Module:
Psychological Foundations of Mental Health

Week 2
Cognitive processes and representations

Topic 1
Perception – Part 2 of 2

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Lecture transcript

Slide 2
So constructing our visual world, we've seen that we don't have an exact copy of the visual world sent directly to our visual cortex. And we know that the inputs process serially, with basic dots being extracted first, followed by lines, then edges, and finally, objects. We've also seen that colour information is only processed for items falling onto the fovea at the back of the eye, and that 3D information is only gained from the perifoveal part of the visual field. This means that, neurally, we are not processing the world around us in the rich and detailed way in which we believe we are experiencing it.

So what is an important mechanism for enabling us to experience the world in the way we believe? Simply, the fact that we constantly make eye movements, which are known as saccades, means that we make successive fixations across the visual field. The images that we process, then, are integrated automatically and very cleverly by our brains.

Have a look at the image on the slide here. It's a representation of what happens when we make a saccade. An eye movement causes a huge movement of everything in your visual field. And yet, these are compensated for by dedicated mechanisms in parietal cortex, which results in the illusory perception of a stable and detailed visual world.

Slide 3
The phenomenon of change blindness that was first shown by Rensink, in the paper I've given you as a reference, shows very well that our illusion of seeing the world around us in rich detail is not true, and that we're actually very inaccurate at perceiving things that are right in front of us. So we don't process very well, as I've already talked about, items that we're not directly fixating, even though our impression is, we survey a scene as if perceiving the whole thing.

So this phenomenon, which is also related to the next topic of attention, shows you, as you look for the change in the image, that it's rather hard to find. So can you see what's changing? Hopefully, it will take you a long time to detect these large changes. And it's showing you that the moment-to-moment representation in the visual field that we possess is not very detailed. Otherwise, it wouldn't be an effortful search to look for this change.

What Rensink did was interleave the original scene and the changed scene with a blank grey, which causes a flicker. And this flicker means that there's motion across the whole image as it's flashing up. And this masks the transient motion that's associated with the change directly.

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When you've spotted the item that's changing, it becomes trivially easy to see it. In fact, it appears as if it's flashing on and off. And this is because our attention has now been captured by the change, which I'll talk about more in the next topic.

Slide 5

To further convince you of the power of our minds to create the illusion of a rich and continuous visual scene, let's just consider, for a moment, the image on the slide. What I want you to focus on is the area labelled "blind spot." This is where the optic nerve fibres take the visual input from the retina to the brain. We have no rods or cones here at all, and therefore, no visual input is processed here. So we're blind for whatever part of the visual field corresponds to the blind spot during that particular fixation.

However, we've got no perception of constantly missing a small part of the visual field. This is filled in, in an illusory way, by the brain, which gives us the mental representation of a continuous perception across the whole field.

Slide 6

If you're interested in finding your own blind spot, have a look at the blind spot exercise following this lecture.

The neural processors that enable us to fill in our blind spot are linked to the perception of some visual illusions. We'll have a look, now, at some striking illusions. And experiencing them is an excellent way to gain some insight into these constructive and interpretive aspects of how we create a mental representation of the world around us.

First, at the start of this topic, I outlined why perception is an effortful and intricate process. And this included the fact the input from the world contains insufficient information for complete perception. Without there being some interpretation based on the rules of perception understood by the visual system, we wouldn't be able to perceive properly.

Look at the image here of the elephant. Do you see a whole elephant? I'm sure that you do, and I'm sure that you don't perceive it as being half an elephant with the back section missing. But of course, there's no visual information there that's completing the back of the elephant. What your visual system is doing is being adept at computing certain expectations that we have. On one of these, if there's an occluding item, it's likely to be masking part of the image.

Look at this cube here. Do you perceive the cube? I hope you do, but there are no lines that make up this image. It doesn't exist. It's completed by your brain in response to the arrangement of the white sections on the circles. You automatically compute that these white sections must be occluded by something, and so fill in the cube.

And in the final example of there being insufficient information, look at these shapes. Do they make any sense at all? Without changing anything about them, but simply adding in occluding elements, the brain works out how to make sense of the image, and we can see Bs covered by inkblots.

All of these are examples of how the visual system can adapt to insufficient information in our visual input. But it compensates so effectively that it can overcompensate, which results in us seeing illusory images, like the 3D cube, which aren't actually there.

Slide 8

Look at this image here. What did you see? The chances are that you could say something like, it was a seaside view, or an image of a pier. And you'll have the impression of having seen most of what was there and have gained the gist of the scene. But if I asked you what the colour of the chairs were, or how many people were there, you'd be very unlikely to know.

This is simply to give you an insight into the limits of how little we can process at any one time. This is in vision, but in other senses too, it's equally true. The visual input contains overwhelming information, and so we're flooded with sensory stimulation, and we need a mechanism to select parts of this image that's important to us. And this selection mechanism is attention, which I'll talk about in the next topic.

Slide 9

In addition to being, at times, insufficient and overwhelming, the visual input is often ambiguous, and so interpretation by our visual system is needed in order for us to understand what's in front of us. Have a look at these two famous examples of ambiguous stimuli. You can see, here, two possible percepts for each one-- a rabbit or a duck on the left, and two faces or a vase on the right. Notice that only one possible interpretation is seen consciously at one time, and you might be able to switch between the two percepts.

The way in which our brain computes ambiguous stimuli means that you can't simultaneously perceive both possibilities. And this is a very useful feature of our system. We need our visual system to give us a clear interpretation of what we're seeing, and not the two possible choices at the same time.

Slide 10

Finally, as the input is often ambiguous, our visual system automatically uses context to interpret the visual scene. Fascinatingly, this context is used even when we don't want it to be, or when it's not useful. If you look at the two figures in the tunnel, these are exactly the same size. But even after you're told that, we still perceive one as being larger, because we're still using this context, and we can't take the figures out of that context.

If you look at the flower-shape dot arrangements, the orange circles in the middle of both of these are exactly the same size. But we automatically are using the context of the surrounding dots and compare them to the elements that surround them. And this means that the one on the left looks much smaller, and knowing that they're the same size doesn't actually change that.