TRANSCRIPT FOR CEN SEMINAR: Lorna Quandt, Movement, language, and the brain: What can we learn from sign language?

Introduction:

Astrid: Hello everyone! Welcome or welcome back to this week's Centre for Educational Neuroscience seminar. To those of you who may be joining us for the first time, we are a research centre in London aiming to link together what we know about how learning happens in the brain and how learning happens in education.

We are privileged this week to be joined by Dr Lorna Quandt from Gallaudet University. Before I introduce Lorna and her topic, we have some accessibility arrangements this week which I will explain.

Firstly, a big thank you to our colleagues at the Deafness Cognition and Language Research Centre at UCL who have assisted with arranging two British Sign Language interpreters, Julie Chambers and Jenny Koehring. Please message me or Mahitab Elgamal and we will grant you the multipin option so that you can see the interpreter alongside your talk. Please be aware that Julie and Jenny will be swapping over every 15 minutes starting with Julie.

Secondly, live automated captions are enabled, and we will provide a transcript afterwards alongside the **video recording,** which will be uploaded to our YouTube channel within a few days.

For anyone unfamiliar with the format of these seminars, our speaker normally speaks for around 45 minutes, and then we have ten to fifteen minutes at the end for questions and answers. Please feel free to put your questions in the chat at any time during the seminar, or wait until the end to raise your virtual hand and speak or sign your question then.

Without further ado, I will now introduce Lorna.

Lorna Quandt is an Associate Professor on the PhD in Educational Neuroscience Program and Co-Director of the Visual Language and Visual Learning (VL2) Center at Gallaudet University. In early 2016, Lorna founded the Action & Brain Lab, where she and her team use EEG and other psychophysiological measures to investigate the neural substrates of action, gesture, sign language, and communication. Since 2018, Lorna has led a team developing a virtual reality game for sign language learning, applying principles of embodied learning to create an interactive learning environment. This work has led to new avenues of research concerning the development and utility of virtual human signers and best practices at the intersection of signed languages and emerging technology.

I will now hand over to Lorna for what is sure to be an extremely fascinating talk.

Thank you.

Main talk:

41
00:03:10.590 --> 00:03:13.238

Lorna Quandt (she/her): Hello! Good afternoon, everyone.

42
00:03:13.920 --> 00:03:22.840
Lorna Quandt (she/her): Thank you, Astrid, for that really kind introduction, and thank you to everyone who made time in their schedule to show up today.

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00:03:23.389 --> 00:03:27.459
Lorna Quandt (she/her): I appreciate the opportunity to share some of my work with you.

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00:03:28.215 --> 00:03:33.890
Lorna Quandt (she/her): Today I'll be focusing on the question you see here on my title slide.

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00:03:34.230 --> 00:03:47.779
Lorna Quandt (she/her): Movement, language, and the brain: What can we learn from sign language? I came to this field of work with a background in cognitive psychology and cognitive neuroscience

46
00:03:47.960 --> 00:03:56.729
Lorna Quandt (she/her): focusing on action perception, how people understand and make sense of other people's movements in the world.

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00:03:56.740 --> 00:04:04.080
Lorna Quandt (she/her): And you'll see how that work has informed my approach to sign language research in the past almost 9 years since arriving at Gallaudet University.

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00:04:10.130 --> 00:04:21.280
Lorna Quandt (she/her): So I'll go ahead with talk, and I am more than happy to take questions at the end, so I will try to wrap up before we get too late in the hour.

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00:04:21.700 --> 00:04:39.289
Lorna Quandt (she/her): So, I am coming to you here from DC. Gallaudet University is the World's Premier University for deaf and hard of hearing students, and so I'm privileged to take this work on with a team of deaf, hearing, all signing staff, students and colleagues at Gallaudet.

52
00:04:44.520 --> 00:04:51.929
Lorna Quandt (she/her): Where does this research start? I have come to this body of research through this topic which is put here on the slide: experience-dependent neuroplasticity.

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00:04:59.420 --> 00:05:02.250
Lorna Quandt (she/her): What I mean by that is all the ways that what we do with our bodies and what we do in the day changes how our brain functions in some way.

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00:05:12.070 --> 00:05:17.279
Lorna Quandt (she/her): So that's a pretty broad idea, that what we do changes, how our brain works.

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00:05:19.150 --> 00:05:23.289
Lorna Quandt (she/her): Particularly, there's this field in the area about looking at how expertise with different types of movements, be it body movements or hand movements, how that type of physical motor expertise changes perceptual skills or changes the way that visual perception occurs.

61
00:05:41.790 --> 00:05:56.130
Lorna Quandt (she/her): So, you can see on this slide. We have some different types of movements that humans do, whether it's very precision archery, or the fine movements of the hands and fingers in playing guitar, or the skills that come along with playing soccer. Those types of movements have all been studied through this lens of experience-dependent neuroplasticity?

64
00:06:10.630 --> 00:06:21.470
Lorna Quandt (she/her): Do expert guitar players show a difference in how their brain processes musical notes, or in how their visual cortex processes other people playing guitar?

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00:06:26.190 --> 00:06:28.859
Lorna Quandt (she/her): These are types of questions that we might look at

68
00:06:28.950 --> 00:06:33.059
Lorna Quandt (she/her): through this lens of experience-dependent neuroplasticity.

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00:06:34.750 --> 00:06:48.000
Lorna Quandt (she/her): And of course, I see this as relating to learning, because these skills that I've put forth as examples are all things that we might learn through the course of our experience over our lifetime.

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00:06:48.530 --> 00:06:52.460
Lorna Quandt (she/her): It might not happen in the classroom. But they’re still forms of learning.

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00:06:55.040 --> 00:07:01.790
Lorna Quandt (she/her): So, we know from this research that action experience leads to changes in perception and cognition.

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00:07:01.790 --> 00:07:25.180

Lorna Quandt (she/her): You might be familiar with the example of expert ballet dancers, view ballet dancing differently than other types of dancing. When expert ballerinas see others performing ballet, their motor cortex engages more, perhaps, because they're drawing upon their own motor repertoire their own feelings of what it's like to do those movements.

74
00:07:30.190 --> 00:07:32.580
Lorna Quandt (she/her): What about sign language experience?

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00:07:32.690 --> 00:07:41.489
Lorna Quandt (she/her): This was one motivating question that you'll see sort of led to a body of work that I'll talk about today.

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00:07:41.600 --> 00:07:48.349
Lorna Quandt (she/her): So if we know that, like learning, archery or soccer can change how our visual system works or how our sensory motor system works, why not think about sign language that way?

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00:07:55.600 --> 00:08:12.729
Lorna Quandt (she/her): And of course I'll be very straightforward. Sign language is unique in that it is not only an action, but it is language at the same time. So we can approach questions that are more related to the linguistic features of sign language.

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00:08:12.730 --> 00:08:27.320
Lorna Quandt (she/her): Or we can look at sign language as a body of physical expertise. People who sign have acquired the ability to produce movements with their hands, arms, and bodies in ways that those who do not sign do not have.

82
00:08:35.059 --> 00:08:48.979
Lorna Quandt (she/her): Just some context about how I think about these questions. We might look at sign language as one part of the puzzle for a deaf baby who is born, or any baby who is born to a family.

83
00:08:49.010 --> 00:08:54.600
Lorna Quandt (she/her): We know that that baby is surrounded by a linguistic environment of some sort.

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00:08:54.800 --> 00:09:09.090
Lorna Quandt (she/her): so we might talk about bilingual babies who grow up in Spanish, English speaking households. We might look at Bimodal, bilingual families where there's a sign language and a spoken language.

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00:09:09.280 --> 00:09:13.899

Lorna Quandt (she/her): And these are all different, rich, environmental sort of situations in which babies are born. Children are raised and humans develop.

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00:09:23.560 --> 00:09:40.859
Lorna Quandt (she/her): And I won't go into it at length today, but we know that for a deaf baby there are multiple avenues which are presented to their families. Those avenues might include sign language from an early age, might include hearing aids or cochlear implants.

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00:09:45.840 --> 00:09:58.490
Lorna Quandt (she/her): a quote for research that came out just recently this year, which I present to sort of show you how I think about this sign language research.

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00:09:59.008 --> 00:10:12.089
Lorna Quandt (she/her): We know that now more than 80% of babies in my country in the United States. More than 80% of babies who are born deaf will receive a cochlear implant

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00:10:13.020 --> 00:10:25.579
Lorna Quandt (she/her): in my perspective. And from this perspective, in the research cochlear implants and sign language do not have to be mutually exclusive. We know this, of course.

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00:10:25.910 --> 00:10:27.460
Lorna Quandt (she/her): and we can see in this quote some sort of framing for that idea.

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00:10:32.960 --> 00:10:47.610
Lorna Quandt (she/her): “Even access to early, short-term nonnative visual language or sign language is beneficial for the language and phonological memory developments of deaf children with cochlear implants, so parents should not be discouraged from learning and exposing their child to sign language.”

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00:10:53.350 --> 00:11:11.349
Lorna Quandt (she/her): So here I'm looking at sign language as one part of a puzzle for a deaf person or deaf child, one which might coexist with other forms of intervention, or may exist alone as the child's primary form of communication and access to language.

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00:11:18.980 --> 00:11:25.110
Lorna Quandt (she/her): Given that cultural context and the important debates happening in that field

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00:11:25.430 --> 00:11:29.619
Lorna Quandt (she/her): for this research's agenda, I see it as twofold.

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00:11:29.690 --> 00:11:41.489
Lorna Quandt (she/her): Potentially, we could have a goal of answering interesting questions about experience, dependent neuroplasticity. So questions about how the brain works and how the brain changes.

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00:11:42.380 --> 00:11:49.919
Lorna Quandt (she/her): while at the same time hopefully being informative to society and informing these debates that are ongoing in the field.

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00:11:55.550 --> 00:12:00.669
Lorna Quandt (she/her): Here's the question that my team and I have been working on for the past several years.

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00:12:01.230 --> 00:12:05.959
Lorna Quandt (she/her): How might being a deaf signer change, perception, or cognition?

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00:12:07.410 --> 00:12:14.359
Lorna Quandt (she/her): Now on this slide, it's a little bit of a tricky question, because it says a deaf signer.

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00:12:16.400 --> 00:12:23.520
Lorna Quandt (she/her): If we see changes in perception or cognition between deaf signers compared to some sort of control group, those differences might be because the signers in question are deaf, meaning that they access more information through the visual modality, and thus their brain may have reorganized or recycled certain areas of tissue in order to take in information through the eyes.

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00:12:47.410 --> 00:13:00.679
Lorna Quandt (she/her): So it could be that potential effects of being a deaf signer. Potential things that we see changed in perception and cognition could come from the sensory state of being deaf or from differences in hearing status.

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00:13:04.710 --> 00:13:11.349
Lorna Quandt (she/her): Or if we have that 2 word phrase, deaf signer, might it be because they are accustomed to using signed languages.

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00:13:14.850 --> 00:13:22.569
Lorna Quandt (she/her): and a quick pause, that I conduct research on American Sign Language being the sign language in my community here.

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00:13:23.053 --> 00:13:35.460

Lorna Quandt (she/her): Most of you are probably living in communities that use. British Sign Language, so I don't have specific research about British Sign Language today, I'll say sign language referring to American Sign Language

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00:13:35.838 --> 00:13:45.879
Lorna Quandt (she/her): but of course I don't have any particular knowledge as to whether what I talk about today would or would not align with the same findings in British Sign Language.

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00:13:45.980 --> 00:13:48.810
Lorna Quandt (she/her): Some might be the same, and some might be different.

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00:13:50.740 --> 00:14:01.829
Lorna Quandt (she/her): So coming back to this slide changes that come along in perception and cognition could also be because of sign language, because maybe we have a group of people who have grown up and have

116
00:14:01.850 --> 00:14:06.990
Lorna Quandt (she/her): 30 years of sign language as their primary form of communication

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00:14:07.140 --> 00:14:20.270
Lorna Quandt (she/her): that involves sensory and motor experience. It involves visual experience of being able to perceive and process fast moving, changing, dynamic sign stimuli.

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00:14:21.710 --> 00:14:29.340
Lorna Quandt (she/her): There are a lot of questions, and we need to disentangle the effects of being deaf from the effects of being a signer

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00:14:29.410 --> 00:14:34.140
Lorna Quandt (she/her): in order to better understand where these potential effects might come from.

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00:14:34.390 --> 00:14:37.310
Lorna Quandt (she/her): and you might be wondering so far, what effects?

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00:14:37.330 --> 00:14:40.409
Lorna Quandt (she/her): So let's look at what effects I'm talking about.

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00:14:42.560 --> 00:14:53.360
Lorna Quandt (she/her): In 2019 there was an important review article that came out by Alan Carr and colleagues in the Journal of Cognitive Neuroscience, called What and how the deaf brain sees.

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00:14:54.360 --> 00:15:05.220
Lorna Quandt (she/her): There were certain parts of the visual system that seemed to be enhanced or modified by the state of being deaf.

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00:15:05.680 --> 00:15:11.810
Lorna Quandt (she/her): So, in particular, the review covers differences in face identification.

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00:15:12.907 --> 00:15:30.170
Lorna Quandt (she/her): In the lower left you can see these Vernier acuity cards. So this is very fine grained low, level visual information that desk people seem to show some heightened sensitivity towards.

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00:15:30.780 --> 00:15:35.700
Lorna Quandt (she/her): We also know that there are differences in peripheral vision for deaf signers.

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00:15:37.040 --> 00:15:49.720
Lorna Quandt (she/her): and this review article concludes by saying that cross modal reorganization in auditory cortex of deaf people is responsible for superior visual abilities.

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00:15:51.290 --> 00:16:04.749
Lorna Quandt (she/her): So this is all very interesting, and this also focuses particularly on the sensory state of deafness, without looking particularly closely at the effect of knowing sign language.

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00:16:07.180 --> 00:16:12.160
Lorna Quandt (she/her): So we know that deafness changes some aspects of visual perception.

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00:16:12.770 --> 00:16:15.540
Lorna Quandt (she/her): But really, what about sign language?

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00:16:20.530 --> 00:16:28.119
Lorna Quandt (she/her): And why would I be so obsessed with this question, what about sign language? What is so interesting about sign language.

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00:16:28.536 --> 00:16:38.049
Lorna Quandt (she/her): If I think about signed languages as a topic of research in this field, there are a few things that stand out for me.

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00:16:39.100 --> 00:16:42.680
Lorna Quandt (she/her): People can acquire sign language from birth and have extensive long-term experience with using their primary language every day of their lives for 70-plus years.

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00:16:55.350 --> 00:16:58.049
Lorna Quandt (she/her): This is long-term experience.

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00:16:58.550 --> 00:17:06.600
Lorna Quandt (she/her): When we look at things like learning to play the guitar or learning to, you know, do ballet moves and dancing

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00:17:06.740 --> 00:17:20.629
Lorna Quandt (she/her): those things can be skills that we acquire over a long period of time, but they simply cannot match the depth and richness of the experience that someone has with sign language as a primary language.

140
00:17:22.630 --> 00:17:34.380
Lorna Quandt (she/her): Signed languages are also highly spatial, as you know, they occur in a three-dimensional space in front of the signer, and between the signer and the conversation partners.

141
00:17:34.830 --> 00:17:38.100
Lorna Quandt (she/her): The use of space is highly rule based.

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00:17:38.716 --> 00:17:47.959
Lorna Quandt (she/her): There's a lot of spatial memory required, and spatial cognition playing into production and perception of signed languages.

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00:17:48.300 --> 00:18:12.809
Lorna Quandt (she/her): And third, just simply the visual motor complexity. Here I'm finger spelling my name just to emphasize that some of the movements and sign language occur very quickly occur on a very fine green scale of space, and occur rapidly in succession. So the visual motor complexity is quite high.

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00:18:14.020 --> 00:18:22.759
Lorna Quandt (she/her): Also sign language, lets us explore questions about it as a language, because, unlike those other examples of

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00:18:22.870 --> 00:18:26.480
Lorna Quandt (she/her): actions that we know change our brain functioning

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00:18:26.510 --> 00:18:28.600
Lorna Quandt (she/her): sign languages are all human, natural, full languages, with rich complexity, even beyond what I've listed on this slide.

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00:18:42.030 --> 00:18:49.479
Lorna Quandt (she/her): Coming back to our question. So both deafness and sign language change, perception, cognition. What would that look like?

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00:18:50.500 --> 00:18:56.260
Lorna Quandt (she/her): could be more related to hearing status, could be related more to sign language experience.

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00:18:56.740 --> 00:19:00.320
Lorna Quandt (she/her): So let's look at one way that we tried to tackle this question.

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00:19:00.330 --> 00:19:07.359
Lorna Quandt (she/her): This is a study that is most closely related to how we see sign language itself.

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00:19:09.450 --> 00:19:24.299
Lorna Quandt (she/her): This study was led by very recently named Dr. Carlyle. She just defended last month, and is now doing a postdoc at Vanderbilt University in the States.

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00:19:25.550 --> 00:19:43.449
Lorna Quandt (she/her): This study was a peak covid study. So you'll see in my talk today more behavioral research than I usually would have shown. But the past couple of years have really given us a lot more behavioral, large scale online data collection opportunities.

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00:19:43.850 --> 00:19:49.199
Lorna Quandt (she/her): So you see here, we ran a study with 283 American Sign Language users.

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00:19:50.240 --> 00:20:01.930
Lorna Quandt (she/her): we had these really interesting stimuli which we created, which are point light displays. So we make them by reporting points on a person's body as they sign.

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00:20:02.140 --> 00:20:08.449
Lorna Quandt (she/her): And then we create these displays. Here. I'll give everyone a chance to see this video again.

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00:20:08.560 --> 00:20:13.000
Lorna Quandt (she/her): This is a place name like a city or a country.

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00:20:14.220 --> 00:20:20.140
Lorna Quandt (she/her): Try and see if you can decode what it is in the American Sign Language. So it's an extra challenge.

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00:20:21.200 --> 00:20:24.730
Lorna Quandt (she/her): If anyone got it right 100 points to you.

161
00:20:24.960 --> 00:20:27.080
Lorna Quandt (she/her): This was Barcelona.

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00:20:30.990 --> 00:20:41.069
Lorna Quandt (she/her): So we use these stimuli to try and assess the fine-grained influences of what predicts finger spelling, skill.

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00:20:43.220 --> 00:20:45.420
Lorna Quandt (she/her): finger spelling, reception.

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00:20:45.500 --> 00:20:47.140
Lorna Quandt (she/her): understanding others.

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00:20:48.890 --> 00:20:55.950
Lorna Quandt (she/her): we had 2 types of stimuli. Some were real place names, and some were fake place names that we made up.

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00:20:56.690 --> 00:21:05.240
Lorna Quandt (she/her): We also varied the stimuli. Half of them had a high number of markers on each hand. So a very dense array of information

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00:21:05.570 --> 00:21:16.519
Lorna Quandt (she/her): and some had many fewer markers. So I'll show you this video on the right. It's Barcelona again, but with fewer markers. So there's even less information.

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00:21:18.320 --> 00:21:27.800
Lorna Quandt (she/her): Unsurprisingly, we found that a high number of markers was significantly more easy for people to understand than a low number of markers.

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00:21:29.440 --> 00:21:36.209
Lorna Quandt (she/her): And, importantly, we found that earlier American Sign Language acquisition is strongly correlated with higher accuracy.

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00:21:39.600 --> 00:21:48.620
Lorna Quandt (she/her): and I realize I should have told you we showed participants these videos and had a free text entry box where they typed in what they thought they saw.

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00:21:48.730 --> 00:21:57.160
Lorna Quandt (she/her): So if they knew they saw Barcelona. They just went ahead and typed in Barcelona. If they weren't quite sure they typed in the best that they could.

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00:21:59.780 --> 00:22:07.349
Lorna Quandt (she/her): We found overall here on the left our responses to fake pseudo place names that we made up.

173
00:22:07.620 --> 00:22:19.099
Lorna Quandt (she/her): and on the right are the real place names, and you can see across the board. Our deaf participants are more accurate, which is what we have on the Y-axis accuracy

174
00:22:19.160 --> 00:22:21.909
Lorna Quandt (she/her): deaf are much more accurate on both

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00:22:21.990 --> 00:22:24.790
Lorna Quandt (she/her): the pseudo and the real place names.

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00:22:25.460 --> 00:22:38.769
Lorna Quandt (she/her): And remember, these are all people who know sign language. So it it does encompass people across a range of fluency skills. But everyone here was able to understand sign language to some degree.

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00:22:39.450 --> 00:22:43.099
Lorna Quandt (she/her): However, our fake placenames were really really challenging.

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00:22:48.840 --> 00:23:11.060
Lorna Quandt (she/her): On the left we can see the effect of age, of acquisition. So to the left is age of acquisition at 0 all the way up to learning American Sign Language at age 40. And you can see that the later someone learned sign language on the top, you can see that they became less accurate as their age of acquisition got higher.

179
00:23:12.850 --> 00:23:21.049
Lorna Quandt (she/her): and on the bottom you can see that their confidence in their answers also decreased, as they had a higher age of acquisition

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00:23:21.920 --> 00:23:33.119
Lorna Quandt (she/her): on the right panels we see the effect of American Sign Language fluency, so this should not be surprising. As people are more fluent, they are performing more accurately and with more confidence.

181
00:23:33.930 --> 00:23:37.029
Lorna Quandt (she/her): So this tells us that this is a reasonable measure of finger spelling perception, although we were not aiming to validate it as an assessment measure. But that's something that we could look at in the future.

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00:23:50.120 --> 00:24:10.909
Lorna Quandt (she/her): We further broke this down by looking only at early signers, people who had learned American Sign Language from age before 5. So even among early signers, deaf participants, are outperforming, hearing participants particularly on these fake placenames when they don't actually have

184
00:24:11.060 --> 00:24:20.769
Lorna Quandt (she/her): any external world knowledge to draw upon. So imagine, if you saw what you thought was Barcelona. With those point light displays you could probably interpolate and guess that Barcelona is a good guess, so you could type that down.

186
00:24:28.000 --> 00:24:36.989
Lorna Quandt (she/her): but with a fake placename you have nothing in the real world to draw upon. So you're relying only on your perceptual skills

187
00:24:37.810 --> 00:24:43.599
Lorna Quandt (she/her): that makes the pseudo place names much harder, and it informs us about the extent to which

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00:24:43.680 --> 00:24:47.370
Lorna Quandt (she/her): top-down influences are affecting accuracy.

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00:24:54.580 --> 00:25:01.799
Lorna Quandt (she/her): To briefly summarize that paper, we saw that features of the stimuli themselves

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00:25:02.220 --> 00:25:06.740
Lorna Quandt (she/her): as well as semantics and linguistic background of the viewer.

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00:25:07.030 --> 00:25:09.890
Lorna Quandt (she/her): all impact finger spelling and perception.

192
00:25:10.450 --> 00:25:18.560
Lorna Quandt (she/her): So fingerspelling perception depends both on your own skills and your own language skills, but also on what you're seeing.

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00:25:18.960 --> 00:25:31.440
Lorna Quandt (she/her): plus as a bonus which I like to mention, we have these stimuli of point light display fingers spelled place names which are uploaded to the Internet for anyone to use for their own studies.

194
00:25:38.050 --> 00:25:43.119
Lorna Quandt (she/her): But that study was only about signers looking at sign language which

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00:25:43.190 --> 00:25:52.459
Lorna Quandt (she/her): doesn't really satisfy my desire to understand more broadly how sign language or deafness might impact perception.

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00:25:52.690 --> 00:25:55.810
Lorna Quandt (she/her): So other than looking at sign language.

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00:25:56.060 --> 00:26:03.540
Lorna Quandt (she/her): What could it look like. If sign language or deafness brings a benefit or a change to perceptual skills.

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00:26:04.460 --> 00:26:13.059
Lorna Quandt (she/her): I hypothesized that deafness and sign language both might change or lead to better spatial skills

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00:26:13.740 --> 00:26:21.190
Lorna Quandt (she/her): because of what I discussed earlier about the importance of 3 dimensional space for sign language communication.

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00:26:22.130 --> 00:26:32.149
Lorna Quandt (she/her): and also something that I've been particularly interested in is whether sign, language, and deafness contribute to better biological motion perception.

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00:26:33.250 --> 00:26:39.730
Lorna Quandt (she/her): And then we're keeping in mind, how do we figure out if the effects are from deafness or sign language?

202

00:26:43.360 --> 00:26:52.879
Lorna Quandt (she/her): I'll walk you through 2 studies that we have done in our lab to look at this question of increased spatial skills.

203
00:26:52.970 --> 00:27:05.690
Lorna Quandt (she/her): So this study was led by Dr. Emily Kubacek, who graduated a couple of years ago. She looked at whether mental rotation was associated with sign language fluency.

204
00:27:06.120 --> 00:27:14.499
Lorna Quandt (she/her): So she used a typical mental rotation task. Where you see a picture of blocks like you see on the left.

205
00:27:14.590 --> 00:27:19.580
Lorna Quandt (she/her): and you have to match, which 2 are correct matching to

206
00:27:20.950 --> 00:27:24.769
Lorna Quandt (she/her): sort of a target target sample of blocks.

[...]

212
00:27:58.030 --> 00:28:06.530
Lorna Quandt (she/her): So with this study, we administered this mental rotation task to a bunch of signers.

213
00:28:07.650 --> 00:28:17.540
Lorna Quandt (she/her): and we found that yes, there was a significant correlation between the score on the American Sign Language. Ct. Which is an American Sign Language comprehension test

214
00:28:18.010 --> 00:28:22.010
Lorna Quandt (she/her): and their scores on this mental rotation task.

215
00:28:22.030 --> 00:28:28.219
Lorna Quandt (she/her): So the better you were with comprehending American Sign Language, the better you were with this mental rotation.

216
00:28:28.420 --> 00:28:32.840
Lorna Quandt (she/her): This is not causational, but it is correlation.

217
00:28:36.170 --> 00:28:46.599

Lorna Quandt (she/her): We've done more recent research. Looking at another spatial cognition test, you might be familiar with block design where a participant is given blocks with different colors.

218
00:28:46.710 --> 00:28:52.449
Lorna Quandt (she/her): They're asked to match the blocks to make a picture as shown on a model.

219
00:28:52.610 --> 00:28:56.439
Lorna Quandt (she/her): and my current student, Melody Schwenk, has shown that

220
00:28:56.540 --> 00:29:05.879
Lorna Quandt (she/her): higher proficiency in American Sign Language with those ASLCT Scores is associated with higher scores on block design.

221
00:29:06.560 --> 00:29:08.729
Lorna Quandt (she/her): So we find that yes.

222
00:29:08.960 --> 00:29:12.530
Lorna Quandt (she/her): particularly American Sign Language fluency

223
00:29:12.580 --> 00:29:18.020
Lorna Quandt (she/her): seems to be correlated with better spatial skills from these 2 studies.

224
00:29:19.290 --> 00:29:29.900
Lorna Quandt (she/her): This is across different hearing statuses and is particularly linked to American Sign Language skills, not a hearing status or any other factor that we looked at.

225
00:29:34.370 --> 00:29:38.199
Lorna Quandt (she/her): Now we will turn to biological motion perception.

226
00:29:38.310 --> 00:29:39.350
Lorna Quandt (she/her): So, broadly speaking, that is a skill that we humans have. We are really good at seeing other animals, particularly other humans moving.

228
00:29:51.480 --> 00:29:56.030
Lorna Quandt (she/her): So your ability to discern this woman walking down the path,

229
00:29:56.670 --> 00:30:00.170
Lorna Quandt (she/her): you are using biological motion perception skills

230
00:30:00.290 --> 00:30:04.259
Lorna Quandt (she/her): that our human brains have evolved to really be good at

231
00:30:04.897 --> 00:30:17.930
Lorna Quandt (she/her): we can recognize a friend walking from 50 feet away. We can recognize a human walking in a crowd, we have pretty good skills when it comes to biological motion.

232
00:30:18.930 --> 00:30:22.319
Lorna Quandt (she/her): One way that we like to study these questions is by using these point light displays that you saw earlier. So we might use them to make a display like this, where we see an everyday movement. Jumping Jacks, for instance, shown only by these points of light.

234
00:30:38.420 --> 00:30:43.969
Lorna Quandt (she/her): So we're removing all the information about what a person looks like or their environment.

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00:30:44.010 --> 00:30:48.960
Lorna Quandt (she/her): And we're focusing only on the motion trajectories

236
00:30:49.140 --> 00:30:54.270
Lorna Quandt (she/her): so that we can understand how we respond to different types of movements.

237
00:31:02.220 --> 00:31:07.600
Lorna Quandt (she/her): So why would sign language confer better biological motion skills?

238
00:31:08.170 --> 00:31:09.880
Lorna Quandt (she/her): Why do I think that?

239
00:31:10.260 --> 00:31:16.799
Lorna Quandt (she/her): So for a few reasons, like, I showed you this sample video before

240
00:31:17.890 --> 00:31:24.430
Lorna Quandt (she/her): seeing finger spelling or signing requires a form of biological motion perception.

241
00:31:24.530 --> 00:31:29.440
Lorna Quandt (she/her): It requires us to understand someone else's movements and make sense of them.

242
00:31:32.510 --> 00:31:55.249
Lorna Quandt (she/her): And when you're fluent in sign language or proficient in assign language, you can perform that skill of understanding sign language, not only under ideal conditions of well lighted, well clipped to videos facing straight at you, or a 1 to one arrangement like this.

243
00:31:55.950 --> 00:32:04.849
Lorna Quandt (she/her): Now, when you're comfortable with sign language, you are able to understand what someone is signing from a fair distance away.

244
00:32:05.630 --> 00:32:08.730
Lorna Quandt (she/her): So when the visual stimulus is much smaller.

245
00:32:08.860 --> 00:32:11.390
Lorna Quandt (she/her): taking up less of your visual field.

246
00:32:12.760 --> 00:32:21.559
Lorna Quandt (she/her): You're also able to understand sign language under subpar lighting conditions in a dark restaurant.

247
00:32:21.690 --> 00:32:25.459
Lorna Quandt (she/her): And of course there are limits to these perceptual skills.

248
00:32:26.220 --> 00:32:28.220
Lorna Quandt (she/her): But they're flexible skills.

249
00:32:29.510 --> 00:32:57.780
Lorna Quandt (she/her): And you can see here on the right, the way that sign language is really used in natural human communication is usually a combination of these different things. You're conversing with someone, and maybe you're at a funny angle. You're not looking straight at them. You're to the side. And there are multiple people all conversing, and maybe it's a little bit dark, and maybe there's backlighting, and maybe you're attending to different conversations.

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00:32:58.420 --> 00:32:59.659
Lorna Quandt (she/her): So my hypothesis has been that this ability to use sign language production and perceptual skills may give us a benefit when it comes to other types of motion perception.

253
00:33:19.210 --> 00:33:24.650
Lorna Quandt (she/her): I almost think of it like a visual cocktail party effect.

254
00:33:24.670 --> 00:33:27.469
Lorna Quandt (she/her): So if you're familiar in cognitive psychology with the idea of the cocktail party effect in spoken language, that's our ability to isolate important stimuli from a crowded, noisy environment. Like, if someone calls our name at a cocktail party, we can attend.

257
00:33:45.230 --> 00:34:06.969
Lorna Quandt (she/her): Similar idea I have about the ability for a deaf or for a fluent signer to easily pick out the important information from their environment and attend to it. Even when that environment is busy, visually crowded and perhaps not ideal viewing conditions.

258
00:34:07.690 --> 00:34:18.770
Lorna Quandt (she/her): I propose that both being deaf and knowing sign language would factor into this ability to have particularly good biological motion perception.

259
00:34:23.949 --> 00:34:39.440
Lorna Quandt (she/her): What we did to examine this question involved creating new stimuli. So we used a motion capture recording studio to record 6 different everyday actions like jumping jacks, kicking a ball, a golf swing, and we recorded each of them from 3 different perspectives. So front oblique and side angles. So we had 18 biological motion stimuli that showed real movements.

262
00:34:55.679 --> 00:35:01.050
Lorna Quandt (she/her): Then we made control versions of those videos with scrambled dots.

263
00:35:01.230 --> 00:35:07.630
Lorna Quandt (she/her): So they matched the actual biological motion signal, but did not show a real action.

264
00:35:11.770 --> 00:35:24.070
Lorna Quandt (she/her): I'm gonna show you what 2 of these videos looks like with the point being that some of them were very easy to see and easy to understand, and some of them are actually quite hard.

265
00:35:24.280 --> 00:35:29.560
Lorna Quandt (she/her): So the job of the participant in this case was to say whether this action involves a ball or not, so like golfing involves a ball. But Jumping Jacks does not.

268
00:35:40.210 --> 00:35:42.660
Lorna Quandt (she/her): So does this require a ball?

269
00:35:44.150 --> 00:35:49.429

Lorna Quandt (she/her): Most people can easily say, no ball just jumping jacks.

270
00:35:50.570 --> 00:35:52.819
Lorna Quandt (she/her): Here's another one a little more tricky.

271
00:35:57.210 --> 00:36:02.369
Lorna Quandt (she/her): so that one is throwing a ball underhanded, and most people get it

272
00:36:02.580 --> 00:36:05.719
Lorna Quandt (she/her): easily, but it might feel a little bit harder.

273
00:36:08.540 --> 00:36:15.739
Lorna Quandt (she/her): 1st we asked people for subjective ratings on, how hard was it for you to understand what you saw

274
00:36:15.990 --> 00:36:20.390
Lorna Quandt (she/her): purely subjective. But tell us what you saw and how hard it was.

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00:36:21.520 --> 00:36:28.139
Lorna Quandt (she/her): and very interestingly, we found a significant difference based on hearing status alone.

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00:36:28.840 --> 00:36:37.219
Lorna Quandt (she/her): Deaf participants rated that it was significantly easier for them to understand what they were seeing compared to hearing participants.

277
00:36:39.680 --> 00:36:41.909
Lorna Quandt (she/her): This was a significant difference.

278
00:36:41.930 --> 00:36:44.020
Lorna Quandt (she/her): but it's purely subjective.

279
00:36:45.920 --> 00:37:00.649
Lorna Quandt (she/her): It was part of an EEG cognitive neuroscience study where we wanted to see the sensory motor involvement of the viewer's brain when they were seeing these type of biological motion stimuli.

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00:37:00.960 --> 00:37:05.240
Lorna Quandt (she/her): So I'm going to show you next the results from the EEG study

281
00:37:05.310 --> 00:37:08.980
Lorna Quandt (she/her): in which we asked deaf native signers

282
00:37:09.680 --> 00:37:12.130
Lorna Quandt (she/her): compared to hearing non-signers

283
00:37:12.920 --> 00:37:18.940
Lorna Quandt (she/her): to look at these images, these videos, and, like, I said before, just

284
00:37:18.970 --> 00:37:30.940
Lorna Quandt (she/her): check whether each image or video required a ball or not. So for each one. They were sort of processing what they saw and thinking about what type of movement that was

285
00:37:33.320 --> 00:37:42.150
Lorna Quandt (she/her): on the top, you'll see EEG, responses from deaf signers. And again, these are deaf native signers.

286
00:37:42.560 --> 00:37:45.390
Lorna Quandt (she/her): and on the bottom we have hearing non-signers.

287
00:37:45.960 --> 00:37:54.130
Lorna Quandt (she/her): And our question with this was to look at how the sensory motor cortex of the brain processes, those actions that they're seeing

288
00:37:54.620 --> 00:38:00.790
Lorna Quandt (she/her): and given ideas of motor simulation or embodied cognition.

289
00:38:00.800 --> 00:38:12.580
Lorna Quandt (she/her): We expect from previous literature to see that people are using their sensory motor cortex to on some level decode the type of movement that they are observing.

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00:38:12.870 --> 00:38:22.649
Lorna Quandt (she/her): And remember, these movements have nothing to do with sign language. They are just jumping jacks and throwing balls and stuff like that.

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00:38:24.920 --> 00:38:34.119
Lorna Quandt (she/her): So these are EEG results showing activity in the Alpha and Beta frequency ranges of the EEG signal

292
00:38:34.540 --> 00:38:37.589
Lorna Quandt (she/her): across the sensory motor cortex of the brain.

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00:38:37.840 --> 00:38:42.640
Lorna Quandt (she/her): So where we see these dark blue blobs here

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00:38:42.820 --> 00:38:49.809
Lorna Quandt (she/her): our easiest interpretation is that that indicates an involvement of the underlying cortex.

295
00:38:50.060 --> 00:38:54.020
Lorna Quandt (she/her): So the brain underneath that area is more active.

296
00:38:56.470 --> 00:39:16.260
Lorna Quandt (she/her): We are comparing between those biological motion videos and the control stimuli. So we expect to see differences in how people respond to the real movements, the Jumping jacks and kicking compared to the scrambled controls that don't show a real movement at all.

297
00:39:16.900 --> 00:39:32.489
Lorna Quandt (she/her): And we found that there's enhanced earlier and more consistent differentiation between those 2 types of stimuli in deaf native signers. So you can see that here, where we compare the 2 categories.

298
00:39:33.065 --> 00:39:43.469
Lorna Quandt (she/her): Statistically, to see that there is earlier differentiation in the low Alpha range and more consistent differentiation across the time. Span.

299
00:39:44.140 --> 00:39:49.109
Lorna Quandt (she/her): So the they're more consistently and more quickly discriminating between real and scrambled movements.

301
00:39:57.370 --> 00:40:07.739
Lorna Quandt (she/her): This was very interesting to me, but I still was not satisfied with this question, because still here, we're looking at a difference between deaf native signers and hearing non-signers.

303
00:40:10.200 --> 00:40:17.149
Lorna Quandt (she/her): We don't know yet if it's more about sign language or more about deafness, and that's what I want to get to.

304
00:40:18.130 --> 00:40:19.370
Lorna Quandt (she/her): So we finally bit off this question by looking at how hearing status and or American Sign Language exposure affect motion processing, and are certain types of motion processing particularly affected.

308
00:40:35.070 --> 00:40:42.099
Lorna Quandt (she/her): This work was led by Dr. Athena Willis, who is doing her postdoc at Rochester right now and she graduated one year ago.

310
00:40:49.630 --> 00:40:57.170
Lorna Quandt (she/her): For this work we recruited broadly big online study. We had 224 participants.

311
00:40:57.630 --> 00:41:00.390
Lorna Quandt (she/her): including deaf signers.

312
00:41:01.140 --> 00:41:02.720
Lorna Quandt (she/her): hearing signers.

313
00:41:02.930 --> 00:41:04.900
Lorna Quandt (she/her): hearing non-signers.

314
00:41:05.760 --> 00:41:07.329
Lorna Quandt (she/her): people in between

315
00:41:07.650 --> 00:41:09.129
Lorna Quandt (she/her): hard of hearing group

316
00:41:09.570 --> 00:41:14.390
Lorna Quandt (she/her): and some deaf people who reported low fluency with American Sign Language.

317
00:41:14.630 --> 00:41:19.250
Lorna Quandt (she/her): Here you can just see a count of how many people we had in each group broken down by their American Sign Language fluency. So we did have a lot of deaf, fluent signers.

319
00:41:25.700 --> 00:41:29.380
Lorna Quandt (she/her): Not very many deaf folks who weren't fluent

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00:41:29.770 --> 00:41:35.720
Lorna Quandt (she/her): and hearing we had pretty good representation with a lot of hearing non-signers.

321
00:41:36.500 --> 00:41:43.360
Lorna Quandt (she/her): So with this broader sample, we were able to run regressions to test our hypotheses about

322
00:41:43.390 --> 00:41:52.870
Lorna Quandt (she/her): how different factors related to American Sign Language, or hearing status might influence people's biological motion perception.

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00:41:56.800 --> 00:42:07.870
Lorna Quandt (she/her): We showed them 3 types of motion perception ranging from really low, level, visual perception on up to more complex action, identification.

324
00:42:09.230 --> 00:42:12.719
Lorna Quandt (she/her): We gathered accuracy and reaction time data.

325
00:42:14.520 --> 00:42:18.529
Lorna Quandt (she/her): We had all these 3 different hearing status groups.

326
00:42:19.030 --> 00:42:22.260
Lorna Quandt (she/her): a total of 224 participants.

327
00:42:22.790 --> 00:42:29.739
Lorna Quandt (she/her): And we gathered background information. What I'll focus on today is their age of acquiring American Sign Language

328
00:42:31.710 --> 00:42:34.880
Lorna Quandt (she/her): for people from any of these hearing status groups.

329
00:42:37.670 --> 00:42:41.370
Lorna Quandt (she/her): Here's their question for the most complicated tasks.

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00:42:41.670 --> 00:42:46.409
Lorna Quandt (she/her): and my students joked with me when I was showing them this task.

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00:42:46.460 --> 00:42:50.709
Lorna Quandt (she/her): They were like, Lorna, are you trying to break people's brains?

332
00:42:51.110 --> 00:42:57.599
Lorna Quandt (she/her): Because this task is really at the upper limit of what people can do with biological motion perception.

333
00:42:58.510 --> 00:43:07.179
Lorna Quandt (she/her): The question is, does this movement involve a ball just like before? But this time half of the simuli are standing upright and half of them are upside down.

335
00:43:13.570 --> 00:43:16.519
Lorna Quandt (she/her): Here's the upright one. Does this involve a ball?

336
00:43:17.870 --> 00:43:20.599
Lorna Quandt (she/her): It does not. It's just someone running.

337
00:43:21.780 --> 00:43:24.720
Lorna Quandt (she/her): Does this involve a ball? Look to the right.

338
00:43:28.550 --> 00:43:35.090
Lorna Quandt (she/her): I know that this involves a ball because I've seen me stimuli a bunch of times. This is someone golfing upside down.

340
00:43:37.230 --> 00:43:50.050
Lorna Quandt (she/her): So this is about as hard as it gets. Yeah, it is a tough one. We wanted to really probe people's biological motion abilities. Because, like I said, our brains are pretty good at it.

342
00:43:54.800 --> 00:44:03.710
Lorna Quandt (she/her): What we found is that deaf people are faster at perceiving people. So one of our tasks was person identification tasks.

343
00:44:03.890 --> 00:44:06.559
Lorna Quandt (she/her): Is there a person or not a person?

344
00:44:06.920 --> 00:44:09.479
Lorna Quandt (she/her): Deaf people are faster at doing that.

345
00:44:09.740 --> 00:44:14.229
Lorna Quandt (she/her): And deaf people are faster at that most complicated task that I just showed you, identifying the actions.

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00:44:19.040 --> 00:44:25.670
Lorna Quandt (she/her): so deaf people show a significantly faster reaction to 2 types of motion processing

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00:44:27.010 --> 00:44:36.589
Lorna Quandt (she/her): at the cost of less accuracy on that task of identifying actions. And I'm going to show you the data to break it down a little bit more.

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00:44:37.070 --> 00:44:46.199
Lorna Quandt (she/her): Most importantly, the results on this page are controlling for sex, age and American Sign Language fluency.

351
00:44:47.010 --> 00:44:51.700
Lorna Quandt (she/her): It is a significant effect based on hearing status specifically.

352
00:44:55.560 --> 00:44:59.680
Lorna Quandt (she/her): So here's what this trade off looks like. That, I think, is really interesting.

353
00:45:00.100 --> 00:45:07.760
Lorna Quandt (she/her): And I'm gonna move a little bit quickly. But I'm happy to discuss offline or in Q&A, which I'm going to save time for.

354
00:45:08.000 --> 00:45:14.919
Lorna Quandt (she/her): So here we have reaction time on the X axis and accuracy on the Y axis.

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00:45:14.980 --> 00:45:22.449
Lorna Quandt (she/her): and each color is a different group. So our deaf participants are in the Blue Line group.

356
00:45:23.130 --> 00:45:27.810
Lorna Quandt (she/her): We see that for the other 2 groups, hearing and heart of hearing

357
00:45:27.930 --> 00:45:31.610
Lorna Quandt (she/her): as they take longer to do the task.

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00:45:31.770 --> 00:45:33.790
Lorna Quandt (she/her): The Rt. Gets higher

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00:45:33.900 --> 00:45:41.559
Lorna Quandt (she/her): as they take longer they're doing worse. So people who are hearing and who do really well at this task are answering pretty quickly and pretty accurately.

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00:45:46.280 --> 00:45:58.169
Lorna Quandt (she/her): However, none of our hearing or hard of hearing participants are answering nearly as fast as the deaf participants, who are much, much faster. Statistically speaking.

363
00:45:58.920 --> 00:46:03.780
Lorna Quandt (she/her): however, you can see that the deaf participants have a tendency

364
00:46:03.870 --> 00:46:06.100
Lorna Quandt (she/her): towards answering quickly

365
00:46:06.280 --> 00:46:08.030
Lorna Quandt (she/her): but less accurately.

366
00:46:08.100 --> 00:46:11.920
Lorna Quandt (she/her): So they are privileging speed over accuracy.

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00:46:12.680 --> 00:46:22.009
Lorna Quandt (she/her): And we have a paper coming out shortly about this and our main takeaway is that for deaf people answering very quickly

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00:46:22.240 --> 00:46:30.690
Lorna Quandt (she/her): at the cost of accuracy, is probably more advantageous than waiting to make a more correct choice.

369
00:46:31.183 --> 00:46:42.020
Lorna Quandt (she/her): There is a cost to benefit analysis on how quickly to respond to a movement in the environment. And we see here that speed might be privileged over accuracy.

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00:46:45.260 --> 00:46:56.970
Lorna Quandt (she/her): We also saw significant effects of age, of acquisition. So now we're not as much thinking about hearing status, but looking at American Sign Language fluency or age of acquisition.

371
00:46:57.700 --> 00:47:08.020
Lorna Quandt (she/her): we saw that earlier age of exposure here on the X-axis was linked to higher accuracy on that last task.

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00:47:08.610 --> 00:47:11.970
Lorna Quandt (she/her): so that hardest visual perception task.

373
00:47:12.260 --> 00:47:20.990
Lorna Quandt (she/her): deaf participants and hearing participants both. The earlier they learned American Sign Language, the more accurate they were with that.

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00:47:23.130 --> 00:47:29.189
Lorna Quandt (she/her): What we can take away from this research, including some of what I talked about earlier

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00:47:29.360 --> 00:47:38.280
Lorna Quandt (she/her): is that deafness leads to a unique approach to complex motion, wherein we see people prioritizing speed over accuracy.

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00:47:40.140 --> 00:47:45.060
Lorna Quandt (she/her): We also see that early sign language exposure increases accuracy with biological motion perception and that high sign language proficiency increases spatial cognition skills. Or that they're at least associated, if not causally.

380
00:48:01.720 --> 00:48:16.559
Lorna Quandt (she/her): So, zooming out to experience-dependent neuroplasticity. We can conclude that sign language, experience alongside deafness, change, perception, and cognition, and we've pieced out a little bit more about which parts of that puzzle contribute independently.

382
00:48:21.080 --> 00:48:25.190
Lorna Quandt (she/her): There are no negative effects of sign language found across the studies

383
00:48:25.350 --> 00:48:29.749
Lorna Quandt (she/her): and the more research we do the more we see is yet to discover.

384
00:48:33.340 --> 00:48:52.010
Lorna Quandt (she/her): So I thank you, the audience and those of you who invited me today. And I thank many contributors, collaborators, team members and funders of this research. Happy to take questions. And also you can always find me at my email, which I'll type into the chat.

385
00:48:56.270 --> 00:48:59.709
Astrid: Thank you so much, Lorna. Absolutely fascinating.