

How are you thinking?

A new understanding of the nature of thought is helping answer existential problems about our experience of reality – and how unique it is, finds **Kate Douglas**

WITH hindsight, it is clear this has been puzzling me for years. It started with the realisation that I don't always see things the way others do. Then I began to wonder what was going on inside other people's minds. I don't mean what they are thinking, but how they are thinking. What form does their stream of consciousness take – and could it be entirely different from mine?

Thinking about thinking is hard. Sure, you may have heard of inner voice and inner vision: there was that buzz about people who don't have any internal monologue, and huge interest in aphantasia, the phenomenon where people have no mind's eye. But there is more to inner experience than that. What about sensations and emotions and abstract ideas? How do these all mesh together to create thoughts? Why do certain things pop into our minds? And what makes someone prone to ruminations or anxiety?

To find out more, I turned to scientists who study the mind. I discovered that we are finally getting to grips with the different ways people think – allowing us to identify whether we think the same way as other people... or not.

Philosophers have mulled over the nature of thought since at least the time of Aristotle. A century ago, it was also a popular subject for psychologists. "But it got kicked out the door by behaviourists," says psychologist Charles Fernyhough at Durham University, UK. "They claimed that it's impossible to be scientific about the subjective nature of experience." So, with the rise of neuroscience, psychology

focused its efforts on objective, measurable phenomena. Thought became sidelined. But it wasn't forgotten entirely.

Enter Russell Hurlburt. In 1973, he invented a method that would give us a better handle on introspective experiences: a beeper that attaches to the ear and goes off at random intervals each day. At the beep, volunteers record their current inner experience. Later, in one-to-one sessions with researchers, they drill down into the exact nature of these thoughts. Over the decades, Hurlburt, at the University of Nevada, Las Vegas, has used this method, called descriptive experience sampling, with thousands of people. "After four or five days, you have a pretty good sense of someone's inner experience," he says.

That's not to say it is easy. The first surprise was that people really struggle to introspect, so much so that beeper studies tend to ignore the first day's data as it is too unreliable. Even defining a "thought" is tricky. We assume we are all talking about the same thing – a conscious mental state – but, in fact, everyone has their own ideas, says Hurlburt. What his method reveals is that our thoughts seem to include five common phenomena: inner speech, inner seeing, feelings or emotions, sensory awareness (such as the sensation of your shoe rubbing) and unsymbolised thinking (explicit thoughts that don't include the experience of words, images or symbols).

The second surprise was that we are poor judges of what is going on inside our own heads. Beeper studies are time-consuming,

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so self-report questionnaires asking people how they think are more common. Comparing these two approaches reveals shocking discrepancies. Research suggests that we massively overestimate the amount of thinking we do in all five main phenomena, with the results of self-report questionnaires being between two and four times higher than those of descriptive experience sampling. So, while I conceive of myself as almost always thinking with pictures, it is likely that only around a quarter of my inner experiences contain them.

What has become clear is that we all think using our own combination of phenomena. Each of the five main ones turns up in about 25 per cent of beeps. “Many people have multiple things going on [in their mind] at the same time and those multiple things can be unbelievably complex,” says Hurlburt. A single thought might contain five or more separate simultaneous images along with inner speech about something else entirely.

Intriguingly, descriptive experience sampling also undermines a long-held idea about different states of consciousness: that we switch between mind wandering and task-focused thinking. Mind wandering is related to activity in the brain’s “default mode network”. The DMN is deactivated in focused thinking. However, Fernyhough and his team found that around 40 per cent of thoughts don’t fit neatly into one or other category, suggesting that both states could be active at different levels at any one time. “People’s experiences seem to unfold on multiple, parallel, simultaneous tracks,” he says.

Even something as straightforward as inner speech isn’t just one thing. “It’s a kind of language, and language is incredibly versatile,” says Fernyhough. It can take the form of a monologue, dialogue or debate, it can be articulate or slangy, nagging or rallying, emotional or dispassionate. Although you are likely to have a combination of any or all of these, one or two may dominate. My own inner voice is largely didactic and encouraging, but others have told me that theirs is so negative they try to drown it out with podcasts.

The same is true for inner seeing. It varies in amount and clarity, with around 4 per cent of people having no inner eye and an unknown proportion experiencing super-vivid imagery. There also seem to be different forms of inner vision. In her book, *Visual Thinking*, Temple Grandin at Colorado State University



How the experts think

If studying inner experience tells us one thing, it is that people tend to have little insight into the way they think. So, with years of research, what have the people who study the mind learned about their own thinking?

I'm much more silent internally than I used to think I was. I think that has all kinds of benefits. Inner speech is an incredibly useful thing, but I'm very happy to go quiet when I can.

Charles Fernyhough, psychologist at Durham University, UK

I have a fantastic memory for things I see. The more things I go out and do, the more pictures are in my memory. And then I can surf around in all these pictures, associate them and invent new things.

Temple Grandin, author of Visual Thinking, researcher at Colorado State University and autism advocate

I've spent a lot of time trying to understand what's going on with other people. That is a daily confrontation with my own presuppositions about the way inner experience ought to be. So I'm guessing my personality has changed as a result.

Russell Hurlburt, psychologist at the University of Nevada, Las Vegas

I may be inclined to negatively interpret bodily sensations, and have this kind of hypervigilance. So it's taught me to relax about changes in my body. I used to wear an Apple watch and I don't any more. I don't think that's useful information for me to know.

Jenny Murphy, psychologist at Royal Holloway, University of London

The surprise is that most people seem to have a lot more inner speech than I do. You always hear that meditation trains you to quiet your mind. Well, my mind is fairly quiet. I listen to a lot of podcasts and audiobooks because if I don't I get bored.

Gary Lupyan, psychologist at the University of Wisconsin-Madison

distinguishes between object visualisers and spatial visualisers. "An object visualiser, like me, thinks in photorealistic pictures," says Grandin. Spatial visualisers think in patterns. The former make good engineers and builders, the latter scientists and strategists, she says. "A lot of people are mixtures."

This mixing holds for all forms of thinking. Take the intuition that people tend to be either visual or verbal thinkers. "It's a kind of myth that there's a trade-off," says Gary Lupyan at the University of Wisconsin-Madison.

"We consistently find positive correlations." In other words, people with vivid inner seeing also tend to have a loquacious inner voice, and those with quiet inner seeing also have a quiet inner voice. What's more, our minds meld different forms of thought in all sorts of ways that resemble synaesthesia, in which the senses become mixed, says Fiona Macpherson at the University of Glasgow, UK: "Lots of people have [internal] number lines, or a visualisation for where numbers might be, and these can be quite complex and unusual."

People are often unaware of their idiosyncrasies. Lupyan describes a chat with two scientists during which it emerged that one visualises only still images while the other has imagery that only moves in one direction. More

"Your internal voice can take the form of a monologue, dialogue or debate, it can be articulate or slangy, nagging or rallying, emotional or dispassionate"

common is the practice of visualising spoken words as text. About 10 per cent of people do this, research by Lupyan and his team reveals. Their Internal Representations Questionnaire enables you to see how your imagery compares with other's. It is enlightening – even if the results come with the caveat that we all tend to overestimate our inner experiences.

"Until very recently, both philosophers and scientists have assumed that everybody thinks just like them," says Macpherson. "We now know there's a lot that is very different." This

is especially true of our sensory experiences of the world – our perceptions – although, again, we may be unaware of our peculiarities. Anil Seth at the University of Sussex, UK, goes so far as to describe perception as a "controlled hallucination" rather than a reflection of reality. "The brain is continuously making its best guess of what's out there," he says. It works like a prediction machine, using all the information available to create our inner experience. "The part that constitutes our conscious perception is the prediction – it's not the readout of the sensory signals," he says.

Perceptual personalities

In an attempt to map the hidden landscape of perceptual diversity, last year Macpherson, Seth and others launched the Perception Census. It consists of a huge range of online interactive tests and illusions spanning perceptions of colour, music, shapes, time and much more. (Give it a try – I discovered that my brain invents whooshing noises to accompany the rhythmic movement of simple shapes.) There are no results as yet, but with thousands of participants already, there has never been such an ambitious attempt to shed light on our inner experience. "I'm hoping this will reveal what correlates with what – whether we have perceptual personalities," says Seth. What we already know for sure is that there is a massive amount of diversity in perception. "You and I might describe ourselves as neurotypical, so we assume it's the same. It's not the same," he says.

The form of our thoughts is one thing, but then there is also the question of content. Your subconscious mind is a hive of activity dealing with everything from controlling breathing and movements to receiving constant input from your body and your senses. What reaches your consciousness is just the tip of the iceberg. Scientists have pinpointed how this happens: information that was previously unconscious becomes available to our conscious mind when there is a burst of synchronised activity distributed across many areas of the cortex – called the global workspace theory. But why we have the thoughts we do is a stickier problem.

Obviously, some of our thinking is focused on the tasks at hand. But many thoughts just seem to emerge unbidden from the subconscious, and that is much harder to explain. "We don't even know how memories look in our mind," says Valerie van Mulukom



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at the University of Coventry, UK. The brain seems to store them not as discrete entities but distributed around a network. “We think what happens is that, for some reason, some connection is made between previously disparate ideas,” she says. “That can then trigger a cascade of links.” This process may have been cued by a smell, taste or thought. Nevertheless, certain memories seem more likely to pop into consciousness than others. They include ones that are recent, emotional, frequently repeated and key to your identity.

This has all sorts of implications for your individual inner experience, including how often you have aha! moments, creative ideas and unwanted intrusive thoughts, which, by the way, are far more common than you might imagine. For instance, one study found that 64 per cent of women and 56 per cent of men experience intrusive thoughts about driving a car off the road. But it doesn’t explain why certain thoughts – often dark ones – get stuck in our minds.

Ethan Kross at the University of Michigan calls this “chatter” and notes that it usually entails thinking about oneself – your experiences, emotions, desires and needs. “We become flooded with emotion and we lose sight of the bigger picture where solutions to our problems often lie,” he says. Everyone gets this from time to time, but some people are more susceptible. “Women are more vulnerable to chatter than men,” says Kross.

So are people with certain personality traits. “Neuroticism has been linked with chatter – it’s almost built into the definition,” he says.

Negative chatter

There is an intriguing idea about why people differ so much when it comes to negative rumination and the anxiety that often accompanies it. The key could be interoception – our processing of signals coming from our own bodies, such as heart rate, breathing and hunger. “There are two competing ideas with regards to anxiety and interoception,” says Jenny Murphy at Royal Holloway, University of London. Either people

Learning how we think may help us understand our differences



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Women are more vulnerable to negative “chatter”

with anxiety pay more attention to these minor bodily fluctuations or anxiety results from inaccurate interoception. Last year, in an analysis combining many studies, Murphy and her colleagues found no evidence for the latter. “It’s the amount of time you’re spending evaluating signals that is linked to increased anxiety,” she says. But there is a second factor. “It is well established that negative interpretations of internal signals creates a feedback loop,” she says. In other words, catastrophising plus excess interoceptive attention might explain why anxious ruminations seem to dominate some people’s inner experience.

It is hard to say what counts as excess, though, because interoception provides essential warning signals that something is wrong with the body. “Maybe it’s more how flexibly you can attend to signals when you need to, but also ignore them when it’s not ideal for you to do so,” says Murphy. Meditation may help us learn to do this. Other evidence-based ways to assist in reducing chatter fall into three main categories: distancing methods, such as coaching yourself using your name, and keeping a journal; seeking support from someone who can help you put your worries in perspective; and environmental interventions, such as exposure to green spaces and experiencing awe.

I’m grateful my mind isn’t prone to chatter or catastrophising, but reflecting on the way other people’s may be has been eye opening. We all have our own ways of thinking, central to who we are – and yet we seldom stop to consider how they shape our approach to the world and each other. While the research into its impact is still in its infancy, it hints that how each of us thinks may influence our behaviour. It has already been shown to affect how well we learn. For instance, children with better ability to manipulate mental images of shapes in their mind in preschool were quicker to learn maths when starting school. Similarly, tennis players who combine self-talk with mental imagery perform better on court. The way you think can even make you more (or less) susceptible to hypnotism or conspiracy theories.

Thinking about thinking will also explain why you don’t always see things the way others do – both literally and metaphorically. “Other people are different to us: sometimes better or worse, but mostly just different,” says Macpherson. “If only we could keep that in mind, I think we could be kinder and more understanding of each other.” ■