UCL Brain Stories Episode 17 - Jenny Bizley

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SPEAKERS

Steve Flemming, Caswell Barry

S Steve Flemming 00:02

Hello, and welcome to brain stories. I'm Steve Fleming and I'm here with my co host, Caswell Berry,

C Caswell Barry 00:08

on brain stories, we aim to provide a behind the scenes profile of the latest and greatest work in neuroscience, highlighting the stories and the scientists who are making this field tick.

S Steve Flemming 00:18

We don't just ask about the science, we ask how the scientists got to where they are today, and where they think their field is going in the future.

C Caswell Barry 00:25

And so today, we're very lucky to be joined by Professor Jenny Bizley who is based at UCLA, our institute generally works on the way in which sounds are perceived by the brain, particularly how sounds arriving from different locations separated, and the role in that which other senses have, as well as how attention influences that processing. So Jenny, Hello, thanks for joining us. Hi. So to get you started, I'm going to ask you sort of, did I get that description? Right? Is that a sort of fair reflection of what you work on? Or have I missed out any big, big important chunks?

01:01

No, I think that was a pretty good description, actually, I think, you know, we have a good understanding of how the air encode sounds. And we have a pretty terrible understanding at the moment of what the dip the brain does after that. And that's really what my research is interested in? How How does the brain allow you to pick your friend's voice out from a sea of other voices when you're in a restaurant or a bar? And to do that, as you said, you use attentional mechanisms you use vision? And of course you use hearing. So yeah, how your brain does that is, is the central question that we're interested in.

Caswell Barry 01:35

So I think people might be quite surprised by that sort of statement, the end that what you can see, or indeed what you know, is around you affects how you hear things. I mean, so what do we know about that? I mean, it seems kind of weird, although I can give one anecdote which might inform this. So I'm incredibly short sighted where it was before I had laser eye surgery. And I realised at the hairdresser's, if you can't see the hairdresser, I couldn't hear what they were saying. It's quite quite an interesting effect. Is that is that at all related to the sorts of things you're you're thinking about?

02:08

Yeah, I mean, I think we all experienced this through COVID. With mask wearing, right, a mask produces an acoustic barrier, but mostly it masks someone's facial movements. And those lip movements are probably the most kind of obvious and fundamental way that we experience every day how vision affects what you hear. But, yeah, I think it's a lot, it can be a lot more rich, potentially, than simply lip movements, in terms of how sort of even low level visual features. So you know, if you look at the hand movements of a guitarist, strumming their strings, or the bow movements of a violin and the string quartet, you'll be able to pull that sound that melody out of the mixture much more effectively. And you can kind of play these games, if you're listening to an orchestra or a string quartet, you can choose which which thread of the music you want to listen to, simply by watching the source or the movements of the source that are generating them. And that, to me, suggests that there's really something fundamental about how vision can help you organise auditory scenes that goes beyond simply, there's probably quite human specific combat, combining of information from lip movements to help you understand speech better.

Caswell Barry 03:22

I mean, how much do we know about how that works? When it feels like you're the the what's now outdated view of the brain of sort of all these different modules doing different bits, you might sort of, if you were thinking about, it might naively think like there's a there's an auditory bit, I just hear sound processes at fine. Whereas the sorts of information we're talking about, you know, things you can see, things you know, about the sort of space around you those are attached to what traditionally attached are quite distinct bits of brain? Does that mean there's more communication between those them we know about does it mean that we shouldn't really be labelling things as like auditory cortex? It's all like doing interesting things. It should be auditory spatial with a bit of vision. Yeah, I

04:06

think you're exactly right, this kind of textbook idea, that canonical idea that, you know think you're exactly right, this kind of textbook idea, that canonical idea that, you know, different chunks of the brain do different things for different sensory modalities has been kind of overturned gradually, I would say, sort of since the early 2000s, when a number of us working in different sensory systems in different species, so from rodents, all the way through to kind of carnivores, non human and human primates, observed that you get activity in what should be primary sensory cortex driven by other sensory modalities. So we see visual activity and auditory cortex, auditory activity and somatosensory cortex. visual cortex can be driven by sounds as well, it doesn't matter. It seems to be a general phenomenon. I think what we have made much less progress on. So there are people who've done your anatomy that shows that there are some direct connections And they're also kind of thalamic loops that might support these things. But I think understanding what the function of those kinds of cross connections are, and what they really mean for perception for action, I think is still a really open question. So we've done some work, looking at how a visual stimulus can, first of all inhuman listeners allow you to separate two competing sounds. So these are non speech sounds more effectively. And simply the timing of a visual stimulus can allow you to pull a sound mixture apart more effectively, in human listeners. And in single neurons in auditory cortex, we can see an analogous effectiveness. So you can basically switch a neuron from representing one sound to the other sound simply by presenting a visual stimulus that changes in time with one of those two sounds. And that sort of low level effect looks a lot like attention in some ways. So in our recordings, these were in in passive or even in a nice the test animals, so we can rule out that it's an attentional effect. But then how these sorts of bottom up sensory effects, interact with things that also look a lot like attention, I think, is a really unanswered question at the moment. And that's something certainly in my lab we're trying to tackle head on. Yeah, at the moment, because I don't think we've really, you know, there's a lot of sort of circuit dissection saying, there's activity here. And it comes from there. But that doesn't necessarily necessarily tell you what it's good for. And I think that's really the unanswered question at the moment, like, Is it some sort of epiphenomenon? Or is it really like a fundamental mechanism that supports perception? Which is obviously what I would like to believe, because we've invested quite a lot of effort in it at the moment.

S Steve Flemming 06:44

And do we know how much these effects depend on uncertainty or the kind of general goal of trying to resolve ambiguity? So going back to cow's wells, example of the hairdresser, there, the limit was essentially, like, if your vision wasn't too good, then then this was, you know, imposing a limit on how much that sense could then resolve ambiguities coming from other senses. So is there a kind of normative potential explanation here where essentially what the brain is trying to do is find the best explanation and then it's using all the senses available to it? Or is there something more fundamental, more more bottom up, that might be going on?

07:31

I mean, I certainly think that the best way to see any of these effects is in situations where there is some level of ambiguity, right? If you're in a anechoic, chamber with one other person having a conversation, and you've got normal hearing, then whether you see their lips or not, is irrelevant. Whereas when you're in a pub on a Friday night, and it's really noisy, then suddenly lip movements become, you know, really helpful to you. So I think, you know, the more that you lean on other senses, but you will lean on other senses more when there is ambiguity or noise. And that's probably an inherent property of the brain, I would imagine.

Caswell Barry 08:13

Does that mean that you think sort of analogous to your auditory neurons that seemed to be sort of gated by visual stimuli? Would you expect to see sort of a reciprocal thing in visual cortex and indeed, for any sort of sensory cortex, then it's all like, there's this sort of delicate interplay between all of the senses.

08:32

I think that the way in which you use the other sense, if we want to call it that the non dominant sense, and what we think of as a sensory cortex, probably depends a lot on which sense we're talking about so that we know for, for audition, you have this particular challenge, where the representation on the sensory receptor surfaces in terms of frequency, and there's nothing about sounds frequency that tells you where it is in space. Sounds, you know, two competing voices will overlap both in time and frequency on the cochlea. So you have this mixture. And I guess the other thing is, sounds are transparent. So sounds don't occlude one another in the same way that you know, at the moment, you're including the shelves behind you on the webcam that won't come across too well on the podcast. So the real challenge to the auditory brain is in taking this complete mixture of frequencies and somehow pulling them apart and then reconstructing them, such that the frequencies that came from one source are grouped together, that a step that isn't 10, separate from frequencies that came to a note from another source, in say, vision or touch where you have a spatial representation on the sensory receptor surface. I don't think that same challenge holds. You already have distinct clusters of neurons that provide some kind of ability to spatially resolve scenes. What what you might struggle with Envision There's things like temporal resolution, the fact that you can only see what's in front of you. The visual object objects include one another. So I think the role for hearing, in augmenting vision is probably different. And it may even be different for animals like us who have, you know, really strong foliated vision, you know, like, we really want to look and direct our high acuity vision to particular things of interest, and I suspect your audition auditory system helps you direct those, you know, a lot of the role of hearing, I think, much as it sort of slightly pains me to admit it for a primate is to direct your visual system to things of interest. And that's not true. The other so I think, you know, I don't think you would see this role for hearing in, in, in scene analysis effectively envision because I don't think that division is challenge, I think what you'd see it for is directing your vision to particular points in space for resolving temporal conflicts. And then in touch, you're going to have different challenges and different ways in which you want to integrate cross sensory information again, in turn. So I don't think there's going to be some Yeah, like some singular fundamental principle of what across modal connection adds, I think it will be sensory specific, and possibly species specific.

Steve Flemming 11:18

That asymmetry there, it just made me realise that I embarrassingly know almost nothing about how the auditory system evolved. But does that imply that essentially, in some animals, the audition might come after vision as a kind of extra sense to resolve these two, if you need one to resolve ambiguities in the other, maybe you have some kind of evolutionary sequence in that in that development.

11:47

So I also know embarrassingly little it turns out now I think about it, about the evolutionary sequence. But I think you could make a counter argument that would be that actually, audition is your only long range panoramic, danger alert system. And there are kind of things like even sort of electro sensing and fish and the cochlea is existing in frogs. Of course, they're also fish. And yeah, I'm not sure why evolutionarily there would be a need for vision overhearing. First of all, that I'm really making this up now.

S Steve Flemming 12:27

Maybe we should move on to things that we feel like we could talk about, I

C Caswell Barry 12:31

have a distant memory of reading something as a child, which probably totally bogus when someone was arguing something along the lines of our cars in evolutionary history, humans used to hang out around seashores. And so vision is not very good, because the Seashore is crinkly. And if you want to talk to people nearby, then like that, that there should be some sort of dominance of information transmission via audition. And this is a slightly different thing. But it's what why is language audit? I guess the argument, their argument was, why was language auditory and not like, visual, right? I've gotten it sounds totally made up? No, I think about it. But yeah.

13:08

It also helps that you don't have to look at the person that you're listening to.

C Caswell Barry 13:13

Awkward scientists?

13:15

Well, like if you're hunting, you can shout across. Yeah.

S Steve Flemming 13:20

So maybe you can say a little bit about how you do the experiments you described. So how do you actually gain evidence for this, these kinds of cross modal interactions? And what what are you looking for in the brain, when you're trying to understand how the auditory computation is unfolding?

13:39

Yeah, so at the moment, we've been taking a sort of a multi pronged approach, which I hope will soon kind of converge to, instead of sort of perhaps circumnavigating the problem actually answering it. So we do psychophysics in humans, which allows us to kind of test a lot more hypotheses a lot more quickly than training animals. So we can kind of refine paradigms and develop ideas and tests of models more efficiently and humans. And we can then kind of take them into animal model, which is the ferret. In a ferret, what we've done is a series of kind of anatomical work to look at the potential input stored at xi cortex in the sort of hope that that would at least rule out some possible hypotheses about what vision might be doing. We've made kind of basic recordings to sort of chart things like as you move from primary cortex to secondary cortex, the proportion of visual responses increases, but that's using very, very simple stimuli. And then we've done studies like the one I described previously, where we record single neurons from from auditory cortex and animals that are listening to the same stimuli that we have used in our human psycho acoustic paradigms. And then we try and kind of put The whole lot together, of course, what we want to do, and what we're now beginning to do is actually train the animals in the behavioural paradigms that we've developed in the humans, to show that they show the same audio visual effects, and then actually record from single neurons during behaviour, because then we get the kind of trial to trial fluctuations to say, okay, like this neuron shows an influence of visual stimulus. And the firing of it in some way correlates or predicts the animal's behaviour on a trial to trial basis. And that kind of tells us that, it, it's more strongly suggestive that these audio visual interactions that we see an auditory cortex are actually feeding forward into behaviour. And of course, like then on top of that, you can do some kind of circuit manipulation, potentially, to eliminate a visual input and show that the animal's behaviour is influenced. But we're still in the ferret model a number of years away from really successfully being able to do that.

C Caswell Barry 15:56

This is the dream, isn't it, putting all these things together, sort of, you know, behavioural measures, reading out for neural populations and then manipulating them. But it seems that you've made your life even harder by doing that in the ferret, rather than like rats, or mice that, I guess the vast majority of systems neuroscientists, well, systems neuroscientists like meat maybe spend their time doing is there. I mean, what's the advantage of ferrets over rodents, for example?

16:25

Yeah, so for hearing, I think the ferret offers a unique advantage. So human hearing is a really fundamentally low frequency phenomena. So pitch requires low frequency hearing, and you need pitch, not just to appreciate music, but to separate competing voices. So if you both speak at the same time, and I'm trying to pull one of your voices out, it'll be the kind of continuity in the pitch contour that allows me to do that. Spatial hearing in humans is really biassed towards interval timing differences. So the difference in timing that arises between the two ears, because the sound source has a shorter or longer path length, depending on where it is kind of in a axes around your head. A ferret ferrets, like humans use these timing differences to do sound localization. And that's really in sharp contrast to mice and rats who you have for mice, their hearing ranges way above the kind of pitch zone, and rats really, too. And neither animal can use ITDs. So I think, yeah, yes, being in interval timing differences, these sound localization cue that we mostly rely on. So if you really want to know how a human pauses an auditory scene, and make sense of sounds, and speech, or music, and all of the things that really we think hearing is important for, then you need an animal that can hear those sounds, I think. And that's and so, you know, we, we don't do experiments with sort of simple stimuli, like pure tones and simple tasks, because the people who work in mice and rats can do those experiments, and they can do it better than us, they can do it faster than us. And they can then use all of the tools and circuit based manipulations that we can't use. What we do is, is try and leverage the intellect of the ferret. So they're also pretty smart, we can train them in complex tasks. And it's low frequency hearing, to gain sort of insights that we'd like to bring gain about the human brain, but that we can't, because you need an animal model. So we, we sort of hope it sits somewhere between those two things. But yeah, it does make life more interesting.

C

Caswell Barry 18:34

I bet it does, are you I mean, I don't know if anyone else at UCLA, UC Berkeley, you actually unique in the world doing this or there are other groups elsewhere.

18:43

So people started using ferrets. Because they're really great for developmental work. The kits are born really quite prematurely. So you can do manipulations that in other animals you'd have to do in utero. So people started using them for visual development work. And there's a number of visual labs that are using ferrets these days, a few in Europe and several in the States, many of whom have sort of switched to or complement that work with non human primate work in hearing people also use them for developmental work, but there are our labs using them for kind of an auditory cortex work in Oxford, in France, and also in the States. So there's not many of us. We're a tight community. But yeah, I'm unique at UCL but not unique in the world for using ferrets. What do we know

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Steve Flemming 19:33

about how this passing of the scene that you mentioned, operates? So it seems like something that we don't often think about with audition in terms of like, as you described so beautifully earlier about pulling out the objects of the auditory scene, pulling out the speaker, be able to attend to one specific instrument in the in the orchestra. So what's known about how that kind of parsing gets done and How that objects representation is, is achieved.

20:03

I want to say very little. I mean, we know, we know quite a lot about the cues that human listeners use to solve that challenge, like which features of the sound are important to allow you to do that. And we know some amount about how the auditory midbrain and the auditory cortex represents those cues. And I think one of the really big unanswered questions really is how you get, actually, it's not a problem specific to audition. It's essentially it's the binding problem, like how do you get these neurons that represent distinct features of an object to actually you form that object, that perceptual representation that we experience? And, yeah, we have some reasonably good evidence that auditory cortex is playing that role, both from recordings but also kind of manipulating activity and auditory cortex. But I think exactly how it's doing it is one of the big unanswered questions. And I think the sort of large scale neural recordings that we're now able to do alongside behaviour might hopefully give us the insight that we've been lacking on that front.

S Steve Flemming 21:12

And does that have a I can imagine that has quite some clinical implications as well for if you're, if there is a problem with not necessarily hearing per se, but the kind of cognitive level of passing the scene, then that might manifest as essentially being unable to track conversations and so on. So how much in your line of work do you do you think about that potential bridge over to clinical application.

21:40

So cochlear implants are probably the most successful example of a neural prosthesis, and they probably work so well, although, of course, they still have limitations because they can put a frequency representation in the ear, which we understand. And while they can help a lot of people that you know, large numbers of people who either have central auditory processing disorder, so there's nothing wrong with that error at all. And it's some kind of cortical problem, or, you know, people who have acoustic neuromas or something like that, where the auditory nerve itself is damaged, there's no point in, in inputting into the cochlea, because that information is still can't access to the, into the brain. So there is quite a movement to sort of develop cortical implants that could help people who cannot benefit from a cochlear implant. The problem is that because we know so little about the code, there is this cause frequency representation that still exists in auditory cortex. But attempts to use that as some kind of input have really been quite unsuccessful. And even in something like the inferior colliculus, which is a few synapses beyond the Cochlear, and still a few synapses away from the auditory cortex. It's pretty poor, the outcomes are pretty poor compared to a cochlear implant. So I think for me, so my work has sort of two ways in which I sort of think about clinical impact. So the first is in terms of just trying to understand auditory cortex better such that we could potentially design a better cortical implant or better signal processing for hearing aids, which are also pretty hopeless for these sort of complex noisy situations we think about. And the second is I do do more sort of direct clinical line in that some of the hearing tests that we've developed, initially actually in animals and then tweaked for humans have now become outcome measures for clinical trials for cochlear implant users and stuff. So there's a clinical trial called the both ears project that is running at the moment led by W. Vickers in Cambridge, who is really looking at the the NICE guidelines now say that children who are born congenitally deaf should have two cochlear implants. But they don't seem to use them in the way that you would hope. Essentially, most children rely on one of them on their on their better aid, rather than kind of actually getting the benefit of binaural hearing that you would hope you would get by replacing hearing in both ears. You know, the aim of this clinical trial is to train hopefully to try and train these children to use both implants more effectively. So yeah, we've provided a test that's the outcome measure for that. So because I'm one of the nice things about being embedded in the urine city, actually is we have lots of clinical colleagues and you can make these kinds of synergies. And actually hearing tests that work for ferrets sometimes work quite well for children. They're quite simple.

C Caswell Barry 24:38

Pretty similar, right? Exactly. That sounds amazing. I just want to pick up on something you said that the aim is to train children to use both cochlear implants it feels like a strange thing to say like hearing feels that sort of basic thing that there is learning you can do on top of it to to improve on it that kind of seems nuts to me. Could you Could you elaborate a little bit?

25:01

I mean, so if you were to come into the anechoic chamber at the Ear Institute, and I was to test your spatial hearing a few times over a few days, you would get better at it, right? You get perceptual learning, just like anything. But in this specific case, you know, the kids will play computer games that will kind of progressively make require that they make finer discriminations using their special hearing. But yeah, obviously, in a very, like a high gamified, hopefully, somewhat engaging way, because they need to do it repeatedly over several weeks. But yeah, there's there's plenty of scope for, for perceptual learning. And it's a pain, right? If you're piloting studies, because you end up with super listeners in the lab who can do every task, and then you bring in real humans, and they can't do anything.

S Steve Flemming 25:49

And is there something about the cochlear implant that leads to this bias, where the kids have one, rely on one rather than the other?

25:56

There's lots of challenges. So the first is that they might have one implanted quite early, and then the other not for a few years after. It may be that one implant is just better, they managed to insert the electrode to kind of deeper into the cochlea. But one of the biggest kind of, I guess, errors, or problems that have been surmounted more recently is that initially, the two implants didn't really even communicate with one another. And it was the same for hearing aids as well. Each one was acting as its own device and trying to boost whatever sound signals it thought was most relevant. And that almost certainly kind of obliterates your spatial perception, because you lose kind of natural level views and things like that.

C Caswell Barry 26:38

So we've we've talked about the science. Now we want to talk about the decisions in your life that led you to this point. I don't know that much about your background, but from looking at your website, I gather you at least have been in the past, a very keen rower. Has that got anything to do with very good auditory processing? Or are we just on a parallel tangent?

27:03

Absolutely nothing.

Steve Flemming 27:06

You still you still rowing

27:10

I have a boat, I still have a single skull, which is in Oxford, over the boathouse, it is captain is about to be sold. And I am just kind of psychologically preparing myself to sell my boat because I only use it a few times a year now I live, I live about an hour away from my boat in a very landlocked bit of the Children's. So turns out small children and rowing are not really compatible.

Steve Flemming 27:36

Small children and a lot of things are not hugely compatible.

Caswell Barry 27:40

bigger boats.

27:44

Really, the whole point is to escape.

Steve Flemming 27:46

I had exactly the same conflicts with having to stop sailing for quite a while when my kids were born. So yeah, I feel your pain. Well, so going beyond rowing? What is it in your past that kind of led you into this field? What really took you into well, I guess neuroscience to start with, but also what really piqued your interest in auditory processing.

28:11

So I mean, if you look at my CV, it looks like I got about halfway through my undergraduate degree and decided I wanted to be an auditory neuroscientist when I grew up. But actually, it was kind of a series of just coincidences, really, as a sort of second year, I knew that I wanted to do a sort of summer research project because I'd spent the previous summer doing a mixture of self service waitressing and working a little chef and really, I didn't want to do that again.

S

Steve Flemming 28:38

Right to opposite ends of the spectrum.

28:42

Take what you can get right. So I yeah, I wrote to an awful lot of neuroscience labs, who, whose website sounded interesting in London because that's where I lived. And Jonathan Ashmore at UCL was kind enough to write back and to offer me a place in his lab, to actually to look for the motor protein that causes the outer hair cells to amplify sound. And what that kind of eight week project taught me was that the cochlea was incredibly beautiful, and that I should never be a molecular biologist. It's not my skill set. And then, yeah, I did a four year neuroscience programme. Again, because I sort of saw I did a degree that gradually specialised in neuroscience. So by the sorts of, you know, the January when you're applying for PhDs, I'd only done one term of neuroscience and didn't really, you know, feel confident picking a PhD topic. So I did a four year programme so that I could kind of hedge my bets a bit longer. And I was really excited by the idea of recording neurons doing kind of extracellular recordings, and Andy kings lab, had a project doing this in auditory cortex. So again, it was really the technique that led me to his lab role. Have any kind of deep seated passion for hearing. But once I was there, I got kind of hooked. And yeah, I've been doing more or less the same thing

S

Steve Flemming 30:09

that was in Oxford, hence, on the boat.

30:12

Yeah. So I didn't start rowing until I finished my PhD. I submitted kind of the January and I thought, oh, what could I do with my last six months of student status? I know I'll learn to row. It was probably a good job. I didn't do it sooner because I might never have graduated. Yeah, I had a had a horse in Oxford. So he was a very, yeah, he was very decrepid. I wrote him not very often. But I had to, you know, feed him twice a day. So I think Andy might have might have had something to say if I took up rowing.

C

Caswell Barry 30:48

This is amazing. You're sort of like full on outdoors. Like there should be some sport that combines horse riding and rowing, like some sort of modern pentathlon, but with water, I don't know.

Steve Flemming 31:01

Well, barges barges used to get pulled by horses, you could have a horse pulling your boat.

Caswell Barry 31:09

So along along that journey, have you ever sort of have you ever been tempted away from auditory neuroscience? Or is it does it? Do you think this sort of, I guess, especially because a lot of Bucha spoke about has been you telling us how, how, essentially, more than just hearing your cortex is or how it's sort of so important for integrating these other other sorts of information? Has that sort of tempted you away? Have you you know, other other other bits of the brain that you have your your eye on? Or different fields? Indeed, you know, he spoke about clinical implications? Do you do you see yourself sort of winding up doing more of more of that sort of work? Or is it basic science all the way?

31:53

I quite like the mix that I have at the moment, which is like mostly basic science, but with some kind of clinical stuff, and a lot depends on? Yeah, I've done a lot more clinical work over the past few years, because I had a really brilliant clinical PhD student who led a lot of that work. So it's sort of, I would say, my clinical work is sort of opportunities driven. For the fundamental science, we are increasingly kind of I mean, as you know, recording and all sorts of different bits of the brain from hippocampus, frontal cortex, parietal cortex, anywhere that might have some kind of role in sound, or be interesting from the point of view of the ferret model, I mean, we've also kind of flirted with a few areas, just because we think the kind of comparative aspect could be kind of interesting and useful. But I think my kind of fundamental passion is really for answering the kind of auditory inspired questions. And also, you know, like, it's a bit presumptuous to think you can just jump into someone else's field. With that, yeah, with the hippocampal work we've been doing. It's very firmly been with people like Dan Bender, who knows an awful lot about the hippocampus. And I think, yeah, we need that otherwise, yeah, we're probably not going to do anything terribly useful.

Steve Flemming 33:10

This might be going off on a bit of a tangent, but it just occurred to me that there could be also implications of the work you're doing here for artificial systems, speech, perception and AI more broadly. So I'm just wondering whether you could say a little bit about that, whether this is anything you get involved in or you see yourself getting involved in more in the future.

33:29

Hopefully Caswell and I have a student actually thinking, you know, who might be doing some work to look at how hearing can be kind of integrated into spatial models. And there are certainly so for example, Nick Klassiker, at the Ear Institute is doing a lot of really interesting articles on artificial intelligence work, looking at speech encoding throughout the brain, in particular in the inferior colliculus. So, that work is going on, I find it very interesting. Again, it's something that I tend to do in collaboration. We're not kind of actually getting our hands dirty with it in the lab, yet sales?

C

Caswell Barry 34:07

I promise, I didn't put Steve up to that question, boy, just to get to talk. I mean, there it's true, though, there is, you know, people working into machine learning and AI have have always instilled do have an eye on, you know, how the brain solves these problems. And as, as you're starting to make, like really substantial progress in sort of new learning about the tricks that make the auditory system work, then, you know, I guess the AI people are watching because that's, that's where the inspiration comes from. So

34:37

I mean, that hopefully, it goes two ways, right? You can learn from the AI models, and test things in the brain, iterate.

C

Caswell Barry 34:44

That's the dream. That is the dream, but it's the dream. I think I mean, in all honesty, I think that direction neuroscience, learning from Ai models is been the most productive and certainly in the last sort of five or 10 years. You know, the inspiration from the brain seems to be You know, important but maybe less frequent every now and then there's a big Oh, that's how it works. It's copy that. And then busy work happens sort of building on that. So I think it does go in both directions.

S

Steve Flemming 35:11

But it does seem just thinking about it. Now that perhaps speech perception is one of those where the alternative direction of travel could be particularly fruitful. Because here we're looking at, we're thinking about something that is very much grounded in a particular type of stimulus that the brain has to deal with where things like language doesn't really matter whether you're dealing with this format, or this format of representation, you can essentially do it all cognitively. And then machine learning could go in a totally different direction to, to the way the brain does it, but perhaps something that's more grounded in a particular type of stimulus could particularly benefit from neuroscience. All right, well, we're almost out of time. Thanks so much, Jenny For this font, fantastic discussion, I've learned a huge amount. I also realised how embarrassing listen, I knew about the auditory system before we started this interview. So it's been it's been wonderful. But we are going to need to wrap it up. But before we do, we ask all of our guests this same famous question now becoming infamous due to brain stories, which is what is your favourite facts about the brain?

36:23

So I think my favourite fact, is probably strongly motivated by the fact I've spent the last two

So I think my favourite fact, is probably strongly motivated by the fact I've spent the last two weeks rockpooling with my kids. So I think what is really awesome is that Kevlar pods have not only kind of evolved an AI that looks really, really similar to our own, they've actually done it right, and put their photoreceptors at the front of the retina instead of behind their blood vessels, so they don't have a blind spot.

C Caswell Barry 36:49

That is cool. It's very cool. Yeah. It's cool. Yeah, they taste nice to

36:58

my five year old was very sad, but she didn't catch on. She obviously has high expectations from British.

S Steve Flemming 37:07

That is a really neat fact. I mean, there must be some kind of torturous path dependent thing that meant that they managed to break out of this, you know, suboptimal solution that wasn't available,

37:20

independently evolved. That's a very similar solution. It's just that the Catholic pubs because I mean, I think, like earliest common ancestor is like a flatworm or something that doesn't have ice.

S Steve Flemming 37:34

Yeah, yeah. I guess what I mean, is there must have been a path dependence in kind of suboptimal branch. That man right, yeah. Wasn't that solution available? Yeah, very, very cool.

C Caswell Barry 37:45

Thank you. That was a fascinating discussion. Thanks, Jenny Beasley for joining us on this episode of brain stories. We'll see you all next time. We would like to thank Matt Wakelin, Maya Speier and Trevor smart for their roles in taking brain stories from an idea to a fully fledged podcast, Patrick Robinson and UCL Digital Education editing and mixing. And follow us on Twitter at UCL brain stories for updates and information about forthcoming episodes.