Module:
Psychological Foundations of Mental Health

Week 2
Cognitive processes and representations

Topic 2
Attention – Part 1 of 2

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Lecture transcript

Slide 3
Remember, attention is the mechanism that we use to select for further in-depth neural processing items that are of most interest to us. This selection could be from the sensory input, as I've already discussed, and it takes place across all types of sensory information. For example, auditory and somatic sensory, as well as visual.

However, if you look here at the quotation from William James, you've heard about him in the introductory topics last week, his principles of psychology relied on introspection rather than experimentation. But nevertheless, he characterised the properties of attention extremely well.

Have a brief read of this quotation here. The mention of trains of thought is very interesting and insightful. Attention does not only select external sensory items of interest to receive further processing, but also internal thoughts and memories.

Slide 4
Next week, you'll learn much more about pathological alterations and attentional selection during some mental health conditions. But let's think about them for a moment, as they're clinically important, and they'll also enable you to gain insight into how attention shapes conscious processing.

When you look at the image on the slide, what do you see? Do you see just lots of people smiling? Or do you notice quite quickly the unhappy looking man in the top right?

There is evidence that we're all biassed to pay attention to faces, rather than neutral items, which makes sense for us as social beings. But there's also evidence that our attention is preferentially captured by emotional faces, both positively and negatively emotional when they're competing with neutral faces.

However, even taking into account this bias towards emotional faces in the general population, sufferers from some types of mental illness, maybe anxiety or depression, are perhaps more likely to draw in their attention towards negative faces. This research on allocation of attention to faces, and perhaps a pathological orientation towards negative faces in anxiety or depression, demonstrates an important feature of attention.

Items that we select by attention, we're aware of. That's, we're conscious of them. And we are not

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aware or conscious of the items in our visual field that we've not selected by attention.

By being aware, that's conscious of them, they are able to affect our behaviours, our decisions, and our emotions in a way in which non-attendant items cannot.

If you attend more readily towards negative stimuli, your conscious environment is more negatively valent than those without those biases. And it's easy to see why this would have negative repercussions in daily life.

Slide 5
So we need attention to select items for us to process in greater detail. What's selected by attention and how is this determined?

Certain types of stimuli are likely to be preferentially selected by attention. In part, these are the things that you would think of as being attention grabbing. Loud things, bright things, things that appear suddenly. This automatic allocation of attention towards these types of sudden, or salient, onsets is a good mechanism to make us aware of potentially dangerous stimuli near us.

Novelty, or in other words, a change in the environment, is a crucial draw of attention. Something changing is interesting to us. It means that there's new information, and therefore we want to process it in greater detail.

A visual change causes a motion transient when it occurs, and this automatically reallocates attentional resources to the position of that change. You saw a direct example of this in the last topic, the change blindness example, and this demonstrated that when your attention was not automatically grabbed by the motion transient of the changing item.

That's because the motion transient was masked by the flicker across the entire image. You had to laboriously search across the whole scene for what was changing. However, when you detected the change, the impression was that it flashed on and off.

The spotlight metaphor is an old one and there are cases in which it probably doesn't describe all the features of attention. However, it's a useful and somewhat accurate way to grasp how the selective processes of attention operate. It can light up part of the sensory input. And, as a spotlight enables you to see something more clearly, it enables enhanced processing of the selected input.

Slide 6
There are two critical types of ways in which attention carries out this selection.

Exogenous attention, or bottom-up attention, is the automatic allocation of your attention based on the properties of the stimuli themselves. For example, there is naturally attention grabbing types of stimuli we just talked about. Being very loud, bright, or a sudden change in the environment.

Endogenous attention, or top-down attention, is not automatic, but instead is the allocation of attention to items that you've chosen to pay attention to, i.e.,.e. they're relevant and interesting to you, but they're not necessarily particularly salient in the general environment.

Exogenous and endogenous spatial cueing paradigms were developed many years ago by Posner, but they're now widely used across a huge number of permutations and in different clinical groups.

Slide 7
I'm now going to outline a couple of paradigms that are used widely to assess visual attention. These are firstly the cueing paradigms I just mentioned developed in the '80s by Posner, and secondly, visual search tasks.

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OK, so first we'll try Posner's exogenous cueing paradigm. If you look at the cross in the centre of the screen, try to keep your eyes on this throughout the whole trial.

So you'll see a cue appear, and you'll see a target stimulus, and I want you to think as quickly as you can whether this target stimulus is a capital letter or a lowercase letter. So remember, it's very important to not move your eyes. This is about cueing your attention over, rather than your eye movements.

So what you saw there was a valid trial. The cue that flashed up briefly moved your attention over to that side of space, and then the target appeared there. In this condition, people find over in numerous trials that their reaction times are much lower if their attention has been correctly cued to the position of the target. And their error rates are also much lower. So it enhances, or boosts, performance.

Now let's look at a different condition in the same paradigm. OK, so there you would have noticed that the cue appeared on one side, but the target then went on to appear on the opposite side. And this is called an invalid trial.

And it means that your attention was cued to the wrong side. And then we see over the course of many trials that performance is worse. So reaction time is slower to the target in invalid trials and errors are much more common.

Slide 8

So that was Posner's exogenous cueing paradigm. He also devised one for cueing attention endogenously. So have a go at these following trials in an endogenous cueing paradigm.

What you saw there was a mixture of valid and invalid trials. Sometimes the arrow was pointing correctly to where the target appeared, and sometimes incorrectly. And we find in experiments on endogenous attention that the valid ones would enhance performance just as much as an exogenous cueing paradigm, and invalid ones would impede it.

Experiments often vary the reliability of the cues in both of these paradigms. So if 80% of the cues that are presented are valid, and only 20% are invalid, it makes sense to use the cue.

Whereas, if only 40% of the cues are valid, and 60% invalid, in the endogenous paradigm, you might be able to ignore them. However, in the exogenous paradigm, you're less likely to be able to suppress, or ignore, your attention being grabbed by the salient cue appearing on the side.

Slide 9

In the visual search paradigm, participants are asked to look for a particular target item as quickly and as accurately as they can. And the target is the one that is unique amongst all the other distractors. And it could be a simple shape, or letter, or more complex stimuli like faces, which you'll hear about next week.

The target is presented on screen among a varying number of distractors. And the number of distractors is called the set size. If you look at the examples on the slide here, the unique targets are very easy to spot. That is, they pop out from the distractors.

This is because they differ in one fundamental dimension, in this case, orientation or colour. The term for this is pop out search, or feature search, as the targets and the distractors differ by only one critical feature or parallel search.

You don't need many cognitive resources to extract the target here. And you don't have to search through all the distractors, so it doesn't matter how many distractors are presented.

This type of search used to be called preattentive, and it was said it required no attention at all to distract the target. And it happened before there had been any attentional selection on the visual field. However, although very few attention resources are needed to detect these targets, there probably has been some basic extraction by attention.

Slide 10

On the slide now, you can see examples of a serial search, the opposite, if you like, to parallel search. Here, finding the unique target requires serially searching through all the items, as it's not defined by a unique feature, but two features. This is sometimes called a conjunction search.

So the target differs from a conjunction of two or more features from the distractors. For example, being blue and horizontal among an array of blue vertical and red horizontal bars.

If you compare the set sizes on this slide, you'll find it much easier to detect the target with fewer distractors, rather than when you have to search through more. And this type of search clearly requires a larger amount of attentional resources.

Look at the graph here which has the search slopes for parallel and serial search. You can see that reaction time does not go up much when more targets are added in parallel search. This is a defining feature of this type of task. There's no increased search time with more distractors, meaning that fewer attentional resources are required.

Note that when you look at graphs of reaction time like this, we only ever compute the reaction time of correct trials.

Now look at the line for the serial search. You can see that our set size, that's the number of distractors, goes up. In this type of serial conjunction search, reaction time rises, too. And the steepness of this slope is a good indicator of how attentionally demanding a search task is.

If the target is very similar to the distractors, or perhaps if the participants have been selected to find a particular target hard, then the search slope will be steeper, as the reaction time rises quickly with the number of distracting items.

