

Name: _____ Student ID#: _____

**University of California, Berkeley
Department of Psychology**

**Psychology 129 / Cognitive Science 102
Scientific Approaches to Consciousness**

Fall 2014

Final Examination KEY

Write your name at the top of every page.

Please indicate your Discussion Section # (or time, or GSI) here: _____.

And please sign the ***UC Berkeley Honor Pledge***:

On my honor, I have neither given nor received assistance in the taking of this exam.

Write your answers *in ink*. Answers written in pencil will not be eligible for regarding. Write legibly, or we won't be able to appreciate how wonderful your answers are.

**The scoring guide used to grade the exam
will be posted to the course website as soon as possible after the exam.**

**Exam grades will be posted on the course website
as soon as possible after December 22.**

Exam Analysis

What follows is a scoring guide used to grade the Final Exam.

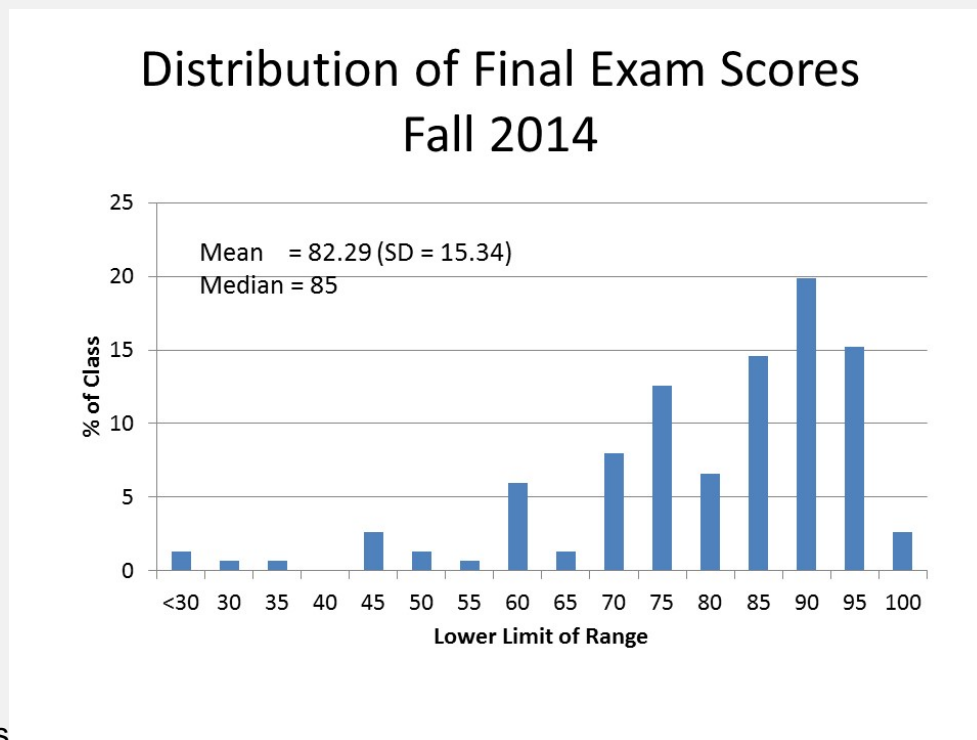
On the initial scoring of the exam, the average score was 80.33 ($SD = 15.71$), corresponding to 80%. Psychometric analysis yielded an excellent reliability (Cronbach's alpha) of .86.

To identify "difficult" items, I examined the percentage scores for each item (items were worth 3-9 points). The average item score, computed as a percentage of the points available for that item, was 82% ($SD = 14%$).

I also computed item-to-total correlations. All of these were acceptable except Items #1 and 2, which were low due to restriction of range. That is to say, everyone did so well on them that there was little or no variability.

By the standards outlined in the Exam Information page, only Item #5 was an outlier, with a percentage score far lower than 2 *SD* below the mean. This item was rescored, giving all students full credit.

Rescoring raised the mean Final Exam score to raising the mean exam score further to 82.29 (*SD* = 15.34).



Final letter grades were determined according to the procedure described in the Exam Information page.

Employing the “industry standards” for letter grades yielded the following percentages in each category (remember, I don’t give grades of A+):

Letter Grade	Minimum Score	% of Class
A	209	22.85
A-	202	15.23
B+	195	7.95
B	186	13.25
B-	180	7.28

C+	173	7.28
C	164	6.62
C-	157	5.30
D+	150	4.64
D	141	1.32
D-	135	1.32
F	<135	6.62

That's a pretty good distribution of letter grades, but it's a little low compared the average for upper-division courses in the Biological and Social Sciences (excluding Psychology), as described in the Exam Information page. There, for example, we find about 43% As, for example (28.75% A and A+, 16.7% A-) and 36.88% Bs.

So, I adjusted my grading standards accordingly, by ratcheting the criteria down a notch. So, students who accrued at least 202 points received a solid A (37.75% of the class), while those who accrued at least 195 points got an A- (7.95% of the class), and so on all the way down (remember, as described in the Exam Information page, I assign letter grades based on points, not percentages). That resulted in 45.70% As and 27.81% Bs, right about at campus standards.

Remember, too, that I guarantee some kind of C to any student who accrues more than 50% of the available points, or 112 points; so all those Ds converted into some kind of C.

Noncumulative Portion

Answer the following 15 questions. Each question is worth 3-5 points, so that this portion of the exam totals 50 points. *Do not provide long-winded answers.* You have approximately 3 minutes, on average, for each question, and we are grading accordingly. Use only the space provided for your answer. Just a few sentences will do – typically, no more than three to five. Get right to the point.

1. The vegetative state is commonly characterized as “wakefulness without consciousness”. Why? [3 points]

Mean Score = 2.82; Item-to-total $r_{pb} = .13$. Vegetative patients are generally unresponsive to stimulation, but their eyes do open and close periodically, according to the normal cycle of waking and sleeping. Moreover, the EEG in vegetative patients shows some signs of various stages of sleep, such as spindles and K-complexes. Comatose patients, by contrast, show little more than persistent slow-wave (delta and theta) activity. [Coma & anesthesia Lectures]

2. General anesthesia is sometimes characterized as a “controlled coma”. Why? [3 points].

M = 2.96; $r_{pb} = -.01$. In general anesthesia the patient is unresponsive to environmental stimulation, just as in a coma. And the EEG in both conditions is characterized by the dominance of low-frequency “delta” and “theta” activity. But patients can be brought out of anesthesia “at will” by the simple expedient of terminating administration of the anesthetic drug. . [Coma & Anesthesia Lectures; Revonsuo, Chapter 8].

3. Some apparently comatose or vegetative patients appear to be in the “minimally conscious state”. How do we know? [4 points]

3.84; .52. Patients in the minimally conscious state sometimes show discriminative response to stimuli, such as words vs. meaningless sounds, in the EEG or fMRI. However, this discriminative responding might reflect automatic, unconscious processing. Better evidence comes from studies in which patients show discriminative responding to commands, or even answer questions by imagining various behavioral responses. Only a small minority of vegetative or ostensibly “MCS” patients show differential response to command. [Revonsuo chapter 8].

4. When do we know, for sure, that a person has fallen asleep? [3 points]

2.74; .54. Conventionally, “sleep” is defined by the disappearance of alpha activity in the EEG. Additional markers of “Stage 2” sleep include the appearance in the EEG of “spindles” and “K-complexes”. Even when the person moves out of Stages 3-4 into Stage REM, we know he’s still asleep because there is no alpha activity mixed in with the beta activity. [Sleep & Dreams Lecture]

5. Norman Malcolm, a philosophical behaviorist in the tradition of Gilbert Ryle, offered a famous theory of dreams. What are the essential points of the theory? [3 points]

1.04; A bad item. Ryle, Malcolm, and other behaviorists identify mental experiences either with environmental stimuli or behavioral responses to them. By virtue of deep levels of muscle relaxation, sleepers cannot engage in behavioral activities during REM. Because dream reports cannot be verified objectively, dreaming can only refer to *dream reports* made upon awakening, rather than anything that happened during sleep itself. [Revonsuo, Chapter 13]

6. What are the elements of Hobson’s AIM theory of dreaming? [4 points]

3.41; .71. According to Hobson, dreaming is one of a number of biochemically induced altered states of consciousness, characterized by high levels of cortical activation, which generates high levels of mental activity, including dream imagery; a closing of

input-output gates to eliminate both external sensory stimuli and voluntary motor activities – forcing mental activity to be based on memory, and preventing sleepers from acting out their dreams; and high levels of cholinergic activity (or, alternatively, low levels of aminergic activity), resulting in poor memory. [Sleep & Dreams Lecture]

7. Why do the “dissociative” and “conversion” disorders belong together? Even though they belong together, how are they different? [3 points].

2.72; .54. Both the dissociative and conversion disorders involve disruptions in the monitoring and/or controlling functions of consciousness. In the dissociative disorders, patients lose conscious access to memories about themselves – either episodic (autobiographical) memory or semantic memory (e.g., identity), or both. In the conversion disorders, patients lose conscious access to sensations and perceptions, or the ability to consciously control voluntary motor activity. [“Hysteria” & Hypnosis Lecture: Kihlstrom chapter on Dissociative Disorders]

8. How are the phenomena of hypnosis “dissociative” in nature? [3 points]

2.82; .56. Many of the phenomena of hypnosis entail dissociations between explicit and implicit memory and perception. In posthypnotic amnesia, for example, subjects perform poorly on explicit memory tasks such as recall and recognition, but show intact levels of implicit memory, such as priming. In hypnotic blindness, for example, subjects do not consciously perceive visual stimuli, but are nonetheless influenced by visual stimuli outside of conscious awareness, as in priming effects on homophone spelling. [“Hysteria” & Hypnosis Lecture; Kihlstrom chapter on Consciousness in Hypnosis]

9. What are the arguments *against* the status of hypnosis as an altered state of consciousness? [4 points]

3.26; .55. It seems unlikely that consciousness can be altered simply by means of verbal suggestions, as seems to be the case with a standard hypnotic induction procedure. Maybe some people can experience genuine alterations in consciousness during hypnosis, but these “virtuosos” are very rare in the population. For most people, hypnotic experiences are simply a product of normal processes, such as mental imagery, expectations, and “going along”. No specific, reliable physiological correlate of hypnosis has ever been found [Revonsuo, Chapter 14]

10. What are the basic characteristics of daydreams? Under what circumstances are they most likely to appear? [3 points]

2.76; .43. Daydreams are instances of mind-wandering, which entails stimulus-independent and task-independent thoughts (SITUTs). SITUTs are most likely to occur under conditions of low cognitive load – either because the task is not cognitively demanding in the first place, or because the person is highly skilled at performing it. [Absorption, Daydreaming, & Meditation Lecture; Revonsuo Chapter 15]

11. What is alpha blocking and why was it studied in in Yoga and Zen meditation? [3 points]

2.09; .59. In two early studies, yogis did not show the alpha-blocking orienting response to surprising stimuli, while Zen masters did not show habituation of alpha-blocking to repeated stimulation. Such findings would suggest actual physical changes in accordance with the goals of the respective meditative traditions—in yoga, to become oblivious to the external world; in Zen, to break free of pre-conceived categories. Unfortunately, these early results have not been replicated. [Absorption, Daydreaming, & Meditation Lecture]

12. How did neuroscientists identify the “default-mode network” in the brain? How convincing is this evidence? [4 points]

2.59; .49. The DFN, or “task-negative network”, consists of a set of brain structures which show *increased* activity when subjects are resting quietly, with their eyes closed, not thinking about anything in particular; and *decreased* activity during attention-demanding tasks. The principal problem with the DFN is that subjects who are not thinking about anything in particular are still thinking about *something* – namely, their daydreams, or mind-wanderings. A better identification of the DFN would come from experiments where subjects in the control condition are thinking about *nothing at all*. [Absorption, Daydreaming, & Meditation Lecture]

13. “Adult chimpanzees, but no other nonhuman animals, show levels of mirror-self recognition comparable to that of human toddlers aged 18-24 months.” Comment. [3 points].

2.55; .45. While the vast majority normal human infants show MSR by 24 months, only a minority of adult chimpanzees actually pass the test. More chimps pass MSR, proportionally, than any other species, but it’s still a minority of the species – primarily, those who were raised in groups. Individual members of other species have been reported to pass MSR, but this evidence is often anecdotal and untested in representative samples of the species in question. [Origins of Consciousness Lecture; Gallup chapter]

14. Does the chimpanzee have a theory of mind? [4 points]

3.41; .57. Only to a limited degree. Chimpanzees do very poorly on “theory of mind” tests in the Primate Cognition Test Battery, compared to human children aged 4-5. Some animals, particularly primates and some other mammalian species, appear to have at least the rudiments of consciousness. But only chimpanzees and orangutans clearly pass mirror self-recognition – and only a minority of chimpanzees at that. And neither chimpanzees nor orangutans perform very well on nonverbal tests of the theory of mind that are passed by a majority of human 2- and 3-year-olds. Perhaps laboratory tests that more adequately represent the animals’ natural behavioral ecology will reveal levels of consciousness that our current paradigms miss. [Origins of Consciousness Lecture]

15. What can we say about consciousness in split-brain patients? [3 points]

2.30; .58. Based on special laboratory tests, it is possible to argue that the right hemisphere can be conscious of stimuli of which the left hemisphere is ignorant, and vice-versa. Some investigators have gone so far as to suggest that the right hemisphere is unconscious, and the left hemisphere functions as a sort of conscious interpreter of the experiences that are accessible to it. Other theorists argue that phenomenal consciousness can be divided, in split-brain patients, but that reflective consciousness and self-awareness remain intact – precisely because these are left-brain functions. [Revonsuo Chapter 6]

Cumulative Portion

Answer *each* of the following 7 questions, which are worth 6-9 points each, bringing this portion of the exam up to 50 points. There is no choice. Your answers can be more expansive than in the noncumulative portion, as appropriate, but they should still be very brief. You have approximately six (6) minutes, on average, for each question, and we are grading accordingly. Of course, you have a full three hours to complete this two-hour exam, so you can take more time if you wish. But again, use only the space provided for your answer. For some questions, just a single paragraph will do.

16. In a recent essay (*chronicle of Higher Education*, 11/14/2014), the philosopher Eric Schwitzgebel characterized David Chalmers’s theory of consciousness as “panpsychist epiphenomenalist property dualism” What do each of these terms mean, and are they correctly applied to Chalmers’s theory?. [6 points: 1 points for each definition, 1 point for each application]

4.14; .58. *Panpsychism* – the idea that every material thing is conscious. Chalmers verges on panpsychism, at least, because he holds that any material object that embodies information is, to that extent, conscious; and that’s almost everything, including thermostats and solar systems.

Property dualism – the idea that the physical and the mental are not different kinds of things (substance dualism), but rather two different kinds of properties of physical things. Chalmers is definitely a property dualist, because he believes that phenomenal experience is a property of all physical systems that represent

Epiphenomenalism – the idea that, while people have phenomenal experiences, conscious mental states play no causal role in the material world. It’s not clear that Chalmers is actually an epiphenomenalist, though it’s hard to see how nonphysical, mental properties could play a causal role in the physical world.

17. Thomas Nagel famously wrote that “consciousness is what makes the mind-body problem really intractable”. Why is this so? And why, according to Searle, does the mind-body problem appear so difficult to solve? *Briefly* summarize three of Searle’s arguments. [9 points]

6.73; .53. Consciousness makes the mind-body problem difficult because it’s easy to imagine a physical system that engages in various sorts of information-processing activities when generating a behavioral response to an environmental stimulus. It’s a lot more difficult to figure out how such an information-processing system could generate phenomenal experience. Or, indeed, why it should do so – that is, why consciousness offers us any adaptive advantage.

Up to 3 points for explicating the Nagel quote. Then any three of the following reasons will do, up to 2 points each, depending on how well the student elaborates on the basics. This list is gleaned from Chapter 1 of the Mystery of Consciousness; students can also abstract similar points from the individual reviews]

- a. First and foremost, there is the language of the mind-body problem itself, rooted in Cartesian dualism – a distinction between mind and body that suggests that there is no causal connection between brain and consciousness.
- b. Even for materialists, there is the Cartesian distinction between mind and body to begin with, which suggests we generally assume that consciousness is caused by the brain, but the brain is enormously complex, with 10 billion neurons and perhaps a thousand times that many synaptic connections among them.
- c. And the very problem of defining consciousness, and characterizing various states of consciousness, seems daunting.
- d. And just when you resolve to abandon dualism, the idea that brain processes are causes and consciousness is an effect seems to return you to dualism, via “the

mistaken notion that causes and effects are discrete events ordered sequentially in time”.

- e. We don't have a good idea of how brain processes could cause qualitative mental states, which leads us to think that maybe they don't.
- f. The appeal of the computer metaphor of the mind, which discounts consciousness in favor of information-processing functions that manipulate symbolic representations.
- g. Confusion between observer-independent features of the world, which exist regardless of what anyone thinks, and observer-dependent features, which are the products of conscious mental activity. In an interesting twist, Searle argues that “information” is observer-relative, because symbols exist only relative to the mind of an observer; and consciousness is observer-independent, because my mental states are mine, no matter what anyone else thinks.
- h. Excessive reliance on “Strong Artificial Intelligence”: because symbolic computational processes always depend on a human interpretation, these same computational processes can't cause conscious mental state.

18. What are the characteristic features of an automatic process? In what way are automatic processes unconscious? How can we separate automatic (unconscious) from controlled (conscious) processes? [9 points: 1 point for each feature; up to 5 more points for the rest.]

6.99; .53. Automatic mental processes are: (1) inevitably evoked by an appropriate stimulus, (2) incorrigibly completed once evoked, (3) consume few or no cognitive resources, and (4) interfere minimally with other ongoing cognitive processes.

Automatic processes are unconscious in the strict sense of the term, because they operate outside of phenomenal awareness and independently of conscious control. More important, they cannot be subject to direct conscious introspection, and can be known only by inference from behavior.

We can separate automatic from controlled processes by techniques such as Jacoby's "Process Dissociation Procedure". Without going into the mathematics, the PDP compares performance in an "Inclusion" condition, in which automatic and controlled processes work in the same direction, with an "Exclusion" condition, in which automatic and controlled processes are placed in opposition to each other. By means of a subtractive logic, PDP measures the comparative strength of the automatic and controlled components of task performance. [Attention and Automaticity]

19. By definition, adequately anesthetized patients cannot recall, postoperatively, the events of their surgery. But under some conditions, they can show priming effects caused by these events. Does this count as a dissociation between explicit and implicit *memory*, or a dissociation between explicit and implicit *perception*? Explain your answer. [9 points]

6.82; .37. At first glance, this looks like a simple dissociation between explicit and implicit memory: recall is a traditional measure of explicit memory, and priming is a widely accepted measure of implicit memory. So, subjects show priming for material that they can't recall. But memory is a byproduct of perception, and there is no point in talking about conscious recollection of an event that wasn't consciously perceived in the first place. Laboratory studies of anesthesia, such as those that led to the MAC and Bispectral analyses of anesthetic depth, not to mention studies using the isolated forearm technique, make it clear that adequately anesthetized patients don't consciously perceive surgical events in the first place. When priming serves as the measure, the difference between implicit memory and implicit perception is whether the prime was consciously perceived (in which case, memory) or not (in which case, perception). So, in this case, the patients are showing priming effects of events that they didn't consciously perceive in the first place. That justifies interpreting these particular priming effects as instances of implicit perception.

20. How can we identify an altered state of consciousness (ASC)? Which of these criteria is most important? Show how these criteria can be applied to any ASC. [9 points]

7.06; .56. An ASC can also be identified by the convergence of an induction technique, reported changes in subjective experience, correlated changes in behavior, or correlated changes in physiological state. But the most important of these is a significant change in the overall pattern of subjective experience from a baseline “normal” state of consciousness.

As for the example, pick a state, any state. Some fit really well. General anesthesia, for example, has the subjective state (total loss of phenomenal awareness), an induction procedure (the anesthetic agent), behavioral correlates (lack of responsiveness to surgical stimuli), and physiological correlates (e.g., low Bispectral index). Others have only some. So, for example, in sleep there’s no induction procedure (unless you count going to bed and turning out the light). And in hypnosis, there are no physiological correlates (unless you count such observations as activation and deactivation of the color area of the brain in hypnotic color-blindness and color hallucination). [Kihlstrom “Hypnosis” article and Revonsuo, Chapter 12]

21. If you were Helen, what idea, image, or thought experiment would you give to your creative-writing students as the basis of a short story? Why would this particular idea appeal to you, and what do you hope you (and the students) would learn from it? [4 points]

3.64; .55. Give 2 points for the image. Any relevant image, plausibly defended, will do - except for the following, which Helen already assigned:

What Is It Like to Be a Bat?
Mary the Color Scientist

Then give another 2 points for the “appeal”, and “pedagogical goal” of the assignment.

My own choice for a short story would still be something on the theme of zombies – behaving organisms that lack consciousness. It appeals because I like to explore what the behavioral consequences of consciousness are, and I’d want the students to explore the limitations of behavior in the absence of conscious awareness and/or conscious control.

22. If you were the director of the Holt-Belling Centre for Cognitive Science, what image would you add to Max Karinthy's mural, and why? [4 points]

3.67; .59. Give 1 point for the image. Any relevant image, plausibly defended, will do -- except for the following, which are already represented in the mural (see Lodge, pp. 50-55).

Thomas Nagel's bat
Altruism (empathy is different, and OK)
The Prisoner's Dilemma
Searle's Chinese Room
Lawrence Davis and Ned Block's "Chinese Nation"
Mary the Color Scientist
Zombies
Schrödinger's Cat

Also exclude representations of individual philosophers, psychologists, and other cognitive scientists as such -- even Descartes and William James! -- except when they're used to refer to something other than themselves, as when David Chalmers is depicted as a zombie twin and Roger Penrose as a Magician -- or, for that matter, as a quantum mechanic, dressed in quantum overalls with a quantum wrench in his hand.

Then give another 3 points for the rationale for the image. Here, though, give up to 2 points even if the image is already on the mural (see list above), depending on the quality of the rationale (the student may have forgotten that the image was already there).

My own choice would be Thomas Eakins' depiction of the first successful use of ether for anesthesia, shown in lecture. Philosophers are always citing pain as an example of qualia or some other feature of consciousness, and W.T.G. Morton was hailed as the man who "abolished pain" -- and the rest of consciousness with it!