

Treating conscious experience as a scientific construct solves a lot of immediate problems. For example, it allows us to give a (temporary) answer to the philosophical question, “What is consciousness anyway? How do you define it?” Scientists don’t have a great answer to this challenge, but we have a wonderful way of getting around it! That is because nearly all scientific constructs begin their careers without adequate definitions. In a way, philosophers are asking us what the building will look like when it is finished. Most scientists are just trying get a solid foundation going, on the assumption that the shape of the building will emerge in due time.

The history of science is full of examples. Consider the career of the concept of “heat.” It surely begins with the perception of hot objects and places, long before human beings even existed. One of homo sapiens’ survival advantages was the ability to endure cold by using fire. To do that you have to have a concept of heat that you can share with others, to tell your babies to stay away from fire, to politely ask the cook to make your zebra steak well-done, and so on. We know that human beings create complex semantic networks that relate concepts like “hot,” “fire,” “cook,” “rare,” “well-done,” and “run! fire!” Semantic networks are a way of describing human knowledge; are similar to the nomological networks of scientific theory.

When humans began to bake clay pots, and to shape bronze and iron, they must have learned a lot more about heat. They must have found out that one kind of metallic ore melted at a lower heat than others, that the color of fired iron changed from red to white as more fuel and air were added, and much more. The semantic network for “heat” began to be increasingly sophisticated. The words that humans devised for it must have become more accurate as well, but like most of our everyday knowledge, it was mostly implicit (unconscious). People don’t need formal definitions most of the time: all they had to do was show each other the uses of the new high tech of fire-making, hundreds of thousands of years ago.

Fast forward many thousands of years. In the years before 1600, Galileo Galilei invented a new way of measuring temperature. It cleverly used tiny glass bottles with colored fluids, suspended in a large glass column filled with water. By adding small amounts of air to the tiny glass bottles, and attaching small metal weights, each little bottle could be calibrated to rise as a direct function of temperature. As heat was applied, the little bottle with the best approximation to the temperature will rise to the top. Heat suddenly became quantitative, a giant step toward greater clarity. The relationship of heat to the behavior of liquids, to gases like air, and to the buoyancy of objects in water began to emerge: A new nomological network was beginning to be worked out.

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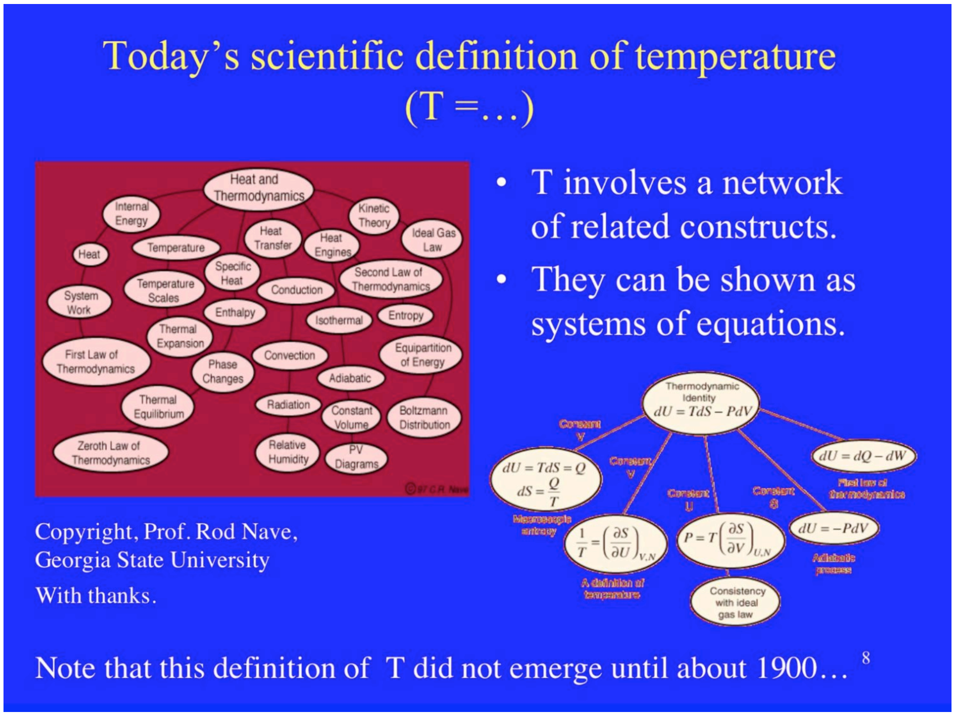
But there were drawbacks. Galileo thermometers have a very narrow temperature range. They cannot tell the difference between small changes in temperature. Our own built-in heat sense has much finer gradations.

Fast forward another few centuries, and around 1700 Fahrenheit invents the mercury thermometer, really just another vertical glass column filled with liquid, but this time it's mercury, which expands steadily as a function of heat in a wide range of "degrees Fahrenheit." By now the small group of amateurs who play with these arcane matters know that a mercury column will rise higher at the top of a mountain than at sea level. (It will take time for the explanation to emerge). The mercury level can even predict a coming storm, as the air pressure drops. The Fahrenheit thermometer now begins to spin off all kinds of useful tools, like barometers, and maybe even the ability to measure the melting point of steel --- providing you stand far away from the furnace. "Heat" is now a quantity, measurable to single degrees F, and its relationship to air pressure and gas volume is becoming clear.

To make a long story short: Even after the mercurcy thermometer was invented, the real theoretical definition of heat was still two centuries into the future. It doesn't get settled until 1900 or so, when thermodynamic theory gains acceptance in physics. "Heat" then became a firm scientific construct, part of an explicit nomological network of constructs that also include the velocity of molecules, mass, and infrared radiation. Now progress comes very quickly, with much better instruments, and spectacular discoveries. Now we can measure the temperature of Alpha Centauri, four light years away from the sun, just from observing its color spectrum. And while thermodynamic theory looks pretty complicated to most of us, it has the most striking simplicity, considering how much it explains. As Einstein said, the astonishing thing about the universe is that it is comprehensible.



OK, long story --- what about consciousness? Here are the lessons we take from the history of the heat concept.

What is consciousness? We just don't know today, at anything like the level of sophistication of thermodynamic theory. That level of understanding could come decades from now, or never. We make our bets as best we can, knowing that life doesn't come with guarantees. But we can find "empirical indices" even today, often called operational definitions. We do have he equivalent of early thermometers, but we can only guess how close they are to the real thing. We will talk more about our operational definitions of conscious cognitions later in the course, but the simplest is one is what we use in everyday life: We ask people about their experiences, and try to verify the answers. This is routinely done in psychology, medicine, and brain science. When somebody comes into an emergency room in an unresponsive state --- that is, unable to answer questions about their experiences --- we also measure the brain voltages on their scalp, the electro-encephalo-gram (encephalus means brain, from Greek, "in the head"). Physicians have well-developed yardsticks for assessing impaired consciousness in medical emergencies, as we will see. In many cases where people are unresponsive we use fMRI or other brain recording methods. All tell us something about conscious processes. So we are seeing a lot of new candidates for better operational definitions of consciousness. None of them are complete or adequate, but they are getting better over time.

The bottom line: We have some interesting ideas, but we don't know "what consciousness is," if by that you mean a complete, explicit theory. If, however, you are asking, "do we have pretty useful ways of telling when conscious events occur?" we are in reasonably good shape. But our methods are far from perfect. We might be somewhere near the stage of Galileo's crude thermometer.

2. Notice that the meaning of the concept of "heat" changed over time, but not so much that the continuities cannot be seen.

The first fire-tamers in human history had a hugely important operational definition of heat, one that made human survival possible --- but it wasn't quite as accurate as the first blacksmith's way of assessing heat, or the first cook's, the first bronze smelter's, or Galileo's or Fahrenheit's. But it would be silly to deny that long before the theory of thermodynamics in 1900, human beings knew a lot about heat. We just don't need complete scientific theories to understand a lot about reality. All that applies to the concept of consciousness today.

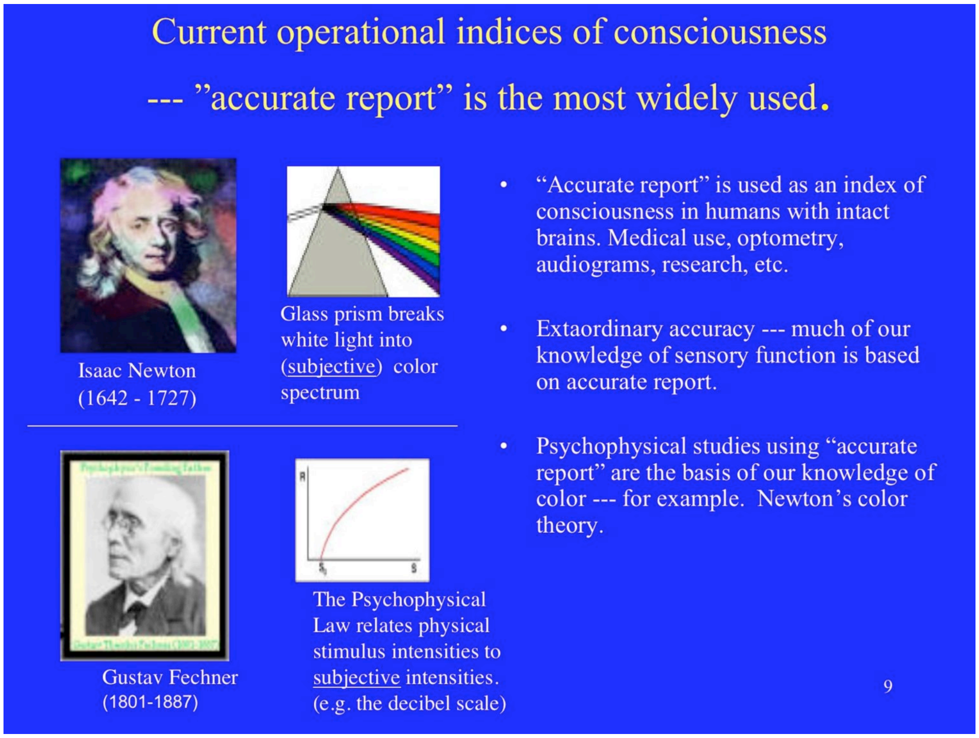
Scientists talk about "bootstrapping" from an early measure of a concept to a better one. Bootstrapping a messy affair, involving constant debate about empirical observations and what they mean. But at the end of the day, rubbing two sticks together with fire has something to do with using high-tech infrared detectors to find out the temperature of Alpha Centauri. In some broad sense, a similar concept of heat is involved. You could point that infrared sensor at a wood fire and it would show what early Homo Sapiens knew out about fires. But it also shows a lot more.

We can stick our fingers into the fire of consciousness, and learn something we didn't know before. So we don't have the final answer! We might not even be close. But we do have quite a useful operational definition to work with: It's our everything way of reporting our feelings and perceptions. As we will see, that "reportability measure" has now been refined in useful ways, and the bootstrapping process is going on even today with functional brain imaging.

Comparing conscious events to each other.

While people have studied consciousness for a long time, they have generally done so by comparing one conscious experience with another one. That is extremely useful, but it doesn't give us the whole story.

Take one of the great discoveries of early psychophysics, the Psychophysical Law as stated by Gustav Fechner in the 1820s. Fechner was a physicist who dedicated his life to trying to solve the mind-body problem ("psycho-physics" means "mind-body"!). In his time the great discovery in physics was a host of dimensions of measurement: temperature, time, microscopic distances, telescopic distances, speed, mass, the force of gravity, and so on. Fechner believed that all physical dimensions had conscious counterparts. If physical and psychical quantities could be related, he believed that the mind-body problem would be solved. Heat is measured by degrees Fahrenheit or Celsius, and the degree of conscious appreciation of heat intensity was measured by "just noticeable differences" (jnd's). Basically, one conscious event (let's say the touch of a hot coffee cup right after boiling) is compared to another conscious event (the touch of the same coffee cup after it's been allowed to cool for sixty seconds). As soon as the heat of two coffee cups can be distinguished, we have a jnd. Using jnd's we can map out the whole range of conscious heat intensities. The same thing can be done with other physical dimensions.



Based on earlier studies, Gustav Fechner realized that

Psychological Stimulus Intensity = log of Physical Stimulus Intensity (multiplied by a constant)

(See http://psychclassics.yorku.ca/Fechner/wozniak.htm)

The Psychophysical Law is amazingly general, applying to all the senses, and also to abstract intensity judgments. It is widely used today. When we talk about “decibels” of sound intensity we are using the Psychophysical Law. The decibel scale is a logarithmic scale in which each step corresponds to a just noticeable difference (jnd). Your audio equipment is calibrated in decibels, just as the colors on your screen are measured in terms of human sensory reports. The method of jnd’s has had enormous ripple effects for the past two centuries, and it all has to do with sensory consciousness.

But does Fechner’s approach solve the scientific problem of trying to understand consciousness? Well, as we pointed out, he thought it solved the mind-body problem, because it related “psyche” (mind) to “physis” (body) as it is studied by physicists. And the field of psychophysics has added enormously to our knowledge of conscious sensations. One cannot understand the conscious appreciation of the color red, for example, without studying centuries of empirical findings about that light, lenses, the physiology of the eye, the neurons in the retina, and the visual pathway well into the cortex. (As we mentioned previously, the vision scientist Steve Palmer wrote a 1999 BBS article on Locke’s inverted spectrum problem that brings that literature to bear on a traditional puzzle in mind-body philosophy).

The limitation is this: We would argue that traditional psychophysical methods do not tell us about consciousness “as such.” That is because they compare conscious events to each other. But comparing the hot feeling of two different coffee cups presupposes conscious experience; it does not study it. The only way we know to study things in science is to treat them as variables, so that we can look at the effects of more vs. less. Standard perception and psychophysics have not done that until recently. (But see the classic work by Rock and Mack in our Advanced Readings for this week).

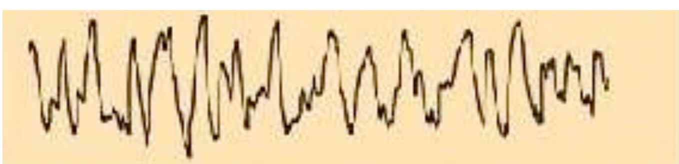
Contrastive analysis: Comparing conscious events to matched unconscious ones.

Scientific studies of consciousness depart from philosophical, contemplative and literary explorations in one major respect: They must treat consciousness as a testable variable. We therefore study the diffferences between attended versus unattended events, masked versus conscious stimuli, the waking state versus sleep, and many others. Brain damage shows surprising dissociations between similar conscious and unconscious functions in blindsight, neglect and even split brain cases.

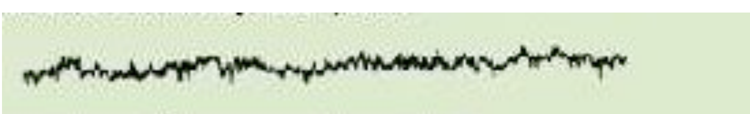
We can talk about three kinds of contrastive analyses:

Contrasts involving states.

We can obviously compare deep, unconscious sleep, to waking consciousness. One of the things EEG researchers found out seventy years ago is that deep sleep is characterized by slow, high-amplitude and quite regular voltages, simply picked up from electrodes on the scalp.



Waking, on the other hand, shows the opposite: fast, low-amplitude, and irregular waves.



Since we are looking at the summed electrical activity of billions of neurons, there are all kinds of ways of taking these waveforms apart, to find out what's happening. But even the "raw" EEG shows huge differences.

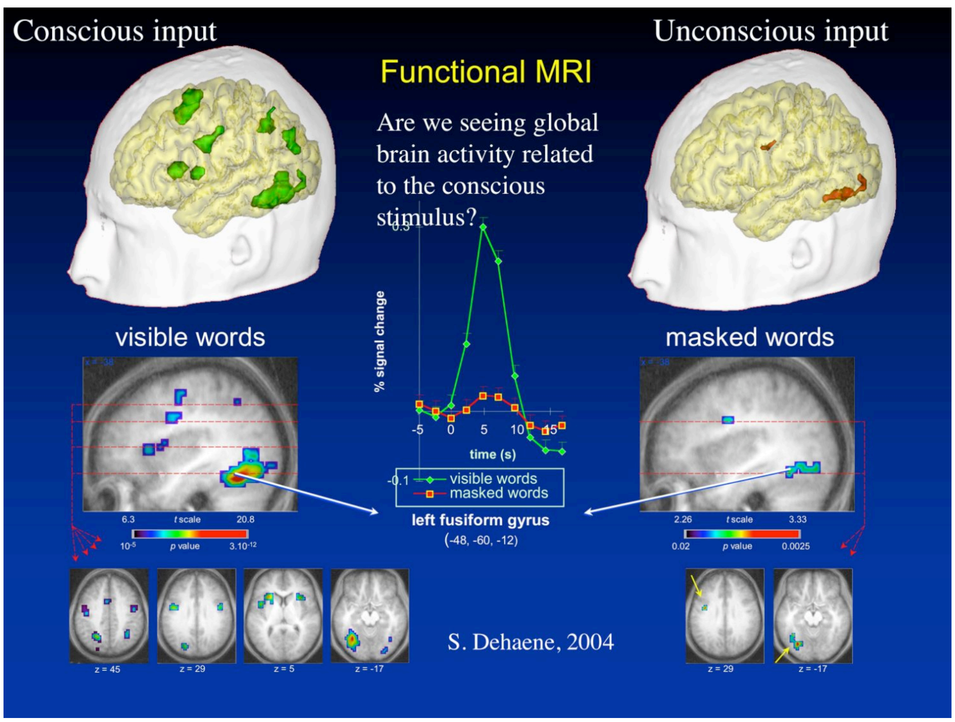
Now it is very interesting that, like deep sleep, other unconscious states also show slow, high-amplitude, and regular waveforms in the EEG. That includes persistent vegetative states (comatose states in which the upper brainstem and perhaps part of cortex may be spared), epileptic loss of consciousness, and even general anesthesia. In epilepsy the EEG waveforms have a different shape, but they are still slow, high in voltage, and regular. These are intriguing regularities, and we will look at some possible explanations later in the course.

2. Contrasts involving contents.

But suppose that we just look at waking people, and try to compare conscious and unconscious events for them while holding the contents of those events constant.

Here is a straightforward example. We can say a word mentally and let it fade; for about ten seconds afterward it can still be recalled. Our ability to retrieve the word easily from immediate memory suggests that an unconscious trace must be maintained for a little while. Both the conscious experience of the word and its unconscious memory are believed to involve brain events, which can be observed directly via brain recording methods today. This contrastive analysis method therefore does not raise the traditional mind-body puzzles of mentalism, dualism and physicalism. All comparisons are between physical events. We simply have a controlled experiment, allowing us to compare the same word when it is conscious and when it is not. We can therefore ask, “What is the effect of being conscious of a word?”

It turns out that conscious words show strikingly different brain activity compared to identical unconscious stimuli (e.g. Dehaene, 2001; Baars, 2002). Here is a typical result from Stanislas Dehaene, comparing conscious and unconscious words. We show it here without much detail, but we’ll come back to it often. Just look at the two heads (they are computer-reconstructed MRI images of Dehaene himself). In the right-hand image you see a red region, corresponding to the part of the brain that recognizes visual word forms. This is the UN-conscious condition. Using the identical stimuli but without masking, that is, with conscious stimuli, the left side shows activation in this same area, but ALSO a great deal of activity in many other regions brain. This result has now been found in many different studies, using many different methodologies. Evidently, consciousness is a difference that makes a difference.



Caption: From Dehaene, S. et al (2001). Cerebral mechanisms of word masking and unconscious repetition priming. Nature Neuroscience. With authors’ permission.

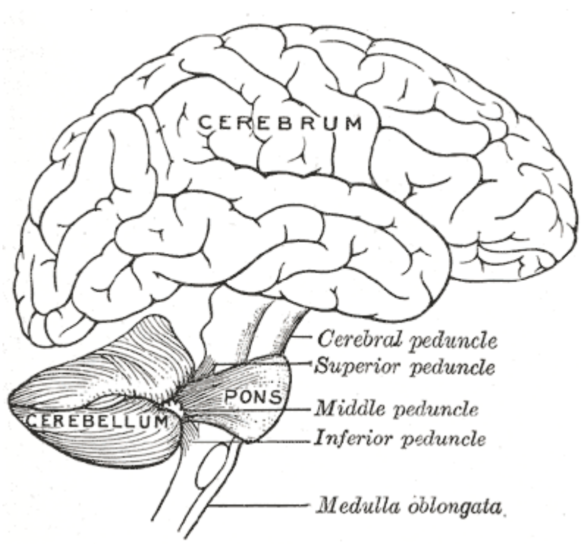
We will discuss this kind of contrast extensitvely in our Phenomenology Lab and in future lectures. It is also covered in the textbook.

3. Contrasts involving brain mechanisms.

Here is a third kind of contrast, between different brain regions. This particular example has been explored very creatively by the neuroscientists Giulio Tononi: It is the difference between the cerebellum (a huge brain organ that does not support conscious experience) and the cerebral cortex (as far as we know today, the major brain region that supports the contents of consciousness, such as sights and sounds, bodily feelings, intentions to act, and the like). Here is how they look. Both are gigantic structures, containing tens of billions of neurons. But if we lose the cerebellum, the most obvious symptom is an inability to make fine motor movements, like grasping an object. People with cerebellar loss can see the conscious visual world, hear and understand speech, and even act intentionally, even though their actions tend to be clumsy.

On the other hand, if we have even very local damage in one small part of visual cortex, for example, people lose the ability to see color, or to experience motion, or even to see anything consciously in the visual world. As we will see in more detail later, conscious CONTENTS seem to depend upon the cortex, at least in humans.

So we have a major contrast: Both cerebellum and cortex are giant, higly sophisticated collections of neural networks. But only one supports conscious experience, as far as we know. What is the difference? We are not going to speculate about an answer here. (But a very readable account is given in the book by Edelman & Tononi, 2000).



Caption: Although the cerebellum looks smaller than the cerebral cortex, in fact it has similar numbers of neurons. The question is therefore: Why does cortex support conscious contents, while cerebellum doesn't?

(From: Gray's Anatomy (1911), copyright Bartleby.com.)

Contrastive analysis allows us to do standard science on the question of conscious cognition without first having to solve the mind-body problem. Any adequate theory of consciousness must account for the entire set of empirical contrasts, which is very large indeed (Baars, 1988, 1997). The scientific questions are therefore highly constrained by evidence.

Note that contrastive analysis does not evade phenomenology. On the contrary, experiential reports are necessary for each contrastive case. In binocular rivalry we compare a conscious stream of optical input to a physically identical unconscious stream. We can observe the effect of both streams on the activity of neurons in the visual brain (e.g. Kreiman et al, 2002). This kind of experimental comparison now been performed in hundreds of experiments, using scores of different methods (e.g. Baars, 2002; Baars et al, 2004; Frackowiack et al, 2004). (Table 1) Any theory that can account for the resulting evidence deals with some aspect of consciousness. If we ever find a way to explain all the contrastive evidence, we will have a complete theory.

But should we use the word "consciousness" for this evidence?

We might avoid the word "consciousness" completely in such studies, and speak in a purely descriptive language about "reportable" vs. "unreportable" brain events. Behaviorists and operationists long argued that this is in fact a better way to talk about consciousness (Stevens, 1966). However, radical operationism forces us to sacrifice the scientific advantages of generalization: if we applied it to the concept of memory, for example, we would have one kind of memory for button presses, a different one for verbal responses, yet a third for confidence ratings, and as many others as we have operational measures. Recognition and recall would be very different events, even for the same memories. We would therefore end up with a confusing swarm of empirical measures. The scientific term "memory" therefore refers to a construct inferred over many observations, just like the term "gravity" does in physics or "species" in biology. This is normal scientific development.

In precisely the same way, the term "consciousness" is a construct that can be readily inferred from numerous brain and behavioral observations, ranging from verbal reports to waking EEG. We could call it by some arbitrary label, such as the letter C, but fortunately, over a host of experimental conditions the concept also happens to correspond to our personal experience. Researchers in perception and psychophysics have long known this, routinely using themselves as observers in their own experiments. Under the proper conditions, objective and subjective sources of information converge with remarkable precision. Indeed, we cannot have our vision or hearing tested without making use of this fundamental psychophysical discovery.

Thus the term "consciousness" in science involves a reasonable application of a common sense term to an objective construct. This is again routine in science. Scientific terms like "force," "matter," "heat," "light," "color," "sleep," and many more, began as common sense terms that were empirically tested and refined over time.

Readers who are accustomed to thinking of conscious experience in terms of philosophical debates may need to adjust to the naturalistic use of the term "consciousness." We will use it like any other psychobiological construct. To say that a conscious stimulus evokes a different pattern of brain activity than a matched unconscious one is not different from saying that the brain basis of speech input is different from speech output. Terms like "perception," "memory," "attention," and "consciousness," all refer to psychobiological constructs.

We are therefore in a very unusual historical situation. For the first time in a hundred years, the discussion of conscious experience is clear of conceptual obstacles. It is true that every traditional argumenta against the free study of consciousness is still alive somewhere. But in the sciences, at least, we are beginning to talk about it without a lot of taboos or prohibitions. There is much more intellectual breathing room than before, which allows us to look at the evidence without precluding any relevant considerations a priori.