Q & A

The 'feel' of seeing:

an interview with J. Kevin O'Regan

You have used the phrase seeing is a way of acting[1]. Do you mean this literally?

Pretty much... but I admit the idea is a bit hard to swallow at first. Let me try to explain. Most people think that we see an object when some mechanism in the brain that represents the object becomes active. But if you take this view, you're immediately faced with what philosophers have called the 'explanatory gap' problem: how can activation of a brain representation (which is something physical) ever give rise to the phenomenal *feel* that is associated with sensations? Having some neurons active, even if an additional special process is involved like synchronous firing or oscillations in reverberant loops, however complicated, will surely never give rise to *feel*! – surely feels are by essence non-physical!

The situation is analogous to the situation at the beginning of the 20th century with regard to the notion of 'life'. People couldn't understand how ordinary biological mechanisms could explain life. They thought there had to be some kind of special 'vital essence' that imbued living organisms with life. But now we realize that the problem arose because they were thinking about life the wrong way. We know today that 'life' is actually just a word that describes a set of *capacities* that certain organisms have: replication, respiration, movement, reacting to external stimuli, etc. Life is not something extra that is added into an organism, but it is a particular 'life-like' set of ways of acting within an environment.

I suggest that we can solve the problem of explaining the origin of *feel* in a similar way. Instead of saying that sensations are generated in our brains, we can say that sensations are very particular capacities that we have to act. For example, we 'see' an object when we know that we can do certain things with our eyes and bodies and expect certain very particular accompanying changes in our sensory input. For example we are seeing an object if, among other things, we know that the sensory input will change drastically when we blink, and that there will be an expanding retinal flow-field when we move forward, and that nothing much will happen if we sniff our noses or block our ears. Seeing is knowing that certain laws of co-variance apply between our actions and the resulting changes in the sensory input. I call these laws the laws of sensorimotor contingency that characterize seeing.

Can you illustrate your idea of sensorimotor contingency with a simple example?

Take the sensation of redness. Most people would say that you see something red when there's activation of a brain mechanism that represents redness. But this just won't do! If something like that were true, then we would have to explain why and how those particular redness-bearing mechanisms actually gave us a sensation of red, rather than giving us no sensation at all. After all, activation of mechanisms in machines, computers and robots has presumably never made them *feel* anything! But under my 'sensorimotor' view this problem evaporates. Like other feels, seeing red is not something that occurs in our brains, but a capacity we have to act. It consists in knowing that certain things will happen when we do certain things.

For example, when I move my eye off the red patch, because of the differences in the way the retina samples colors in peripheral vision, the incoming sensory stimulation will change in a particular way that is typical of red. When I tilt the red piece of paper, there are particular laws that describe how the reflected light changes, depending on whether skylight or sunlight or lamplight is being reflected off it. Knowing these laws of sensorimotor contingency, and knowing that they are currently applicable, *constitutes* the feeling of red. Note that this knowledge of sensorimotor contingencies is a practical kind of knowledge, or a 'know-how'. It's like the feel of driving a car – you're not able to describe verbally every single aspect of the experience. Nevertheless all the things you can do, like press on the accelerator and know the car will whoosh forward, constitute the 'what-it-is-like-ness' of driving a car. Similarly, all the red-related things you can do constitute the feeling of red.

In one of your papers you seemed to be suggesting that qualia are illusory, but in that case how can the uninterrupted nature of visual experience be explained?

Wait a minute, I don't want to say that qualia are 'illusory'! In one sense that would be ridiculous: we all know we have qualia, we all have feelings and sensations and pains, and they really feel like something, and not like nothing. So qualia are not illusory. On the other hand what I do want to say is that qualia are not exactly what you think they are. In particular, although we talk about particular qualia as though they are going on all the time, as though they have an occurrent or ongoing quality, in fact if you really think about it, you realize that this occurrent or ongoing quality is actually just a consequence of the fact that every time you check to see whether you're having the particular quale, well, then you have it. It's a bit like the refrigerator light: it always seems to be on! You open the fridge, it's on. You close the fridge, and then surreptitiously open it again to check, but it's still on. So you're led to think that it's in fact always on. Similarly, to see redness you first check that redness-type contingencies are currently applicable. After that you have the *continuous* feeling of redness and don't have to keep checking.

Again, similarly, I claim that the impression of richness and continuous presence of the outside world comes not from its internal representation being continuously activated in the brain, but because you know that information in the world is immediately available through the slightest flick of the eye or drawing of attention. Although this seems to be a very bizarre stance to take at first sight, it has the great advantage of allowing us to escape from the 'explanatory gap' problem. Taking this stance means that there is no longer an internal brain mechanism whose activation causes qualia, and so there is no problem of trying to dream up some arcane or magical quantum gravity process or whatever to imbue phenomenology into that brain mechanism.

There is a bit of a problem in this position though, which is that we still need to explain why the feelings involved in sensations like red or the continuity of vision are so much more 'real' and intimately 'felt' than our knowledge of the refrigerator light being on. To explain this difference I appeal to two interesting concepts: 'bodiliness' and 'grabbiness', which characterize sensations and differentiate them from other kinds of knowledge. But I guess we don't have time to go into that here.

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Your theory appears to suggest that people should be able to 'see' non-visual input, because experience comes from the rules that govern changes in sensory input. Does this mean that, assuming the right sensory input, we should be able to 'taste' sky-blue, or 'see' a high pitched sound, rather like synaesthetes?

Exactly! In fact there is a little bit of evidence that such possibilities exist. Many years ago Paul Bach y Rita equipped blind people with an array of vibrators attached to their backs or stomachs. A TV camera that the blind person manipulated, transmitted the incoming image into an image-like pattern of vibration. With surprisingly little practice people went from feeling tickles on their skin to sensing the presence of objects in front of them, so much so that when an object loomed towards the camera, they jumped back in alarm.

Another related finding is what's called the 'face sense' of the blind: blind people sometimes feel the presence of nearby objects as a light touch on their faces, like a veil or spider-web. It turns out that this sensation, which is experienced as tactile, actually derives from auditory stimulation, since the sensation goes away when the people have their ears blocked with putty. The McGurk effect, in which the combination of seeing a person's lips pronounce one sound and hearing a different sound results in the perception of a third sound, is another example where sensation in one modality is influenced by stimulation in a different modality.

What are you working on at the moment?

I'm starting some experiments to investigate more systematically the phenomena of 'sensory substitution'. I'm very excited about this work, because it suggests a way to create new forms of sensory prostheses to help blind or deaf people. It also opens up the way to creating entirely new sense modalities. In virtual reality environments for example, it might be possible to find ways of providing people with bizarre new sensations that they've never had before. Another interesting application might be to the problem of pain.

What led to your work on change blindness?

I had been working for many years on the problem of why the visual world doesn't appear to move as the eye shifts from fixation point to fixation point in a scene. I had done some intriguing experiments showing that you could, for example, shift or change some text every time the eye moved, and people wouldn't notice it – Dave Irwin and Bruce Bridgeman had also done similar experiments. George McConkie and his collaborators had shown that surprisingly big changes in pictures of natural scenes could go unnoticed if they occurred during an eye movement.

These results and others had led me to the conclusion that the brain didn't actually combine each of the 'snapshots' taken by the eye into a composite internal picture. Instead, I concluded that the outside world could, in a certain sense, constitute its own representation, acting somewhat like an external memory store, immediately available for access through eye movements or attention. My idea was that the feeling we have of seeing 'everything out there' derives from the exquisite availability of information, at the slightest flick of the eye or of attention, in the outside world.

A consequence of the idea of 'the world as an outside memory' was that all the details that we think we see at any moment are not actually represented in the brain. This explained why, when changes were made during eye saccades, they were not noticed; usually when changes occur, attention is attracted to them because they create a local disturbance that is detected by transient detectors in the low-level visual system. But eye saccades create a global disruption of the retinal image that masks the attention-grabbing action of local transients and prevents attention being drawn to the location of the change. Because we have no detailed internal representation of the content of the scene, we have no evidence that a change has occurred. It's a bit as though, overnight, you forget a latin verb: because there's no alarm signal to alert you of what has happened, you have no way of knowing it unless you actually try to recall that particular verb.

When I visited Nissan Cambridge Basic Research on several occasions over the period 1994–97, I told Ron Rensink and Jim Clark about my theory. Ron realized that we should be able to recreate the effects previously observed with eye saccades without using eye saccades at all. This could be done by simply inserting a very brief flicker between the original and the changed image, creating a global disruption in the continuity of the image, similar to that created by a saccade. The 'flicker' paradigm was born… We later realized that we didn't even need to use a large global transient – just a few 'mudsplashes' scattered around the picture, not even superimposed on the location of the change, sufficed as decoys to prevent attention going to the correct change location.

Is change blindness important for your theory of visual awareness?

Change blindness was very important in promoting my theory because it drew attention to the possibility that seeing might not consist in making an internal replica of the outside world. Of course most psychologists have known since the 1970s, with George Sperling's wonderful experiments on iconic memory, that seeing did not involve an exact internal 'icon' of the world. After further excellent theoretical analyses by psychologists like Ralph Norman Haber and Max Coltheart, the philosopher Daniel Dennett ruthlessly dismissed the 'internal picture' notion in his critique of the 'Cartesian theatre', and Zenon Pylyshyn also militated for this cause.

So really people should have known in advance that change blindness would work. In fact Bill Phillips and Hal Pashler had done some nice experiments very similar to today's change blindness experiments, but no one had taken much notice because they had used simple stimuli – letters or symbols. The real shock of change blindness came when McConkie and ourselves used natural scenes. But, as I say, people should actually not have been surprised at all. In reality, change blindness is totally banal, given what we've known about vision since Sperling.

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Reference

1 O'Regan, J.K. and Noë, A. A sensorimotor account of vision and visual consciousness. *Behav. Brain Sci.* 24(5) (in press); http://www.bbsonline.org/Preprints/ORegan/