

## 'Time is all you've got'

Catherine Loveday and Jon Sutton talk to John Wearden

**People can make surprisingly accurate judgements of time, albeit in a relative sense. Why is that so important?**

Well, in order to make movements, to predict when things are going to happen, it's quite important to have a time-measuring system. If it's too distorted, I would reach out for these glasses and not be able to pick them up. So the system must adjust itself somehow to be accurate, and this may explain the fact that there are no people as bad at timing as amnesiacs are at memory. There are certain groups who, in some experiments, have got timing deficits, but these are very small, so it's incredibly robust. But then, if you've got fundamental timing systems keeping you alive, can you have very a distorted timing system and still perceive, move...

**Thinking of it as an evolved sense, imagine walking through a forest and you hear a rustling in the bushes, and the sound coming to different ears is a few milliseconds different, but the triangulation allows you to pinpoint it.** There are apparently deep connections between time perception and information processing more generally, but we're only dipping our toe into that really. It would suggest that if your timing was very distorted then you wouldn't be able to do memory experiments, you probably wouldn't be able to perceive things correctly. So it's not terribly surprising that you never get a group who are normal but they can't time timing at all. How could they speak if their time sense is faulty? It seems almost impossible, like in Elgar's *Dream of Gerontius*, he is in a world without time and it's impossible to imagine what that would be like.

So in searching for an actual neural substrate, you're hampered by two things: one, this lack of a patient group, and two you haven't got an organ – in vision, audition, gustation, you can trace the connections – it goes somewhere, this surely must be involved to some degree.

**It's a bit like consciousness in that way.**

Yes, you do an fMRI on a timing task and 27 areas light up. Sure, there's lots of work going on, and there are usual suspects, but control and the use of different timing tasks are real problems. And then when you get real-life timing it's possible the mechanisms are quite different.

**In terms of real-life timing, it's interesting that in the early days of television the engineers went to great lengths to synchronise the sound and the images, then they realised that as long as the delay was less than a hundred milliseconds, no one noticed it. How come the brain is so good at distinguishing that, but it can override it?**

Well, this is a real issue. One of the findings, again, something which has been known since the 19th century and something I have worked on, is the difference between visual and auditory stimuli. If you present tones or squares of colour on a screen, the tones appear to last about 20 per cent longer than the visual stimuli. When you tell people this, they're always terribly surprised and they say, 'Why haven't we noticed this in real life?' Well, there's the possibility that for meaningful stimuli, this effect doesn't actually occur. We've got a couple of unpublished experiments where we've looked at film clips. They watch the vision without the sound or they just listen to the sound, and then you get them to retrospectively estimate the duration. No effect at all. So it's only in the lab, in slightly artificial situations, that people show this effect. I thought it was like a message from a distant star, it's telling you something important but you don't know what.

**I'm interested in the way time seems to ride over the other senses, so it's a meta-sense – time is involved in the**

**flash of a lightbulb or the persistence of a scent.**

Certainly, you seem to automatically measure the duration, at least to some degree, of events that occur, or you can reconstruct some kind of measure of duration. If you were given two tones that differed in intensity and nobody mentioned how long they lasted, then they asked you if they differed in duration as well, if they differed fairly markedly in duration you'd be able to detect this, even though you didn't know this was the focus of the task. It's almost as if it comes in addition, it's almost impossible to switch off.

**And it's very linked to memory, I suppose.**

This is possibly true for other things as well: if you had an experiment that was presented as a shape discrimination, but you were suddenly asked 'Did the green one come first or the red one?', I'd be very surprised if people couldn't tell you. It may not be that peculiar to time, maybe you analyse the stimulus and its temporal aspects are just one of the things that you store, whether you store it for very long.

**Is memory behind many of our real-life time experiences, and the sayings surrounding them, like 'Time flies when you're having fun'?**

With colleagues at John Moore's University, we did a questionnaire study. 'Fast time' anecdotes, time when you were enjoying yourself, were all of the following sort: 'I went to a club with my mates and then when we went out,

I looked at my watch and it was four o'clock', therefore, time must have passed quickly. There are two things: (1) they got an external time marker, and (2) the idea that it had passed quickly was

clearly an inference. They didn't feel it passing quickly when they were having fun, they didn't feel it at all!

I used to think you could measure the temporal phenomenology somehow, during the event, if you were clever enough, but of course you can't. The idea that time has passed quickly is an inference based on clock time. It's like my mother, who lives on her own, says the days seem to last for ever, but the months flash past. When the time marker comes at the end of the day – the six o'clock news, or time to make dinner – that's the time marker and nothing's happened, therefore it must have flashed by. But when they're in it, it doesn't flash by.

**I know you've tried to get funding to**

"I thought it was like a message from a distant star"

### research time experiences in the elderly and several other real-life projects, including waiting time at airports.

Inside me there is an epic, apocalyptic moan about failing to get grant funding, but I don't really want to dwell on that. The problem of funding is very acute and always has been for time perception in Britain. As far as I know, hardly anyone's ever received money for it, for reasons which are not at all clear. And this has hampered research in a more general way – if you can't get money, you can't have post-docs, who then become lecturers, who then become professors, and so on.

Science journalists quite often ask 'Why don't you study that?'. If someone would give me some money, I would! What you tend to find is that people's careers might start out with time perception and then they fizzle out, particularly these days where that academic is partly a fund-raiser for the university, so to work in something where you can't get money is frowned upon. So mainly people have to work on their own, or in small groups, and there's a limit to what you can do – you can do a psychophysical experiment, but you can't do an experience sampling methodology study lasting months without having research assistants and big infrastructure.

### So if you did have the bottomless purse, that would be the one?

Yes, I'd maybe try and look at the perception of time and the passage of time in the elderly. The scientific literature is a bit confused, but if you get old people into the lab, they're not much different from anyone else. They're more variable and possibly less accurate sometimes... they're worse than students, but they're worse than students at everything... they don't have particular timing deficits. So this thing about time getting faster as you grow older, and people feeling that time drags terribly in their daily lives, is related to things you can't easily duplicate in the lab.

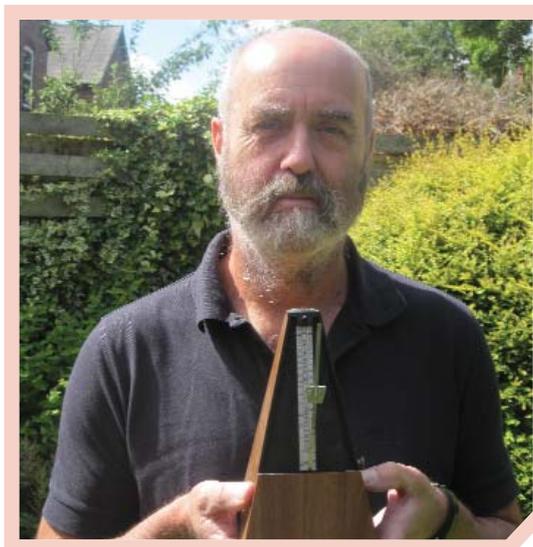
### I guess interest, arousal and emotion would also be important in these real-life studies.

There's obviously been this idea that in very high states of emotional arousal, time appears to stand still. If you think about it that would be very evolutionarily sensible, as you're really speeded up in comparison with the outside world. There's this 1950s science fiction book was called *The Stars My Destination* by

Alfred Bester, where you can get an augmentation to yourself, like a kind of martial art where temporarily you're just speeded up, so you know the mugger approaches you, and you just accelerate... But of course does it really do so or do you just think it does, and how can you replicate those situations?

### David Eagleman tried, didn't he... getting people to jump off towers.

Eagleman wanted to find a situation that provoked this sensation of being in a life-threatening situation, and of course ethically it's very difficult to do! What he found was that people remembered the duration of the fall as longer than it was, but he was looking at another thing as



**John Wearden is a Professor of Psychology at Keele University (for more information see [tinyurl.com/weardenj](http://tinyurl.com/weardenj))**

**Catherine Loveday is a Principal Lecturer at the University of Westminster**

**Jon Sutton is Managing Editor of *The Psychologist***

well. He had a digital display, with a number that was going faster than you could see. If your psychological processes were speeded up, you would be able to see it, but they couldn't see it. So he concluded that it was a memory effect.

In any case, you can easily give people the phenomenal sense of time dragging. All you need to do is put them in a supermarket queue, where you think the person in front of you has only got two jars of jam, and then they want to pay by Uzbekistan credit card! But would you necessarily mis-estimate the interval? That's almost a purely phenomenological effect.

But you've got to be careful here. If you precede tones and lights with a series of clicks, they seem to last longer. But do they only speed up your time perception or do they really speed you up? Do your psychological processes take place in subjective time or real time? Can you get more in if your psychological time is speeded up? Well, the answer tentatively is yes. Our work in the *Quarterly Journal of Psychology* in 2011 has shown that reaction times are actually faster if your reaction time is preceded by a train of clicks: you can go faster than you could possibly go. Things like the Sperling memory task, you can actually get more off the eye card, as if you actually had more time to do it. The effects are quite small, but it looks as if there is some deep connection between psychological time and information processing. But maybe they're the same thing, or both reflections of some internal time system!

### Does the internal physiology change – for example, does heart-rate go up?

No, it doesn't, there's no physiological effect – the click trains are boring as hell! There may be changes in brain activity, but...

**...no funding!**  
You've mentioned external time markers, and the effect that they have on your subsequent memory of events. You wear a watch, I notice. I don't (JS), and I try to avoid external time markers as much as possible. Would you predict that would have any effect on our real-life experience of time?

Well, one of Dan Zakay's ideas is that your time experience is affected by two variables:

temporal relevance and temporal uncertainty. So is time important in the situation, and how uncertain is it? He said that people have a heightened experience of time passing in situations of high temporal relevance and high temporal uncertainty. The obvious one is if you're going to the airport and there's a traffic jam, and you don't know whether you will miss your plane. In underground systems now they give you a countdown to the next train arriving, and that seems to remove at least part of the aversiveness of the waiting experience. And that Zakay stuff makes sense... whether you could actually apply ideas of time relevance and

## time

certainty just by asking people, nobody has ever done it.

If you want to work on real-life timing, the real challenge is to design situations which are enough like real life to capture the essence of it, but not so much that it's impossible to understand what's really going on. Film clips seem to be complicated: people have talked about the importance of segmentation, the number of different things which happen, but it's very difficult to judge.

**That's presumably one of the main things that a film director is doing, it's about getting that timing, that pace right.**

There's work on the use of time in films, to create suspense. Boring events, like someone getting out of their car and walking to a door, are often collapsed, whereas something like James Bond cuffed to the atomic bomb in *Goldfinger* has to be slowed down to get more and more things in. They've known all about these things for years, just as Bach and Telemann knew about auditory stream segmentation before Bregman's book on it, and in fact he now illustrates it with them. Similarly, the operas of Wagner gain their power from their enormous length and repetition.

**You used to play double bass in the National Youth Orchestra, so that link between time perception and music, particularly I suppose with rhythmic parts like bass and drums...**

Well the odd thing is that time and rhythm perception have proceeded on largely different lines for years, with very little interaction between them. There's been work on time in music, by Marie Rhys-Jones and Marianne Boltz who was her pupil, but it's more about tonal expectancies and how you can manipulate how long things seem to last. There are common ideas though, such as the use of the pacemaker...

**I think there's the difference between rhythmic perception and rhythmic production as well.**

Well, John Gibbon said that was the most profound problem in the whole of time psychology: when does a rhythm become a rhythm? I give you two clicks – click click – and you have to make some judgement about the duration between them. Then I give you three clicks, or four. I bet the precision of judgement of the interval increases markedly when you

have a whole series, but how many do you need?

**It's interesting as well that rhythmically we tend to quantise those beats, so something has the feeling of a beat but we notice those imprecisions.**

Of course in real life it's generally relative rather than absolute. For example, when I was in the National Youth Orchestra, before the conductor came in for the rehearsal we used to tune up. We were doing Berlioz' overture *Le Corsaire*, which has different sections to it, there's a slow bit in the middle. And one of the violinists started playing the start of *Le Corsaire*, and somebody else joined in, and very soon the whole orchestra was playing *Le Corsaire*. While we were doing all this the conductor walked in, but just gestured for us to carry on, and we did

"the real challenge is to design situations which are enough like real life"

rarely in real music required to produce an exact 500ms beat, it only has to be relatively correct.

I'm interested in music... when I was 49-years old I decided I should learn something about 20th-century music – serial Schoenbergian-type stuff. That has been an interesting adventure, and they have all kinds of interesting things that they do with time. You do find yourself in a minority of one though, I have to listen to it on headphones because my wife can't possibly listen to it!

**I find it quite difficult, I have to say (CL).**

You have to listen to it about 50 times, that's the thing. Schoenberg's alright, he sounds like Brahms after a while! Ferneyhough, he's the guy! Listen to his Second and Third String Quartets if you want to hear something totally amazing.

There just seems to be no temporal structure at all, although of course it's all very carefully calculated.

**Perhaps more important in real life isn't time perception, it's your own personal view of time, how you see time progressing in your life.**

I'm not so susceptible to this thing of time getting faster as you get older. I'm a bit sceptical about it and in fact I'm right to be. An actual study by Wittmann and Lehnhoff found that most people didn't actually agree with that! But my children are grown up, I'm coming to the end of my career...

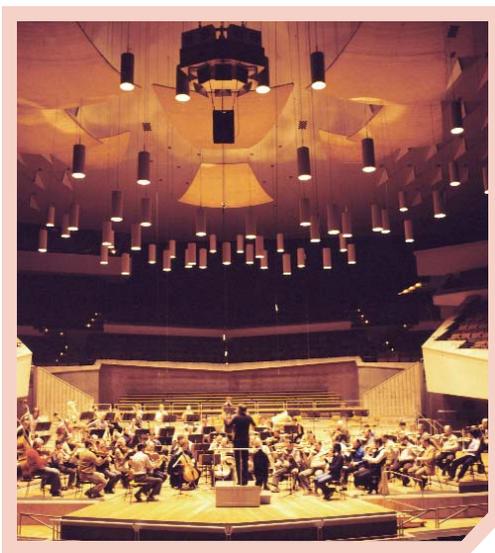
**... 'the rapidly darkening twilight of my career', you said to me!**

Absolutely! Obviously I had a heart attack a couple of years ago, even though I'm a low-risk subject, which didn't have much of an effect but it makes you think about things a bit.

**It makes you think about and appreciate time more, take each day as it comes, those old maxims?**

Doesn't seem to, I waste just as much time as ever! It makes you think that you should do things you want to do: good and bad things! But you do look at different periods... does it only seem a short period of time since my children were young? In some ways it does, but then if you try to fill in in memory all the things you have done, obviously it seems like an enormous amount of time.

It certainly makes you more self-indulgent though. Time is all you've got: if you want to see a place, you should go.



the whole 15 minutes. Now there's no conductor, no external time. Is that some impossible, miraculous feat of timing done by virtuoso players? Not at all, it's dead easy.

**It's football terraces.**

Yes, they're not very good at it though! They always sing the National Anthem too fast or slow. But it's not at all difficult to do, and musicians do that kind of thing all the time. Everything was relatively timed correctly, but it wasn't necessarily absolutely timed correctly. It may be that it lasted longer when we played it on our own. But you're very