

The neuroscience of navigation

In this second of a two part interview, **Nigel Scard** continues his discussion with Professor of Neuroscience, **Kate Jeffery**, to find out more about our ability to navigate our built environment. They explore how traditional methods of assistance such as compass points and signage can help, alongside additional information that technology now offers

How can we help people navigate 3D multi-level spaces common in our urban environments?

There's been some work looking at people's propensity to get confused in multi-level buildings. One reason might be that people don't process vertical distances so effectively but it might also be that the different levels often resemble each other. Just as we find in horizontal spaces which resemble each other, our mental maps are confused by that. So to stop that confusion you'd try to make each level look really different, perhaps giving different levels different shapes with different directional cues. You can use different colours but that doesn't work so well since the spatial system doesn't care about colours.

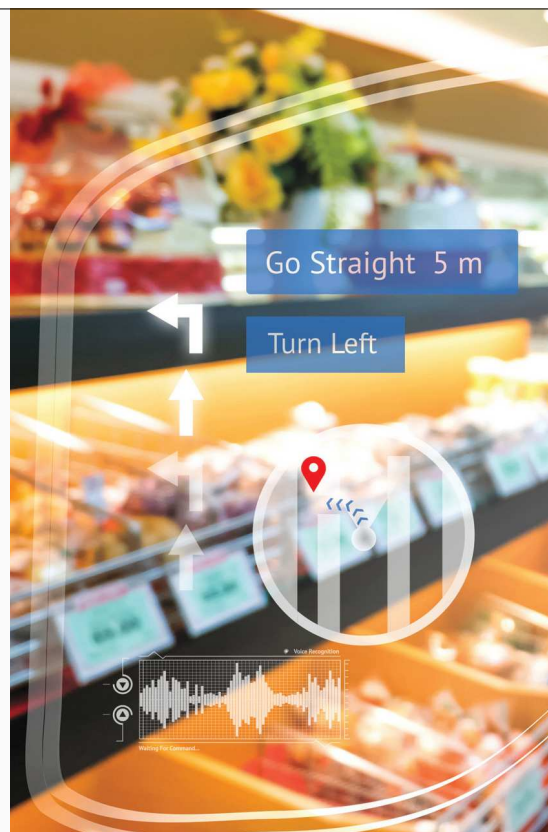
How can we improve the connection between underground and surface level locations, for instance knowing where we'll emerge when we exit an underground station?

One of the things you're deprived of when you come up from underground is that you have no compass information, you have no idea which way you're facing in the world at large. There are

signs telling you what the different exits are but if you don't already have the knowledge of what those mean, it's not very helpful. But you may know, for instance, that when you come out of a certain station, you want to head north, so if you had some compass information it would make it easier. Also, if you had that information, the first time you go into that space you could become oriented in such a way that lets you make a mental map of that space so that the next time you go to that space you have a better understanding of where you are. That's a really good example of the type of built space that I think could be improved by taking into account the kind of information the brain needs. One thing that I'd love to see is a compass rose at the top of every escalator. It would be interesting to start to add that sort of information and see if it makes people's experience better.

Do you see common mistakes in signage design to assist wayfinding?

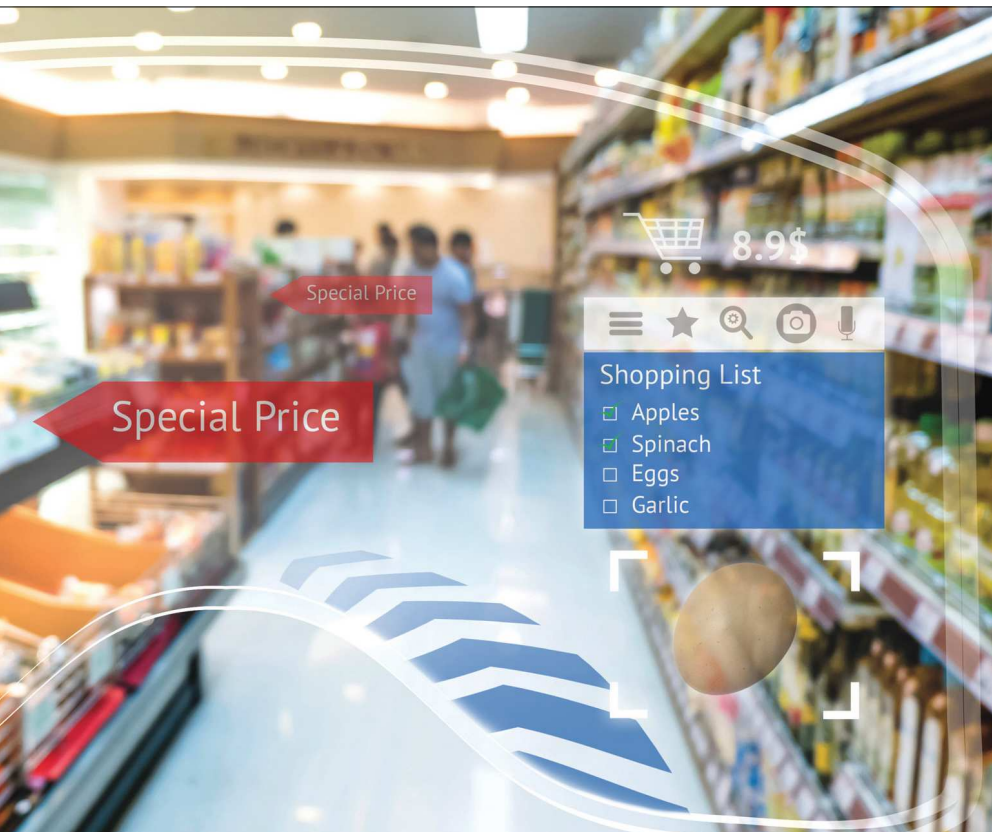
One mistake is assuming people know where they're going.



For example, when you come up the escalator into the Piccadilly Circus station concourse, there are signs indicating exits for different streets, which presupposes that you know which street you want to take. You may not have memorised the names of the streets but you may know that you want to go north up to Oxford Circus for instance. However, you wouldn't know that Regent Street would be the road to take.

Other issues with signs are that there may be too many of them, sometimes the text is too small or there is a sign as opposed to something more naturalistic that would have helped you orient more easily. Signs have their place but they're also very difficult to process cognitively, they rely on the language centres of the brain which are evolutionarily very recent, so it's hard work and if you don't speak the language or you're visually impaired then they're useless. So, I'd like to see a lot less signage and a lot more naturalistic





- AR could be used to help navigate many environments in different ways

I prefer technology to work with my own cognition rather than acting as an alternative to it

Can Virtual Reality help enhance our navigation skills?

Yes, I think VR is going to be a really useful tool, partly for just studying people, trying out architectural designs or trying to understand what information people use. I've started to get interested in using VR myself to look at things like how people process the symmetry of buildings. I think it offers the opportunity to be useful in other ways also. For instance, we know that the brain's spatial map organises information well in our own heads, so people will often use a spatial strategy to remember things. We're best at remembering things that happened in particular places, so if you're trying to teach a history student something, you might create an environment such as a virtual museum.

You could play around with worlds that aren't possible, such as flying through space or creating a 4-dimensional world. I've been thinking about that and whether we could make a mental map of a 4-dimensional world if we had the opportunity to explore one. There are some exciting opportunities to come. ●

Kate Jeffery is a Professor of Behavioural Neuroscience at University College London. Her area of special interest is the neuroscience of navigation – visit jefferylab.com. Kate chairs the Cognition and Navigation Special Interest Group (CogNav) of the Royal Institute of Navigation – see cognavrin.org.uk.

Nigel Scard is a Human Factors Specialist at Liv Systems. He has an interest in neuroscience and its potential application for human factors and is a member of the CogNav group.

design if we're going to improve navigation in our towns, cities and buildings.

What are the likely future developments in navigation assistance technologies?

Well, phones will get better and one improvement would be for them to work as well indoors as outdoors for finding your way around. But I'm quite intrigued by the possibilities for Augmented Reality (AR). Instead of having your information source in a device you hold in your hand, you have it integrated through your glasses, mixed in with your perception of the world – I think that technology will come along pretty quickly. I love technology but I prefer when it works with my own cognition rather than as an alternative to it so it's more seamless and more efficient.

How could AR smart glasses be used to assist navigation?

Even just arrows superimposed on people's view would be a start, you could either follow the arrow directly or go exploring based on that type of help but for people who like compass

directions it would be useful to know which way was north. Also, you could make use of the overlay capacity.

So for example, you could look at a building and by adjusting a setting make the building transparent so you could see through it to what's behind it. You could make a 'glass' city this way.

One of the things that's confusing about navigating through streets with tall buildings is that because you can't see past your immediate surroundings you don't really get a sense of the broader relationships. In a city like London, if you could see through buildings using AR you could identify landmarks such as the Shard. On the other hand, if you were in a suburb with no landmarks, you could create fake landmarks yourself, such as a big monument, so that you then had something to anchor your sense of direction. There are all sorts of fun things that you could do.

