Attention grabbers snatch lion's share of visual memory

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When watching a relay race, we will allocate more memory to key objects: the faces of the relay team we are supporting, the baton, etc. Less important details, such as members of the other teams, will be allocated less memory. Visually arresting details such as a runner's pink hair will catch our attention and be allocated more memory. Credit: actionplus.co.uk

Our visual memory is not as good as we may think, according to research funded by the Wellcome Trust – but it can be used more flexibly than scientists previously thought. In a study published today in the journal *Science*, researchers have shown how we remember what we see and why we can recall visually important or striking images most clearly, using a

topical example of a relay race to illustrate the concept.

For almost fifty years now, scientists have believed that when we look at a visually "busy" scene, we are only able to store a very limited number of objects in our visual short-term or working memory – the memory that we hold for a few seconds after looking at a scene. For some time, this figure was believed to be four or five objects, but data from a recent pape suggested it could be as low as two objects in any one scene.

Now, researchers at University College London have shown that our visual working memory is not restricted to a limited number of objects, but can be shared out across the whole image, with more memory allocated for objects of interest and less for background detail.

For example, when watching a relay race, we might focus on – and allocate more memory to – the faces of the relay team we are supporting, but may also allocate a significant proportion to the baton, a key object in the scene. Less important details, such as the athletes' clothes and members of the other teams, will be allocated less memory and recalled less clearly. However, visually arresting details – such as one of the runners' pink hair – will catch our attention and will be allocated more memory, too.

"It's all about allocating working memory to the things that are most important," says Dr Paul Bays, lead author of the study. "When something grabs our attention, we automatically divert some of our working memory to it in case it turns out to be important. In other words, it gets the lion's share of memory resources."

In an experiment, volunteers were asked to look at a computer screen featuring a number of objects. After a short time the screen went blank and one of the objects reappeared, but in a slightly different place. The volunteer had to determine whether it had moved to the right or left. The

accuracy with which they could recall the original object's position decreased with the number of objects in the scene, but there was no sharp drop in performance at a limit of four objects, as would previously have been predicted.

"When we look at a scene, we don't remember every detail, only the broad gist and one or two specific details," explains Professor Masud Husain, a Wellcome Trust Senior Fellow in Clinical Research. "We allocate very small portions of our memory to the background and far more to the important details. If you test people, you find that they have very little knowledge of the details of what they just saw because their visual memory is so limited.

"Limited memory puts clear limitations on what we actually see, rather than what we think we see. Seeing involves looking at objects and storing them briefly in our working memory. But that memory is incredibly small, so what we actually see is extremely restricted. Our vision is determined not just by what we look at, but by our memory of the scene."

In their experiments, the researchers also found that eye movements led to a surprising and counter-intuitive insight into how short-lived our visual memory is. Volunteers were instructed to view the objects in a particular sequence, but before their eyes moved to the final object, the image disappeared. The researchers found that the volunteers could more accurately recall the location of the object that they were about to look at than the one that they had just been looking at.

"When we decide to look at an object, we clearly perceive it as being significant and reallocate our memory to it," says Dr Bays. "So, even though we haven't looked at it yet, we still remember more about it than the object we've just looked at."

Professor Husain's work as a clinical neurologist brings him into contact with patients who have undergone brain damage, for example following stroke. Sometimes this leads to visual neglect, a term used to describe a lack of attention to part of the visual field, caused by damage to one hemisphere of the brain. For example, when reading a newspaper a patient may appear not to see the left-hand page, even though they can see it if it is pointed out.

"Part of the reason these patients may not be aware of objects is because they have very severe limitations in their visual working memory capacity," says Professor Husain. "Without memory devoted to some parts of the visual field, patients don't 'see' objects there."

References:

1. Bays, P. and Husain, M. Dynamic Shifts of Limited Working Memory Resources in Human Vision. Science, 8 August 2008.

2. W. Zhang, S. J. Luck. Discrete fixed-resolution representations in visual working memory. Nature, 8 May 2008.

Source: Wellcome Trust