Sponsored by the Center for Consciousness Studies
Consciousness: The Webcourse

Week 5

It's dark backstage:

Contexts, intentions, and expectations.

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Readings for this week: Baars, *Theater*, Chapter 5. Behind the scenes: The contexts that shape conscious experiences. Read Chapter 4 if you have not done so yet.

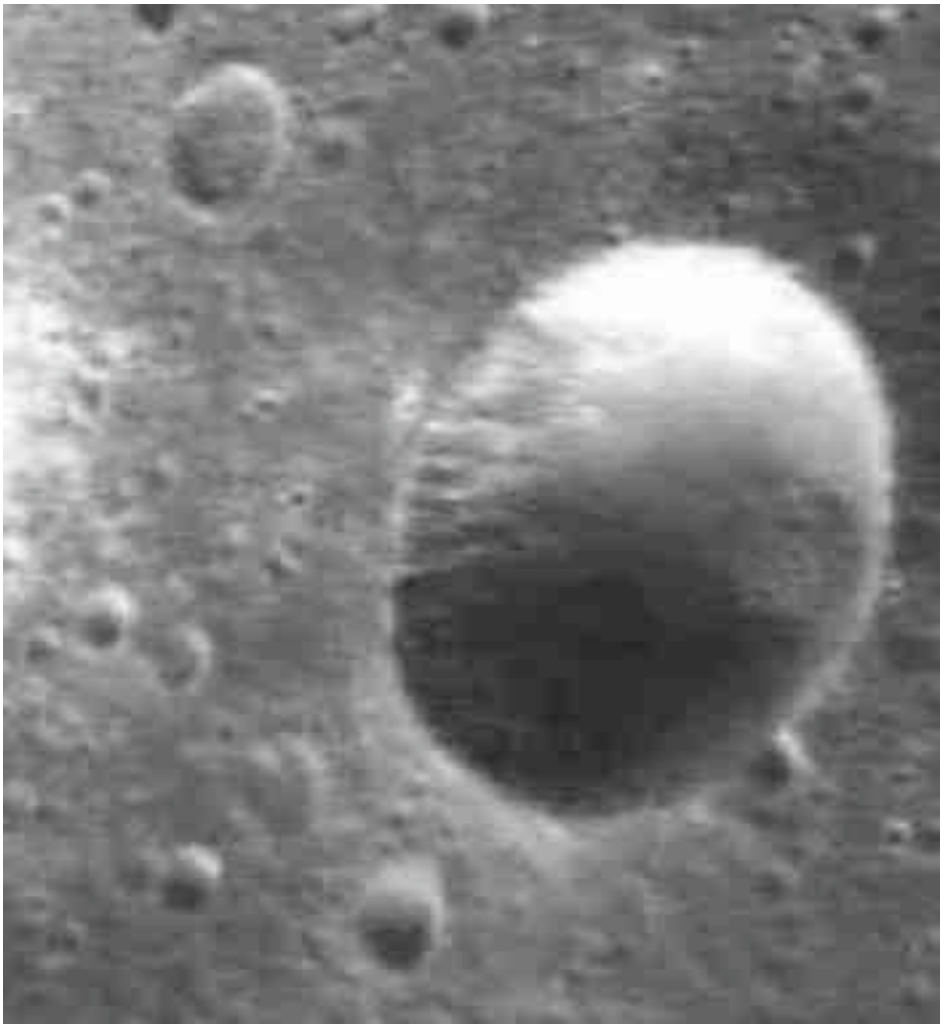
Lecture 5

The idea of "context" is one of the most challenging ones in this course. It's hard to see "contexts" until you start looking for them --- because they are unconscious. Yet contextual knowledge shapes every moment of our waking lives. For example, your conscious experience of the sentence you are reading *right now* is shaped, not just by the visible letters and words you are reading, but also many UN-conscious levels of meaning, grammar, your conceptual assumptions, conventions of discourse, emotional meanings, and so on.

Backstage in the Theater of Consciousness.

(Photo: A De Keyser.)

A famous example is the craters and hills on the moon. The next figure shows an example. Are those hollow craters or bumpy hills???



Try turning the picture upside-down. Do you see a difference?

What is the difference?

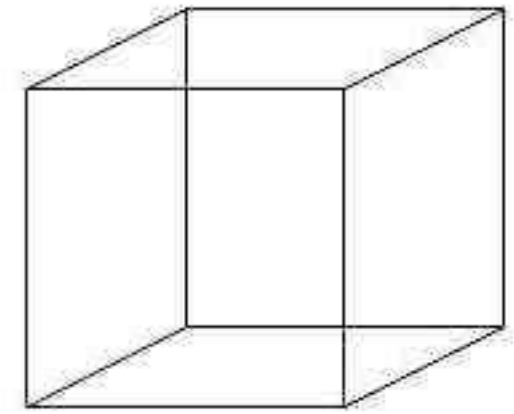
Consider the way the sunlight falls on a real crater --- where is the lightest part of the crater? Now think of the same question about a round hill. Where is the lightest part of the hill?

In fact, the moon has many nice round craters, and very few nice round hills. (I'm sure you can imagine why that is true). So these are all craters. But depending upon the direction of the incoming light --- or rather, the *assumed* direction of the incoming sunlight --- you will see it differently. Why do you think we make assumptions about the direction of light (we earth-dwelling, gravity-well-dwelling creatures?)

Here is another example.

When you look at the room in front of you, every square corner you can see is actually a corner of a Necker cube. It is easy to show that. Just take a sheet of paper, roll it into a tube, and look through it at a three-way corner of the room. In most cases you should be able to flip it back and forth, just like a Necker cube. The inside corner of the room will switch to an outside corner. Likewise, if you look at a square box from the outside and point your " reduction tube " to one of its outside three-way corners, you can flip it to make it look like the inside corner of the box!

The tube the man is looking through is just a "reduction tube" --- like a rolled-up tube of paper.



The Necker Cube is visible in every square-cornered room.

In all these cases, your unconscious knowledge about corners and rooms influences your conscious experience of those corners. That is the key concept of "context". We could imagine context to be all the activity going on in the dark behind the visible part of the stage. It includes the stage hands, the play director, the playwright, the voice coach, and all the others who play a role backstage but do not appear in the bright spot.

If you think about context in your own life you'll start seeing it everywhere. For example, context shows up whenever we are confronted with ambiguous words (and most words in English are ambiguous). One example we like to give is the word "set." In the Oxford English Dictionary "set" is explained in about 75,000 words. That is because it has many different meanings in many different contexts. However, we are almost never conscious of the way contextual knowledge shapes our understanding of words with many meetings. Thus, unconscious contextual knowledge shapes our conscious experience of words and their meanings.

The effects of context can also be seen in jokes. Many jokes are structured to set up expectations about a punchline. A skilled joke teller will pause just before the punchline to allow your expectations to peak, and then to violate your expectations in an unexpected direction. Just try to recall a joke you happen to know --- one that actually makes people laugh. In most cases you will see that they start with a "set-up" that creates expectations, followed by a punchline that pulls the rug out. This set of expectations can be called a "context." Without it, jokes don't make people laugh.

For example, here's a setup, which establishes a *context*:

"As everybody knows, Marilyn Monroe and Robert Kennedy were…"

((*) answer given at the end of this lecture.).

Music can be understood the same way. Traditional Western music is structured by a certain scale --- like major or minor --- which starts on a note called the tonic. If you sing "do re mi fa sol la ti do", the first "do" is the beginning note of a major scale, the tonic. In simple children's melodies we stay in the same scale throughout the song--- that is, all the notes we use, or almost all, are selected from one scale. Since we are not conscious of that scale (unless we are trained musicians), yet our conscious experience is shaped by the scale or key, we can think of it as a *context.*

In popular songs that are a little more complex we might have one scale (or context) at the beginning, then a related one in the middle, then back to the first (A-B-A). In long works like symphonies, composers play with the harmonic contexts in all kinds of ways. Jazz musicians do the same in improvisational sessions. But in all these types of music we expect to end up where we started, with the tonic note --- that same "do" note at the beginning of the scale. At the end, the harmonic tensions resolve, and the melody feels finished and satisfying. That's how we know it is the end of the piece.

(Notice what happens in the music demonstrations when the melody does NOT go back to that fundamental "do," when you expected it to.)

Most people who love music can't describe their contextual knowledge, although they notice *changes* in context when they happen. Musicians have to *consciously study* these contextual structures to make them "explicit" --- so we can talk about them, shape them, and not be fooled by them if we don't want to be. Musical scales, harmonies and rhythms are usually implicit (unconscious). But they shape our conscious experiences of the music, so they fit the definition of context.

Perfectionism as context.

Our own personalities are often opaque to us. They are generally *unconscious* contexts that frame our conscious experiences --- our hopes, fears, beliefs, intentions, feelings, and even the way we perceive ourselves and others.

A good example is "perfectionism," which is very common among people who achieve a great deal in life. Remember that every time we jump through a demanding hoop in life, like raising children, passing that difficult exam, graduating with a degree, starting a business, getting a promotion or finishing a marathon, we need to mobilize our own motivations. Perfectionism is a very useful thing because that is how we motivate ourselves. Having a lot of motivated people is how societies thrive, build their

economies, cure diseases, and make scientific discoveries. But perfectionism has its price as well --- and it is mostly unconscious.

A number of researchers have found that perfectionists --- most of us in this webcourse!!! --- demand unrealistic performance of themselves, and then get mad at themselves if they fall short of perfection. (Obviously, there are no perfect human beings.) Since we practice those habits over and over again, they tend to become automatic and unconscious, like the habits of an athlete. Remember the definition of "context" we are using: Unconscious events that shape our conscious experiences.

Albert Ellis, a New York psychiatrists who did pioneering research on these issues, lists some perfectionistic beliefs. (These have also been found in later research.)

Perfectionistic beliefs:

1. It is a dire necessity for me to be loved or approved by virtually every significant other person in their community.

2. One absolutely must be competent, adequate and achieving in all important respects or else one is an inadequate, worthless person.

3. It is awful and terrible when things are not the way we would very much like them to be.

You can easily see how *useful* those beliefs are in spurring us toward achievement, toward earning the love and appreciation of others, and so on. Those are all very important things.

So on the one hand, perfectionistic beliefs are very useful to people. On the other hand, they also lead us to *discount* our own achievements, and to always look for the next hurdle to jump. So high achievers learn to be quite hard on themselves. They often get much less practice in praising and appreciating themselves, or in simply being aware of their own human limitations. They have a harsh critic inside.

David D. Burns, who has written excellent books on depression and mood, talks about the tendency high achievers have to

4. Discount the positives: You insist that your accomplishments or positive qualities 'don't count.'

Other cognitive distortions that go along with perfectionism include.

5. Mental filter: You dwell on negatives and ignore positives.

6. Overgeneralization: You view a negative event as a never-ending patttern of defeat.

Remember, these are mostly unconscious, or semi-conscious beliefs that shape our conscious experiences of ourselves and others. Notice that in many cases we can make these beliefs conscious by analyzing our own decision-making.

People can also have more self-accepting beliefs, but for many of us it takes seom work to remind ourselves of positives. So called "Positive mood inductions" are quite effective, and mood therapies may be designed to encourage more balanced ways of thinking about ourselves. Cognitive Behavior Therapy makes use of a number of simple ways to challenge oversimplified perfectionistic thoughts.
http://www.springerlink.com/content/n8667538n514h07u/

The contexts of movement.

All of our bodily movements are guided by dynamic but unconscious expectations. If you sit in a car going through a drive-in carwash, you can experience that as the giant brushes come down to clean your car. You will often have a strong sense of forward motion --- not because your car is moving forward, but because all the orientation cues around you are moving backwards. Your visual system says: this must be motion! And you often *feel* conscious motion.

Our mind-brain constantly makes predictions about the conscious feedback we will get from the world in response to our body's movements. Thus if you are walking downstairs and there is an extra step at the bottom of the staircase, you can feel quite shocked when your foot does not touch what you expected to be the floor. It's very disorienting. The opposite is also true. If you walked downstair and you expected another step down that ISN'T there, and your foot suddenly strikes the floor when you didn't expect it to, your whole body is shaken up.

T.S. Eliot's play "The Cocktail Party" makes a lot out of this phenomenon. In the play Eliot suggests that a guest at the cocktail party who has just fixed his tie and coat in the mirror and feels he is looking just right, can walk down the stairs and suddenly come up short at the bottom of the staircase. His whole carefully arranged sense of himself is shaken. Eliot writes that he feels "as if he is a victim at the mercy of a malevolent staircase." Starting from the feeling of being an agent acting upon the world, the guest at the cocktail party has become an object acted upon by the world. Eliot was a wonderful

observer of human nature. He may well have been right that when our "body context" is shaken up profoundly at the bottom of the staircase that our self image may also be shaken up. (Of course Charlie Chaplin made that same point by slipping on a banana peel and desperately trying to maintain his dignity. A lot of physical humor has to do with the threat to one's dignity and pride.)

So context is very important. Many thousands of psychological experiments seem to show the same thing. In perceptual studies experimenters are often surprised when they find out that completely unexpected variables shape what seems to be a very simple task. Brain studies are often like that, too. We are constantly surprised by findings, even ones that we thought were obvious. It is very healthy and humbling.

Here is an example. For the last several decades every introductory textbook in psychology and brain science has made the claim that dreams occur during REM sleep (REM = rapid eye movement, which is easily measured by picking up the large voltages generated when our eyes make big movements.). We certainly believed that ourselves until a couple of years ago. The reason was that scientists studied dreams by awakening people from REM sleep, which is very easy to do. You just wait for the eye movements, and check the EEG to see if it looks like waking EEG (low, fast and irregular). The sleeper's skeletal muscles are also inhibited during REM sleep --- otherwise, people might get up and act out their dreams. So sleep researchers would check those three variables, and have a good case for a REM state. They would wake the sleeper up, and almost every time would get good dream reports. Everything seemed just fine.

The only trouble was that we were wrong! Mental activity occurs during all stages of sleep, not just in REM. (e.g., L. Palagani et al, 2004) Probably because people only studied dreaming during the REM state itself, they simply verified their expectations that that was the only time dreaming occurs. Only when some skeptics began to study dream reports during "non REM sleep" did researchers become aware of the fact that dreams also occur outside of REM. This was a discombobulating finding. Our 1997 textbook still reflects the standard story that normal dreams occur during REM. The new edition will have to correct that, because Mother Nature chimed in.

Think about this for a moment. Sleep researchers discovered the relationship between REM sleep and dreams almost 50 years ago. Like anyone else, scientists don't like to waste their time looking for things that they don't think exist. You don't look for diamonds lying in the street; you go to your local jeweler. Since everybody assumed that dreams occur primarily during REM, they simply did not look outside of REM in their studies. The correlation between REM and dreams became a "contextual assumption" for standard sleep research; it was taken for granted, and only vaguely conscious when it guided research decisions.

This happens repeatedly in the history of science --- and just about anywhere in life where people keep a record of their expectations, and what actually turns out to be true. The stock market is always driven by context, and it always finds out that last week's expectations were wrong. Engineers, business people, farmers, are always finding out they were wrong. In fact, the only people who DON'T keep finding out they were wrong last week are the ones who don't check themselves.

Last year the journal Science published a finding that there is an entire previously unknown ecosystem beneath the Antarctic. Nobody looked before, so it only became visible when part of the Antarctic began to calve away. This happens so often that Arthur C. Clarke, the science fiction writer, has proposed **Clarke's First Law:**

"When a distinguished but elderly scientist states that something is possible he is almost certainly right. When he states that something is impossible, he is very probably wrong."

Clarke defines 'elderly' as :"In physics, mathematics and astronautics it means over thirty; in other disciplines, senile decay is sometimes postponed to the forties. There are of course, glorious exceptions; but as every researcher just out of college knows, scientists of over fifty are good for nothing but board meetings, and should at all costs be kept out of the laboratory". (in *Profiles of the Future*.)
http://www.lsi.usp.br/~rbianchi/clarke/ACC.Laws.html

We can cite a lot of examples.

Outstanding physicists claimed around 1900 that heavier-than-air flight was impossible, about ten years before the Wright Brothers. In the 1950s some scientists scoffed at the idea that humans would ever reach the moon. Toward the end of the 19th century some top physicists believed that all the major discoveries had been made; only the gaps had to be filled in. Within the next few decades Thermodynamic Theory appeared, then Relativity Theory, then Quantum Mechanics, all stunning to some of the smartest people in the field. Einstein disliked the very idea Quantum Mechanics, but he was probably wrong. So we all are vulnerable to getting caught up in unconscious contextual assumptions.

That is why it is so essential to keep rational debate going in science, to make room for skeptics, and to let Mother Nature have the last word.

It isn't just scientific communities that have this problem of " fixedness" --- which we are calling a context effect. Every human community seems to have the same vulnerability. So does every individual. Errors due to fixed expectations are extremely common. It is often said that generals always fight the last war; but that's true for

politicians, doctors, and probably artists, too. The only way to avoid contextual fixedness is to stay in bed with the blankets over your head --- or if you don't want to do that, to test the world around you in a way that is both assertive and flexible. We need to take the risk of making educated guesses about the world, and we need to test those guesses as carefully as we can. The result is that adaptive human cognition is always testing itself, just as good science (which is just one kind of cognition) is always dynamically testing itself. That is also why science tends to work over the long term --- because it does expose itself to testing, and the possibility of failure, and then to self-correction. Our guess is that this is also true in the arts and humanities.

All this was classically stated by the philosopher Karl Popper: "The history of science ... is a history of error. But science is one of the few human activities in which errors are systematically criticized and fairly often, in time, corrected. This is why we can say that, in science, we often learn from our mistakes, and why we can speak clearly and sensibly about making progress there."

We should not suppose that scientists are any better than other human beings in understanding their world in general. (See Clarke's Law, above). It is the process of heated scientific debate, and a constant focus on evidence and testable hypotheses, that tends to drive the sciences, over the longer term, in a cumulatively better direction in some small part of the knowable world. But the same thing is true of us as individuals and communities, if we allow the same dynamic to take place. So – there is an answer to contextual fixedness, but it does not come with guarantees; it just tends toward greater accuracy over time.

As we mentioned, in the theater metaphor we can imagine context as being those ghostly shapes that flit back and forth in the darkness backstage --- the scene setters and play directors and all those busy people who are not directly visible. They influence everything that happens in the bright spot on stage.

The main point to remember is that it is useful to define the term "context" as the unconscious shaping of conscious experiences. We need some word for this idea, and "context" is a useful one.

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Prior knowledge as a context effect.

Kathleen Fisher, who studies the effects of prior knowledge on learning, tells the following story:

I was waiting for a bus on a street corner in London when I struck up a conversation

with the man standing next to me. I said: "I don't go anywhere without my Macintosh." He said enthusiastically: "Neither do I." Our conversation continued for possibly several minutes before we realized that I was talking about my *Macintosh computer* (hanging on my right shoulder) while he was talking about his *Macintosh rain gear* (draped over his left arm). We had a good laugh. This illustrates the nature of prior knowledge and the way it can interfere with communication.
(http://www.sci.sdsu.edu/CRMSE/kfisher_pubs.htm)

Fisher believes that differences in prior knowledge can block learning in college courses.

"Misunderstandings can often be quickly clarified in ordinary conversations. But when they occur in one-way information delivery (as in lectures or books), they can persist for weeks or semesters or quite often indefinitely. … For example, the majority of students who study photosynthesis fail to understand that carbon derived from carbon dioxide in the air is used by plants to construct themselves, first by incorporating the carbon into sugars and then incorporating the sugars into cellulose. The persistent failure of understanding seems to derive from strong underlying assumptions that air (including carbon dioxide) has no weight, and therefore cannot be used to create a massive tree."

Like other aspects of context in human cognition, this is a very big topic. But for now, we just want you to understand the basic idea, and to start looking for it in your own life. If you want to pursue this particular aspect of context, Professor Fisher has excellent material on the website shown above.

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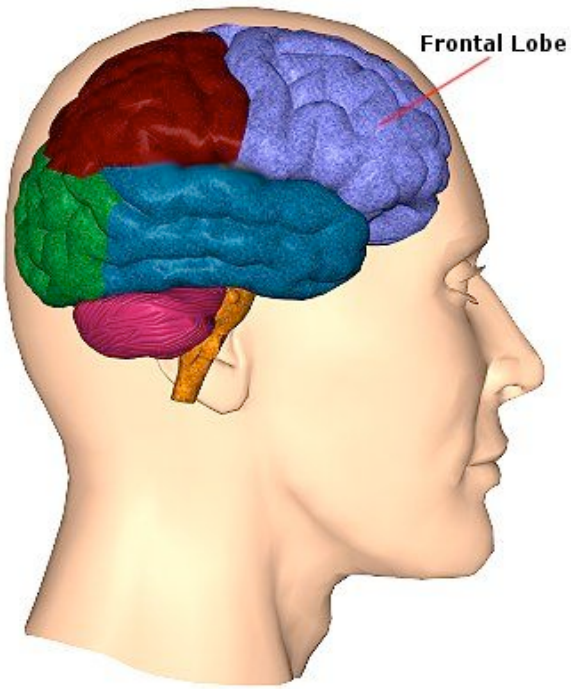
Some brain disorders may involve deficits in contextual functioning.



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Fixedness after brain damage: prefrontal cortex.

Below is a list of deficits that are found in patients with damage to the frontal lobe, especially "the front of the front" or the prefrontal cortex. The classical signs of such damage often involve fixedness --- being caught up in one (unconscious) context and not being able to get out of it. Below are directly quotations from online course material by Prof. Annie Crooks at Leeds University in the UK. Our comments are added *in italics*. (http://www.le.ac.uk/pc/aec7/ps3019/ps3019-executive.html)

(Here is the list of typical symptoms of frontal damage:)

"Perseveration

- Difficulty in disengaging from actions being carried out
- Frontal patients can be repetitive in their speech and actions
- Have trouble with Alternate Uses Test (*that is, a test that shows objects, like a pencil, and asks the patient what else could be done with that object besides writing. Frontal patients tend to become stuck in the primary use of a pencil, and can't generate alternative uses very easily.)*

Wisconsin Card Sort Test (WCST)

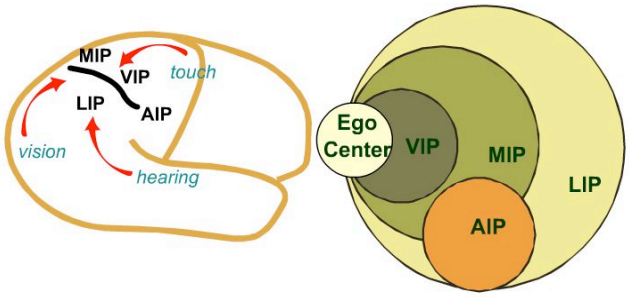
- Cards vary according to colour, shape and number of items
- Patients have to sort cards according to rule only experimenter knows *(that is, all the colored ones go together, or all the same shaped ones, and so on).*

- Patient has to work out rule from experimenter saying "right" or "wrong"
- Once the patient has learned the rule, experimenter changes it *(so that the first rule no longer works)*.
- Patients therefore need to be sufficiently flexible to reject previously confirmed hypothesis and seek another *(notice the importance of flexibility!)*
- Frontal patients perseverate, and are therefore unable to switch to new rule
- They tend to continue with old rule despite being told consistently it is wrong."

So it would seem that parts of the frontal cortex allow us to "decontexualize" or to switch from one context to another.

Unconscious egocentric maps.

Another "contextual" region of the brain involves the parietal cortex (see figure above), especially those parts that have "egocentric maps" of the space around our own body. Here are two drawings from Professor Tutis Villis (on the web, copyright Villis 2003 and 2004), showing egocentric maps in the parietal cortex for the macaque monkey. They appear to be very similar to the human ones located in the corresponding parts of our cortex.



The upper drawing shows how different sensory modalities all make use of the parietal map of egocentric space --- that is the space surrounding the body, from the viewpoint of the observer. The lower drawing shows how a dish of strawberries is depicted in one of the contextual maps. When a monkey reaches for a strawberry, or brings it to his mouth, corresponding cells fire in the parietal maps. What is interesting from our point of view, is that there are no "feature" cells in this part of the brain – that is, no color, shape, or object-sensitive cells. It's just a spatial body-centered set of maps. In other words, the "objects of consciousness" are not represented here, but the "spatial context" for those objects is.

As you know from page 127 in our textbook, damage to the right parietal region can result in a collapse of the left side of conscious space! (A condition called *neglect*.) So this looks like a part of the brain that shapes conscious experiences very profoundly, but which does not itself have the information that underlies the objects of consciousness.

It seems likely to us that many parts of the brain provide contextual information like this. A short list of guesses is:

1. the amygdala for emotion
2. the vestibular system for balance and orientation to gravity – up and down.
3. the cerebellum for aspects of action (includine mental actions, like inner speech)
4. the basal ganglia for automatic action components
5. the prefrontal cortex for higher-level "self" systems (as we will see later)
6. the parietal cortex for action control and spatial context for sensory objects.

This is a set of hypotheses. We will have to see if they work out.

FOOTNOTE:

((*) Marilynn and Robert Kennedy: the answer is "… a movie actress and a Senator, respectively."