WEBVTT

NOTE duration:"01:02:50"

NOTE recognizability:0.895

NOTE language:en-us

NOTE Confidence: 0.782029491111111

00:00:00.000 --> 00:00:02.344 OK. Good afternoon, everyone,

NOTE Confidence: 0.782029491111111

00:00:02.344 --> 00:00:05.274 and welcome to Graham Rounds.

NOTE Confidence: 0.782029491111111

00:00:05.280 --> 00:00:06.728 I'm Sarah Santis Alonso.

NOTE Confidence: 0.782029491111111

00:00:06.728 --> 00:00:08.538 I'm an Associate Research Scientist

NOTE Confidence: 0.782029491111111

00:00:08.538 --> 00:00:10.278 at the Child Study Center.

NOTE Confidence: 0.782029491111111

00:00:10.280 --> 00:00:11.480 I joined the Child Study

NOTE Confidence: 0.782029491111111

00:00:11.480 --> 00:00:12.680 Center about a year ago,

NOTE Confidence: 0.782029491111111

00:00:12.680 --> 00:00:15.488 and I've been conducting research on

NOTE Confidence: 0.782029491111111

00:00:15.488 --> 00:00:17.360 language neurodevelopment since then.

NOTE Confidence: 0.782029491111111

00:00:17.360 --> 00:00:19.800 And first, before moving on to today's talk,

NOTE Confidence: 0.782029491111111

00:00:19.800 --> 00:00:21.389 I want to start with a reminder

NOTE Confidence: 0.782029491111111

00:00:21.389 --> 00:00:22.901 that next week we're going to

NOTE Confidence: 0.782029491111111

00:00:22.901 --> 00:00:24.196 hear from Doctor David Yan,

NOTE Confidence: 0.782029491111111

00:00:24.200 --> 00:00:27.152 and he will be speaking about the Asian

NOTE Confidence: 0.782029491111111

00:00:27.152 --> 00:00:28.840 American experience in healthcare.

NOTE Confidence: 0.782029491111111

00:00:28.840 --> 00:00:31.432 So we hope to see many of you there.

NOTE Confidence: 0.782029491111111

00:00:31.440 --> 00:00:33.960 And now moving on to today's talk,

NOTE Confidence: 0.782029491111111

00:00:33.960 --> 00:00:36.102 it is my great pleasure to welcome

NOTE Confidence: 0.782029491111111

00:00:36.102 --> 00:00:38.520 you all to today's presentation

NOTE Confidence: 0.782029491111111

00:00:38.520 --> 00:00:40.920 featuring Doctor Dee Kaslim.

NOTE Confidence: 0.782029491111111

00:00:40.920 --> 00:00:42.520 So I've known Dee Kaslim

NOTE Confidence: 0.782029491111111

00:00:42.520 --> 00:00:44.120 for about 6 years now.

NOTE Confidence: 0.782029491111111

00:00:44.120 --> 00:00:45.264 First, I suppose Doctor,

NOTE Confidence: 0.782029491111111

00:00:45.264 --> 00:00:47.725 a fellow in his lab and more recently

NOTE Confidence: 0.782029491111111

00:00:47.725 --> 00:00:49.425 as a colleague and collaborator

NOTE Confidence: 0.782029491111111

00:00:49.425 --> 00:00:51.758 here at the Chalice Study Center.

NOTE Confidence: 0.782029491111111

00:00:51.760 --> 00:00:53.510 And as an introductory note

NOTE Confidence: 0.782029491111111

00:00:53.510 --> 00:00:54.560 to his presentation,

NOTE Confidence: 0.782029491111111

00:00:54.560 --> 00:00:56.996 I'd like to emphasize a couple of

NOTE Confidence: 0.782029491111111

00:00:56.996 --> 00:00:59.430 qualities that I've been making a very

NOTE Confidence: 0.782029491111111

00:00:59.430 --> 00:01:02.160 unique individual scientist to work with.

NOTE Confidence: 0.782029491111111

00:01:02.160 --> 00:01:02.776 So first,

NOTE Confidence: 0.782029491111111

00:01:02.776 --> 00:01:04.316 as many of you know,

NOTE Confidence: 0.782029491111111

00:01:04.320 --> 00:01:06.678 **** is a truly remarkable scientist.

NOTE Confidence: 0.782029491111111

00:01:06.680 --> 00:01:08.108 He's made ground breaking

NOTE Confidence: 0.782029491111111

00:01:08.108 --> 00:01:10.250 contributions to a wide range of

NOTE Confidence: 0.782029491111111

00:01:10.320 --> 00:01:12.480 fields including infant perception,

NOTE Confidence: 0.782029491111111

00:01:12.480 --> 00:01:13.460 language acquisition,

NOTE Confidence: 0.782029491111111

00:01:13.460 --> 00:01:14.440 cognitive neuroscience,

NOTE Confidence: 0.782029491111111

00:01:14.440 --> 00:01:16.890 and I've always been inspired

NOTE Confidence: 0.782029491111111

00:01:16.890 --> 00:01:18.992 by his curiosity to learn and

NOTE Confidence: 0.782029491111111

00:01:18.992 --> 00:01:21.040 to delve deep into new fields.

NOTE Confidence: 0.782029491111111

00:01:21.040 --> 00:01:23.280 And indeed, as we've seen today's talk,

NOTE Confidence: 0.782029491111111

00:01:23.280 --> 00:01:26.145 he has a very interdisciplinary

NOTE Confidence: 0.782029491111111

00:01:26.145 --> 00:01:28.912 approach to science and he

NOTE Confidence: 0.782029491111111

00:01:28.912 --> 00:01:30.800 integrates insights from psychology,

NOTE Confidence: 0.782029491111111

00:01:30.800 --> 00:01:31.353 linguistics,

NOTE Confidence: 0.782029491111111

00:01:31.353 --> 00:01:33.012 connecting neuroscience to

NOTE Confidence: 0.782029491111111

00:01:33.012 --> 00:01:34.118 computational modelling.

NOTE Confidence: 0.782029491111111

00:01:34.120 --> 00:01:37.172 And he has received a number of awards

NOTE Confidence: 0.782029491111111

00:01:37.172 --> 00:01:38.560 for his scientific contributions,

NOTE Confidence: 0.782029491111111

00:01:38.560 --> 00:01:41.332 much recently the Atkinson Prize in

NOTE Confidence: 0.782029491111111

00:01:41.332 --> 00:01:43.180 Psychological and Cognitive Sciences

NOTE Confidence: 0.782029491111111

00:01:43.248 --> 00:01:45.558 by the National Academy of Sciences.

NOTE Confidence: 0.782029491111111

00:01:45.560 --> 00:01:47.590 He's also a member of the American

NOTE Confidence: 0.782029491111111

00:01:47.590 --> 00:01:49.725 Academy of Arts and Sciences and a

NOTE Confidence: 0.782029491111111

00:01:49.725 --> 00:01:52.120 member of the National Academy of Sciences.

NOTE Confidence: 0.782029491111111

00:01:52.120 --> 00:01:54.472 And the second quality that I want to

NOTE Confidence: 0.782029491111111

00:01:54.472 --> 00:01:56.544 emphasize is that he is and continues

NOTE Confidence: 0.782029491111111

00:01:56.544 --> 00:01:58.320 to be an extraordinary role model.

NOTE Confidence: 0.782029491111111

00:01:58.320 --> 00:01:59.121 As a mentor.

NOTE Confidence: 0.782029491111111

00:01:59.121 --> 00:02:00.990 He's able to create a supportive and

NOTE Confidence: 0.782029491111111

00:02:01.047 --> 00:02:03.117 nurturing environment for his mentees.

NOTE Confidence: 0.782029491111111

00:02:03.120 --> 00:02:04.800 So he has this truly unique quality.

NOTE Confidence: 0.782029491111111

00:02:04.800 --> 00:02:07.239 I think that he's able to see the strength

NOTE Confidence: 0.782029491111111

00:02:07.239 --> 00:02:09.797 in every individual and helps them grow.

NOTE Confidence: 0.782029491111111

00:02:09.800 --> 00:02:11.160 And as a personal note,

NOTE Confidence: 0.782029491111111

00:02:11.160 --> 00:02:13.224 I I mentioned that as I was transitioning

NOTE Confidence: 0.782029491111111

00:02:13.224 --> 00:02:15.440 to his lab as a post doctoral fellow,

NOTE Confidence: 0.782029491111111

00:02:15.440 --> 00:02:17.470 I talked to some of his prior

NOTE Confidence: 0.782029491111111

00:02:17.470 --> 00:02:19.150 mentees and they could only

NOTE Confidence: 0.782029491111111

00:02:19.150 --> 00:02:21.000 say positive things about him.

NOTE Confidence: 0.782029491111111

00:02:21.000 --> 00:02:24.258 I couldn't believe it and but you know,

NOTE Confidence: 0.782029491111111

00:02:24.258 --> 00:02:26.358 I was convinced this was the the way to

NOTE Confidence: 0.782029491111111

00:02:26.358 --> 00:02:29.400 go and Fast forward six years later,

NOTE Confidence: 0.782029491111111

00:02:29.400 --> 00:02:31.143 I only have positive things to say

NOTE Confidence: 0.782029491111111

00:02:31.143 --> 00:02:33.199 about him and I think that it is true.

NOTE Confidence: 0.782029491111111

00:02:33.200 --> 00:02:34.838 I think that this is because

NOTE Confidence: 0.782029491111111

00:02:34.838 --> 00:02:36.599 he is truly able to create.

NOTE Confidence: 0.782029491111111

00:02:36.600 --> 00:02:38.130 He's committed to the growth

NOTE Confidence: 0.782029491111111

00:02:38.130 --> 00:02:40.096 and success of of their mentees

NOTE Confidence: 0.782029491111111

00:02:40.096 --> 00:02:42.352 and really able to create this

NOTE Confidence: 0.782029491111111

00:02:42.352 --> 00:02:43.840 nurturing environment for them.

NOTE Confidence: 0.782029491111111

00:02:43.840 --> 00:02:46.140 And he has indeed received

NOTE Confidence: 0.782029491111111

00:02:46.140 --> 00:02:47.520 several mentorship awards,

NOTE Confidence: 0.782029491111111

00:02:47.520 --> 00:02:49.473 and I want to mention a couple of them.

NOTE Confidence: 0.782029491111111

00:02:49.480 --> 00:02:50.392 So in 2015,

NOTE Confidence: 0.782029491111111

00:02:50.392 --> 00:02:52.216 he received the Mentor Award for

NOTE Confidence: 0.782029491111111

00:02:52.216 --> 00:02:54.619 Lifetime Achievement by the American

NOTE Confidence: 0.782029491111111

00:02:54.619 --> 00:02:56.149 Psychological Association that

NOTE Confidence: 0.782029491111111

00:02:56.149 --> 00:02:57.679 acknowledges his extraordinary

NOTE Confidence: 0.917966105333333

00:02:57.744 --> 00:02:59.549 leadership to increase the participation

NOTE Confidence: 0.917966105333333

00:02:59.549 --> 00:03:02.860 of women of all racial and ethnic groups.

NOTE Confidence: 0.917966105333333

00:03:02.860 --> 00:03:05.988 And in 2018, he received the honorary

NOTE Confidence: 0.917966105333333

00:03:05.988 --> 00:03:08.023 Honorary award for Enduring Leadership

NOTE Confidence: 0.917966105333333

00:03:08.023 --> 00:03:10.761 by by Women in Cognitive Science that

NOTE Confidence: 0.917966105333333

00:03:10.761 --> 00:03:13.166 recognizes his important role in

NOTE Confidence: 0.917966105333333

00:03:13.166 --> 00:03:16.519 advancing the career of women scientists.

NOTE Confidence: 0.917966105333333

00:03:16.520 --> 00:03:18.320 And with a further ado,

NOTE Confidence: 0.917966105333333

00:03:18.320 --> 00:03:20.471 I invite you to join me and and extending

NOTE Confidence: 0.917966105333333

00:03:20.471 --> 00:03:22.596 a warm welcome to Doctor de Castle.

NOTE Confidence: 0.88338382

00:03:27.440 --> 00:03:29.160 Well, thank you so much, Sarah. And

NOTE Confidence: 0.92832077

00:03:31.600 --> 00:03:33.791 it's very easy to mentor people when

NOTE Confidence: 0.92832077

00:03:33.791 --> 00:03:35.080 they're really outstanding people

NOTE Confidence: 0.92832077

00:03:35.080 --> 00:03:37.036 and scientists in their own right.

NOTE Confidence: 0.92832077

00:03:37.040 --> 00:03:38.350 And so I've been really

NOTE Confidence: 0.92832077

00:03:38.350 --> 00:03:39.398 fortunate to have many,

NOTE Confidence: 0.92832077

00:03:39.400 --> 00:03:41.290 many talented students and post

NOTE Confidence: 0.92832077

00:03:41.290 --> 00:03:43.919 docs working with me over the years.

NOTE Confidence: 0.92832077

00:03:43.920 --> 00:03:46.237 So thanks to the child Studies center,

NOTE Confidence: 0.92832077

00:03:46.240 --> 00:03:48.310 Kieran and Linda for inviting

NOTE Confidence: 0.92832077

00:03:48.310 --> 00:03:50.960 me to give this talk today.

NOTE Confidence: 0.92832077

00:03:50.960 --> 00:03:52.360 This is kind of an overview talk.

NOTE Confidence: 0.92832077

00:03:52.360 --> 00:03:54.709 I wanted to give you a flavor for what's

NOTE Confidence: 0.92832077

00:03:54.709 --> 00:03:57.196 going on in the lab over the past two years.

NOTE Confidence: 0.92832077

00:03:57.200 --> 00:03:59.640 So here's a road map for today's talk.

NOTE Confidence: 0.92832077

00:03:59.640 --> 00:04:00.960 I want first of all,

NOTE Confidence: 0.92832077

00:04:00.960 --> 00:04:02.560 for those of you who are not so

NOTE Confidence: 0.92832077

00:04:02.560 --> 00:04:03.742 familiar with the methods that

NOTE Confidence: 0.92832077

00:04:03.742 --> 00:04:05.200 are used to study human infants,

NOTE Confidence: 0.92832077

00:04:05.200 --> 00:04:07.876 talk about those behavioral methods briefly.

NOTE Confidence: 0.92832077

00:04:07.880 --> 00:04:09.833 And then give some examples of the

NOTE Confidence: 0.92832077

00:04:09.833 --> 00:04:11.833 findings that you can obtain from

NOTE Confidence: 0.92832077

00:04:11.833 --> 00:04:13.678 infants using those behavioral methods.

NOTE Confidence: 0.92832077

00:04:13.680 --> 00:04:15.675 And then review the neural methods that

NOTE Confidence: 0.92832077

00:04:15.675 --> 00:04:17.440 are available for use with infants,

NOTE Confidence: 0.92832077

00:04:17.440 --> 00:04:18.976 which are quite constrained.

NOTE Confidence: 0.92832077

00:04:18.976 --> 00:04:21.280 And then some findings that have

NOTE Confidence: 0.92832077

00:04:21.351 --> 00:04:23.621 illustrated how that neural information

NOTE Confidence: 0.92832077

00:04:23.621 --> 00:04:25.437 can advance our understanding

NOTE Confidence: 0.92832077

00:04:25.437 --> 00:04:27.208 of the behavioral manifestations

NOTE Confidence: 0.92832077

00:04:27.208 --> 00:04:28.312 of language development.

NOTE Confidence: 0.92832077

00:04:28.312 --> 00:04:30.152 And then at the end,

NOTE Confidence: 0.92832077

00:04:30.160 --> 00:04:31.938 for those of you who are interested

NOTE Confidence: 0.92832077

00:04:31.938 --> 00:04:33.357 in some practical applications of

NOTE Confidence: 0.92832077

00:04:33.357 --> 00:04:35.392 this work allude to some research

NOTE Confidence: 0.92832077

00:04:35.392 --> 00:04:37.540 that I think has some translational

NOTE Confidence: 0.92832077

00:04:37.607 --> 00:04:38.639 components to it.

NOTE Confidence: 0.92832077

00:04:38.640 --> 00:04:39.760 So first of all,

NOTE Confidence: 0.92832077

00:04:39.760 --> 00:04:40.600 reviewing behavioral methods,

NOTE Confidence: 0.92832077

00:04:40.600 --> 00:04:42.805 really almost everything we know

NOTE Confidence: 0.92832077

00:04:42.805 --> 00:04:44.569 about psychological development in

NOTE Confidence: 0.92832077

00:04:44.569 --> 00:04:46.798 infants is is come from initially

NOTE Confidence: 0.92832077

00:04:46.798 --> 00:04:48.182 from behavioral responses such

NOTE Confidence: 0.92832077

00:04:48.182 --> 00:04:50.360 as crying and facial expressions,

NOTE Confidence: 0.92832077

00:04:50.360 --> 00:04:51.320 high amplitude sucking,

NOTE Confidence: 0.92832077

00:04:51.320 --> 00:04:53.560 which has been used to study learning,

NOTE Confidence: 0.92832077

00:04:53.560 --> 00:04:54.784 reaching and grasping responses.

NOTE Confidence: 0.92832077

00:04:54.784 --> 00:04:55.396 You know,

NOTE Confidence: 0.92832077

00:04:55.400 --> 00:04:56.945 Arnold Gazelle did the classic

NOTE Confidence: 0.92832077

00:04:56.945 --> 00:04:59.440 work here at Yale on that and

NOTE Confidence: 0.92832077

00:04:59.440 --> 00:05:01.360 crawling and walking.

NOTE Confidence: 0.92832077

00:05:01.360 --> 00:05:03.664 And what drove the this increase

NOTE Confidence: 0.92832077

00:05:03.664 --> 00:05:06.100 in our knowledge over the past 30

NOTE Confidence: 0.92832077

00:05:06.100 --> 00:05:07.805 or 40 years was capitalizing on

NOTE Confidence: 0.92832077

00:05:07.805 --> 00:05:09.280 a particular kind of behavior.

NOTE Confidence: 0.92832077

00:05:09.280 --> 00:05:12.160 And that's I've reviewed it in an article,

NOTE Confidence: 0.92832077

00:05:12.160 --> 00:05:13.978 It's it's the looking behavior that

NOTE Confidence: 0.92832077

00:05:13.978 --> 00:05:15.600 infants exhibit toward different stimuli,

NOTE Confidence: 0.92832077

00:05:15.600 --> 00:05:17.355 not just visual stimuli but

NOTE Confidence: 0.92832077

00:05:17.355 --> 00:05:18.759 auditory stimuli as well,

NOTE Confidence: 0.92832077

00:05:18.760 --> 00:05:21.320 which I will summarize briefly.

NOTE Confidence: 0.92832077

00:05:21.320 --> 00:05:23.470 So these looking paradigms really

NOTE Confidence: 0.92832077

00:05:23.470 --> 00:05:25.771 are quite powerful and they apply

NOTE Confidence: 0.92832077

00:05:25.771 --> 00:05:27.119 in different content domains.

NOTE Confidence: 0.92832077

00:05:27.120 --> 00:05:28.825 You can measure spontaneous preferences

NOTE Confidence: 0.92832077

00:05:28.825 --> 00:05:31.160 that infants bring to the laboratory.

NOTE Confidence: 0.92832077

00:05:31.160 --> 00:05:33.816 You can expose them to stimuli and see

NOTE Confidence: 0.92832077

00:05:33.816 --> 00:05:36.677 how they become familiarized with them.

NOTE Confidence: 0.92832077

00:05:36.680 --> 00:05:38.924 You can study learning with these

NOTE Confidence: 0.92832077

00:05:38.924 --> 00:05:41.334 techniques and you can also study

NOTE Confidence: 0.92832077

00:05:41.334 --> 00:05:43.439 how they explore their environment

NOTE Confidence: 0.92832077

00:05:43.439 --> 00:05:45.440 with their visual attention.

NOTE Confidence: 0.92832077

00:05:45.440 --> 00:05:47.328 And this has been used in to measure

NOTE Confidence: 0.92832077

00:05:47.328 --> 00:05:49.252 all sorts of content domains within

NOTE Confidence: 0.92832077

00:05:49.252 --> 00:05:50.992 infancy such as sensory thresholds,

NOTE Confidence: 0.92832077

00:05:51.000 --> 00:05:53.512 visual acuity, for example,

NOTE Confidence: 0.92832077

00:05:53.512 --> 00:05:55.396 cross modal integration.

NOTE Confidence: 0.92832077

00:05:55.400 --> 00:05:57.608 It's also been used to study

NOTE Confidence: 0.92832077

00:05:57.608 --> 00:05:58.712 discrimination and categorization,

NOTE Confidence: 0.92832077

00:05:58.720 --> 00:06:01.682 such As for faces and speech and it.

NOTE Confidence: 0.92832077

00:06:01.682 --> 00:06:03.610 And it's even been used to study what

NOTE Confidence: 0.92832077

00:06:03.671 --> 00:06:05.783 you might consider sort of higher

NOTE Confidence: 0.92832077

00:06:05.783 --> 00:06:08.250 level cognitive processes like space number,

NOTE Confidence: 0.92832077

00:06:08.250 --> 00:06:12.040 the grammar in languages and theory of mind,

NOTE Confidence: 0.92832077

00:06:12.040 --> 00:06:12.910 among others.

NOTE Confidence: 0.92832077

00:06:12.910 --> 00:06:15.085 So these behavioral methods then

NOTE Confidence: 0.92832077

00:06:15.085 --> 00:06:18.065 have been deployed to the study of

NOTE Confidence: 0.92832077

00:06:18.065 --> 00:06:20.471 language development in many different ways.

NOTE Confidence: 0.92832077

00:06:20.480 --> 00:06:22.424 And I'm just going to summarize

NOTE Confidence: 0.92832077

00:06:22.424 --> 00:06:23.396 3 very briefly.

NOTE Confidence: 0.92832077

00:06:23.400 --> 00:06:26.116 One is the discrimination of speech contrast,

NOTE Confidence: 0.92832077

00:06:26.120 --> 00:06:28.220 the ability of infants to tell

NOTE Confidence: 0.92832077

00:06:28.220 --> 00:06:29.620 what one speech sound

NOTE Confidence: 0.914311003125

00:06:29.692 --> 00:06:32.320 is different from another speech sound.

NOTE Confidence: 0.914311003125

00:06:32.320 --> 00:06:33.880 The 2nd is statistical learning,

NOTE Confidence: 0.914311003125

00:06:33.880 --> 00:06:36.288 a very rapid form of implicit learning

NOTE Confidence: 0.914311003125

00:06:36.288 --> 00:06:38.688 that infants have quite early in life.

NOTE Confidence: 0.914311003125

00:06:38.688 --> 00:06:40.398 And then spoken word recognition,

NOTE Confidence: 0.914311003125

00:06:40.400 --> 00:06:42.375 which is obviously relevant to

NOTE Confidence: 0.914311003125

00:06:42.375 --> 00:06:44.350 language understanding the spoken items

NOTE Confidence: 0.914311003125

00:06:44.408 --> 00:06:46.263 that are presented to you and what

NOTE Confidence: 0.914311003125

00:06:46.263 --> 00:06:48.358 they mean in the in the real world.

NOTE Confidence: 0.914311003125

00:06:48.360 --> 00:06:50.118 So one of the techniques that

NOTE Confidence: 0.914311003125

00:06:50.118 --> 00:06:52.128 employs looking time is called the

NOTE Confidence: 0.914311003125

00:06:52.128 --> 00:06:53.680 head turn preference procedure.

NOTE Confidence: 0.914311003125

00:06:53.680 --> 00:06:55.738 This is a procedure in which the

NOTE Confidence: 0.914311003125

00:06:55.738 --> 00:06:57.640 baby is seated on a parent's

NOTE Confidence: 0.914311003125

00:06:57.640 --> 00:06:59.554 lap inside of a soundproof room,

NOTE Confidence: 0.914311003125

00:06:59.560 --> 00:07:01.786 and there is very uninteresting visual

NOTE Confidence: 0.914311003125

00:07:01.786 --> 00:07:03.092 stimuli, like a blinking light.

NOTE Confidence: 0.914311003125

00:07:03.092 --> 00:07:05.781 And it turns out if you present out of a

NOTE Confidence: 0.914311003125

00:07:05.781 --> 00:07:07.635 loudspeaker adjacent to that blinking light,

NOTE Confidence: 0.914311003125

00:07:07.640 --> 00:07:08.936 an auditory stimulus instance

NOTE Confidence: 0.914311003125

00:07:08.936 --> 00:07:11.257 will look at it for some period

NOTE Confidence: 0.914311003125

00:07:11.257 --> 00:07:13.159 of time before they look away.

NOTE Confidence: 0.914311003125

00:07:13.160 --> 00:07:14.620 Not to measure their preference

NOTE Confidence: 0.914311003125

00:07:14.620 --> 00:07:16.080 for listening to the sound.

NOTE Confidence: 0.914311003125

00:07:16.080 --> 00:07:17.436 It's not about the blinking light,

NOTE Confidence: 0.914311003125

00:07:17.440 --> 00:07:19.960 it's about the sound.

NOTE Confidence: 0.914311003125

00:07:19.960 --> 00:07:22.508 And you can use this to study

NOTE Confidence: 0.914311003125

00:07:22.508 --> 00:07:23.236 perceptual discrimination.

NOTE Confidence: 0.914311003125

00:07:23.240 --> 00:07:23.928 For example,

NOTE Confidence: 0.914311003125

00:07:23.928 --> 00:07:25.648 some sounds we've looked at

NOTE Confidence: 0.914311003125

00:07:25.648 --> 00:07:27.160 longer than other sounds,

NOTE Confidence: 0.914311003125

00:07:27.160 --> 00:07:28.540 or after you've been familiarized

NOTE Confidence: 0.914311003125

00:07:28.540 --> 00:07:30.204 to one class of sounds and

NOTE Confidence: 0.914311003125

00:07:30.204 --> 00:07:31.560 then changed to a new sound,

NOTE Confidence: 0.914311003125

00:07:31.560 --> 00:07:33.898 they will show an increase in their

NOTE Confidence: 0.914311003125

00:07:33.898 --> 00:07:35.640 visual attention to that sound.

NOTE Confidence: 0.914311003125

00:07:35.640 --> 00:07:37.740 And one of the classic findings in

NOTE Confidence: 0.914311003125

00:07:37.740 --> 00:07:40.064 the field by Janet Worker and Richard

NOTE Confidence: 0.914311003125

00:07:40.064 --> 00:07:42.538 Tees is that stimuli speech stimuli

NOTE Confidence: 0.914311003125

00:07:42.538 --> 00:07:45.940 that are used in a particular language

NOTE Confidence: 0.914311003125

00:07:46.020 --> 00:07:48.638 but are not used in the language

NOTE Confidence: 0.914311003125

00:07:48.638 --> 00:07:51.198 of infants who are being tested.

NOTE Confidence: 0.914311003125

00:07:51.200 --> 00:07:53.720 So these are non-native speech.

NOTE Confidence: 0.914311003125

00:07:53.720 --> 00:07:57.106 Contrast shows an interesting

NOTE Confidence: 0.914311003125

00:07:57.106 --> 00:07:58.954 phenomenon called perceptual narrowing,

NOTE Confidence: 0.914311003125

00:07:58.960 --> 00:08:01.640 that is 6 and seven month old babies.

NOTE Confidence: 0.914311003125

00:08:01.640 --> 00:08:03.800 Even though that is not a native language,

NOTE Confidence: 0.914311003125

00:08:03.800 --> 00:08:05.816 contrast will never let us be

NOTE Confidence: 0.914311003125

00:08:05.816 --> 00:08:07.160 able to discriminate it.

NOTE Confidence: 0.914311003125

00:08:07.160 --> 00:08:08.936 But you can see over the

NOTE Confidence: 0.914311003125

00:08:08.936 --> 00:08:10.120 course of several months,

NOTE Confidence: 0.914311003125

00:08:10.120 --> 00:08:11.480 by 12 months of age,

NOTE Confidence: 0.914311003125

00:08:11.480 --> 00:08:13.824 they're essentially unable to

NOTE Confidence: 0.914311003125

00:08:13.824 --> 00:08:14.996 discriminate that.

NOTE Confidence: 0.914311003125

00:08:15.000 --> 00:08:18.152 If you ask whether infants from that native

NOTE Confidence: 0.914311003125

00:08:18.152 --> 00:08:20.240 speaking environment can discriminate it,

NOTE Confidence: 0.914311003125

00:08:20.240 --> 00:08:21.440 the answer is yes,

NOTE Confidence: 0.914311003125

00:08:21.440 --> 00:08:22.040 of course.

NOTE Confidence: 0.914311003125

00:08:22.040 --> 00:08:24.884 So you have this interesting phenomenon

NOTE Confidence: 0.914311003125

00:08:24.884 --> 00:08:26.467 whereby universal properties of

NOTE Confidence: 0.914311003125

00:08:26.467 --> 00:08:28.312 discrimination are present in infants

NOTE Confidence: 0.914311003125

00:08:28.312 --> 00:08:30.797 at six months of age and then they're

NOTE Confidence: 0.914311003125

00:08:30.797 --> 00:08:33.161 kind of winnowed away as a result of

NOTE Confidence: 0.914311003125

00:08:33.161 --> 00:08:34.636 exposure to their native language.

NOTE Confidence: 0.914311003125

00:08:34.640 --> 00:08:37.250 Kind of use it or lose it is the

NOTE Confidence: 0.914311003125

00:08:37.250 --> 00:08:38.758 expression that's used here.

NOTE Confidence: 0.914311003125

00:08:38.760 --> 00:08:40.560 So that's in the domain

NOTE Confidence: 0.914311003125

00:08:40.560 --> 00:08:41.640 of speech discrimination.

NOTE Confidence: 0.914311003125

00:08:41.640 --> 00:08:44.784 But what about how infants acquire

NOTE Confidence: 0.914311003125

00:08:44.784 --> 00:08:47.800 information about new combinations of sounds?

NOTE Confidence: 0.914311003125

00:08:47.800 --> 00:08:50.928 And one of the things that we were

NOTE Confidence: 0.914311003125

00:08:50.928 --> 00:08:53.123 very interested in a number of years

NOTE Confidence: 0.914311003125

00:08:53.123 --> 00:08:55.363 ago is how do infants understand where

NOTE Confidence: 0.914311003125

00:08:55.363 --> 00:08:57.879 one word ends and the next word begins?

NOTE Confidence: 0.914311003125

00:08:57.880 --> 00:09:00.130 Because as you're listening to me

NOTE Confidence: 0.914311003125

00:09:00.130 --> 00:09:02.320 speak and hopefully fluent sentences,

NOTE Confidence: 0.914311003125

00:09:02.320 --> 00:09:04.372 there's no obvious boundary between the

NOTE Confidence: 0.914311003125

00:09:04.372 --> 00:09:06.960 words except at the end of an utterance.

NOTE Confidence: 0.914311003125

00:09:06.960 --> 00:09:09.075 So if you take an example of a set

NOTE Confidence: 0.914311003125

00:09:09.075 --> 00:09:11.065 of sentences that a mother might

NOTE Confidence: 0.914311003125

00:09:11.065 --> 00:09:13.200 speak to an infant like these,

NOTE Confidence: 0.914311003125

00:09:13.200 --> 00:09:15.750 you can ask whether there's statistical

NOTE Confidence: 0.914311003125

00:09:15.750 --> 00:09:17.840 information that defines a word.

NOTE Confidence: 0.914311003125

00:09:17.840 --> 00:09:18.950 So for example,

NOTE Confidence: 0.914311003125

00:09:18.950 --> 00:09:21.170 Bey followed by B is happening

NOTE Confidence: 0.914311003125

00:09:21.170 --> 00:09:23.679 every time the word baby is spoken.

NOTE Confidence: 0.914311003125

00:09:23.680 --> 00:09:26.050 But those other syllables that

NOTE Confidence: 0.914311003125

00:09:26.050 --> 00:09:28.420 come between words like T

NOTE Confidence: 0.877564162727273

00:09:28.506 --> 00:09:30.242 Bey happen relatively infrequently.

NOTE Confidence: 0.877564162727273

00:09:30.242 --> 00:09:33.206 So you have word combinations of

NOTE Confidence: 0.877564162727273

00:09:33.206 --> 00:09:35.855 syllables and non word or word

NOTE Confidence: 0.877564162727273

00:09:35.855 --> 00:09:37.519 boundary combinations of syllables.

NOTE Confidence: 0.877564162727273

00:09:37.520 --> 00:09:40.319 So what we did is created a synthetic stream

NOTE Confidence: 0.877564162727273

00:09:40.319 --> 00:09:43.155 of speech in which there were no pauses.

NOTE Confidence: 0.877564162727273

00:09:43.160 --> 00:09:45.640 So there's no person who's taking a pause,

NOTE Confidence: 0.877564162727273

00:09:45.640 --> 00:09:47.440 taking a breath at the end of an utterance.

NOTE Confidence: 0.877564162727273

00:09:47.440 --> 00:09:49.280 It's just a continuous stream.

NOTE Confidence: 0.877564162727273

00:09:49.280 --> 00:09:51.518 Sounds like this.

NOTE Confidence: 0.877564162727273

00:09:51.520 --> 00:09:54.915 Oh, unfortunately, no one can hear that.

NOTE Confidence: 0.877564162727273

00:09:54.920 --> 00:09:57.332 That's OK. I will imagine that

NOTE Confidence: 0.877564162727273

00:09:57.332 --> 00:09:59.520 this is just concatenated speech.

NOTE Confidence: 0.877564162727273

00:09:59.520 --> 00:10:02.440 It's continuous, there's no pauses.

NOTE Confidence: 0.877564162727273

00:10:02.440 --> 00:10:03.559 And then what?

NOTE Confidence: 0.877564162727273

00:10:03.559 --> 00:10:04.678 The question is,

NOTE Confidence: 0.877564162727273

00:10:04.680 --> 00:10:07.493 can you extract from that stream

NOTE Confidence: 0.877564162727273

00:10:07.493 --> 00:10:09.758 of speech the underlying structure

NOTE Confidence: 0.877564162727273

00:10:09.758 --> 00:10:11.117 that's defined statistically?

NOTE Confidence: 0.877564162727273

00:10:11.120 --> 00:10:13.717 In fact, in this stream of speech,

NOTE Confidence: 0.877564162727273

00:10:13.720 --> 00:10:17.720 it consisted only of these

NOTE Confidence: 0.877564162727273

00:10:17.720 --> 00:10:20.279 343 syllable words,

NOTE Confidence: 0.877564162727273

00:10:20.280 --> 00:10:23.066 and they were 3 syllable words that

NOTE Confidence: 0.877564162727273

00:10:23.066 --> 00:10:25.280 were represented in random order,

NOTE Confidence: 0.877564162727273

00:10:25.280 --> 00:10:26.985 but they're concatenated together as

NOTE Confidence: 0.877564162727273

00:10:26.985 --> 00:10:29.120 a continuous stream with no pauses.

NOTE Confidence: 0.877564162727273

00:10:29.120 --> 00:10:30.988 So the question is,

NOTE Confidence: 0.877564162727273

00:10:30.988 --> 00:10:33.323 can infants extract the structure

NOTE Confidence: 0.877564162727273

00:10:33.323 --> 00:10:35.799 by merely listening to it?

NOTE Confidence: 0.877564162727273

00:10:35.800 --> 00:10:38.416 And So what you do is present the

NOTE Confidence: 0.877564162727273

00:10:38.416 --> 00:10:41.314 stream of speech for two minutes to 8

NOTE Confidence: 0.877564162727273

00:10:41.314 --> 00:10:43.798 month olds and then give them a test.

NOTE Confidence: 0.877564162727273

00:10:43.800 --> 00:10:47.320 And the test is this following critical test,

NOTE Confidence: 0.877564162727273

00:10:47.320 --> 00:10:49.434 they're going to hear a word which

NOTE Confidence: 0.877564162727273

00:10:49.434 --> 00:10:51.852 would be one of those triples that's

NOTE Confidence: 0.877564162727273

00:10:51.852 --> 00:10:54.641 actually a part of the structure of the

NOTE Confidence: 0.877564162727273

00:10:54.641 --> 00:10:57.240 stream verses on other chest trials,

NOTE Confidence: 0.877564162727273

00:10:57.240 --> 00:10:58.360 what's called a part word.

NOTE Confidence: 0.877564162727273

00:10:58.360 --> 00:11:00.584 So it's the last syllable of one word

NOTE Confidence: 0.877564162727273

00:11:00.584 --> 00:11:03.436 and the next two syllables of the next word.

NOTE Confidence: 0.877564162727273

00:11:03.440 --> 00:11:06.198 Now that is something that they've heard,

NOTE Confidence: 0.877564162727273

00:11:06.200 --> 00:11:08.660 but it has a statistical property

NOTE Confidence: 0.877564162727273

00:11:08.660 --> 00:11:11.154 highlighted here that the likelihood

NOTE Confidence: 0.877564162727273

00:11:11.154 --> 00:11:13.944 that that that particular syllable

NOTE Confidence: 0.877564162727273

00:11:13.944 --> 00:11:17.650 da follows to is 1/3 because there's

NOTE Confidence: 0.877564162727273

00:11:17.650 --> 00:11:19.820 four words and it can be followed

NOTE Confidence: 0.877564162727273

00:11:19.885 --> 00:11:21.754 by one of the other three words.

NOTE Confidence: 0.877564162727273

00:11:21.760 --> 00:11:23.954 So it's a very subtle probabilistic

NOTE Confidence: 0.877564162727273

00:11:23.954 --> 00:11:26.078 relationship that they would have to

NOTE Confidence: 0.877564162727273

00:11:26.078 --> 00:11:28.237 extract from this 2 minutes of speech.

NOTE Confidence: 0.877564162727273

00:11:28.240 --> 00:11:30.725 And the answer is that they do

NOTE Confidence: 0.877564162727273

00:11:30.725 --> 00:11:32.067 discriminate between these words

NOTE Confidence: 0.877564162727273

00:11:32.067 --> 00:11:34.041 and part words after only two

NOTE Confidence: 0.877564162727273

00:11:34.041 --> 00:11:35.119 minutes of exposure.

NOTE Confidence: 0.877564162727273

00:11:35.120 --> 00:11:36.638 And they do so by showing

NOTE Confidence: 0.877564162727273

00:11:36.638 --> 00:11:37.397 a novelty preference.

NOTE Confidence: 0.877564162727273

00:11:37.400 --> 00:11:38.272 That is,

NOTE Confidence: 0.877564162727273

00:11:38.272 --> 00:11:40.888 they listen longer to that slightly

NOTE Confidence: 0.877564162727273

00:11:40.888 --> 00:11:43.036 less statistically coherent part word

NOTE Confidence: 0.877564162727273

00:11:43.036 --> 00:11:45.436 than to the the words themselves.

NOTE Confidence: 0.877564162727273

00:11:45.440 --> 00:11:47.995 And this is not unique to language.

NOTE Confidence: 0.877564162727273

00:11:48.000 --> 00:11:49.946 We did follow up experiments with musical

NOTE Confidence: 0.877564162727273

00:11:49.946 --> 00:11:51.760 tones that had the same underlying

NOTE Confidence: 0.877564162727273

00:11:51.760 --> 00:11:53.916 structure and you see the same phenomenon.

NOTE Confidence: 0.877564162727273

00:11:53.920 --> 00:11:56.120 We've even done it in the visual domain.

NOTE Confidence: 0.877564162727273

00:11:56.120 --> 00:11:59.000 So it's a domain general property.

NOTE Confidence: 0.877564162727273

00:11:59.000 --> 00:12:00.400 It's not specific to language,

NOTE Confidence: 0.877564162727273

00:12:00.400 --> 00:12:03.880 but obviously language capitalizes on it.

NOTE Confidence: 0.877564162727273

00:12:03.880 --> 00:12:05.360 So that's a learning effect.

NOTE Confidence: 0.877564162727273

00:12:05.360 --> 00:12:06.560 We've seen discrimination

NOTE Confidence: 0.877564162727273

00:12:06.560 --> 00:12:08.160 effect and learning effect.

NOTE Confidence: 0.877564162727273

00:12:08.160 --> 00:12:10.836 And now what about recognizing words?

NOTE Confidence: 0.877564162727273

00:12:10.840 --> 00:12:12.900 So canonical example of this

NOTE Confidence: 0.877564162727273

00:12:12.900 --> 00:12:14.960 would be two known objects,

NOTE Confidence: 0.877564162727273

00:12:14.960 --> 00:12:16.796 that is, objects that have words

NOTE Confidence: 0.877564162727273

00:12:16.796 --> 00:12:18.760 that are known by the infant,

NOTE Confidence: 0.877564162727273

00:12:18.760 --> 00:12:20.221 apple and ball,

NOTE Confidence: 0.877564162727273

00:12:20.221 --> 00:12:23.143 and simply an utterance while they're

NOTE Confidence: 0.877564162727273

00:12:23.143 --> 00:12:26.200 faced with these two visual stimuli.

NOTE Confidence: 0.877564162727273

00:12:26.200 --> 00:12:28.076 Where's the apple or where's the ball?

NOTE Confidence: 0.877564162727273

00:12:28.080 --> 00:12:30.192 And what you might expect is that the

NOTE Confidence: 0.877564162727273

00:12:30.192 --> 00:12:31.926 infant would look at the appropriate

NOTE Confidence: 0.877564162727273

00:12:31.926 --> 00:12:33.960 referent of that word apple or ball.

NOTE Confidence: 0.877564162727273

00:12:33.960 --> 00:12:34.809 And in fact,

NOTE Confidence: 0.877564162727273

00:12:34.809 --> 00:12:36.224 that's exactly what you find

NOTE Confidence: 0.877564162727273

00:12:36.224 --> 00:12:37.520 at 14 month olds.

NOTE Confidence: 0.877564162727273

00:12:37.520 --> 00:12:40.040 You see that when the

NOTE Confidence: 0.900558494545455

00:12:40.040 --> 00:12:41.650 word is spoken, they're gonna

NOTE Confidence: 0.900558494545455

00:12:41.650 --> 00:12:43.760 move their eyes to the target,

NOTE Confidence: 0.900558494545455

00:12:43.760 --> 00:12:45.020 and they're not gonna move

NOTE Confidence: 0.900558494545455

00:12:45.020 --> 00:12:46.280 their eyes to the distractor.

NOTE Confidence: 0.900558494545455

00:12:46.280 --> 00:12:47.772 It's a highly reliable

NOTE Confidence: 0.900558494545455

00:12:47.772 --> 00:12:49.637 effect in 14 month olds.

NOTE Confidence: 0.900558494545455

00:12:49.640 --> 00:12:53.160 Moreover, you can teach infants a new word.

NOTE Confidence: 0.900558494545455

00:12:53.160 --> 00:12:54.708 So this is an experiment in

NOTE Confidence: 0.900558494545455

00:12:54.708 --> 00:12:56.517 which we took two novel objects

NOTE Confidence: 0.900558494545455

00:12:56.517 --> 00:12:58.317 that they'd never seen before,

NOTE Confidence: 0.900558494545455

00:12:58.320 --> 00:13:00.890 and we held them up in front of the baby

NOTE Confidence: 0.900558494545455

00:13:00.956 --> 00:13:03.719 and said the word for that object 10 times.

NOTE Confidence: 0.900558494545455

00:13:03.720 --> 00:13:05.757 So it only took like 2 minutes.

NOTE Confidence: 0.900558494545455

00:13:05.760 --> 00:13:07.489 And then we did a test using

NOTE Confidence: 0.900558494545455

00:13:07.489 --> 00:13:09.160 this very same procedure here,

NOTE Confidence: 0.900558494545455

00:13:09.160 --> 00:13:12.120 right, for those novel objects.

NOTE Confidence: 0.900558494545455

00:13:12.120 --> 00:13:15.152 And we picked these novel words for the

NOTE Confidence: 0.900558494545455

00:13:15.152 --> 00:13:17.837 novel objects during the teaching phase,

NOTE Confidence: 0.900558494545455

00:13:17.840 --> 00:13:19.960 so that in one circumstance,

NOTE Confidence: 0.900558494545455

00:13:19.960 --> 00:13:21.115 the MEB circumstance,

NOTE Confidence: 0.900558494545455

00:13:21.115 --> 00:13:24.398 there is no other word in the child's

NOTE Confidence: 0.900558494545455

00:13:24.398 --> 00:13:26.918 vocabulary that sounds like MEB.

NOTE Confidence: 0.900558494545455

00:13:26.920 --> 00:13:29.069 We had another group of subjects and

NOTE Confidence: 0.900558494545455

00:13:29.069 --> 00:13:31.257 we labeled that object Tog and we

NOTE Confidence: 0.900558494545455

00:13:31.257 --> 00:13:33.063 picked that that non word because

NOTE Confidence: 0.900558494545455

00:13:33.128 --> 00:13:35.361 it's very similar sounding to a word

NOTE Confidence: 0.900558494545455

00:13:35.361 --> 00:13:37.136 that's already in the vocabulary,

NOTE Confidence: 0.900558494545455

00:13:37.136 --> 00:13:38.360 the word dog.

NOTE Confidence: 0.900558494545455

00:13:38.360 --> 00:13:39.860 And we had another counterbalance

NOTE Confidence: 0.900558494545455

00:13:39.860 --> 00:13:41.800 condition where we had shang and gal.

NOTE Confidence: 0.900558494545455

00:13:41.800 --> 00:13:43.080 Again, the same logic.

NOTE Confidence: 0.900558494545455

00:13:43.080 --> 00:13:45.452 And what we found is that when

NOTE Confidence: 0.900558494545455

00:13:45.452 --> 00:13:47.352 we presented these novel objects

NOTE Confidence: 0.900558494545455

00:13:47.352 --> 00:13:49.480 with novel words to infants,

NOTE Confidence: 0.900558494545455

00:13:49.480 --> 00:13:51.256 they could readily learn them in

NOTE Confidence: 0.900558494545455

00:13:51.256 --> 00:13:53.318 the course of just a few minutes,

NOTE Confidence: 0.900558494545455

00:13:53.320 --> 00:13:56.004 but only when they didn't have another

NOTE Confidence: 0.900558494545455

00:13:56.004 --> 00:13:58.596 word in the vocabulary that sounded like it.

NOTE Confidence: 0.900558494545455

00:13:58.600 --> 00:14:00.556 So when we ran that condition,

NOTE Confidence: 0.900558494545455

00:14:00.560 --> 00:14:02.480 they failed on that circumstance.

NOTE Confidence: 0.900558494545455

00:14:02.480 --> 00:14:04.838 And that's mirroring effects in adult,

NOTE Confidence: 0.900558494545455

00:14:04.840 --> 00:14:06.730 where you have a much more

NOTE Confidence: 0.900558494545455

00:14:06.730 --> 00:14:07.360 complicated vocabulary,

NOTE Confidence: 0.900558494545455

00:14:07.360 --> 00:14:09.088 but it's harder to learn words

NOTE Confidence: 0.900558494545455

00:14:09.088 --> 00:14:09.952 that sound alike.

NOTE Confidence: 0.961996125333333

00:14:12.200 --> 00:14:15.976 But infants are not slaves to the particular

NOTE Confidence: 0.961996125333333

00:14:15.976 --> 00:14:19.238 words that they've heard in the past,

NOTE Confidence: 0.961996125333333

00:14:19.240 --> 00:14:21.460 because they can rapidly adjust

NOTE Confidence: 0.961996125333333

00:14:21.460 --> 00:14:23.611 how they interpret words based

NOTE Confidence: 0.961996125333333

00:14:23.611 --> 00:14:25.837 on the accent of the speaker.

NOTE Confidence: 0.961996125333333

00:14:25.840 --> 00:14:28.136 So what we did is we had two

NOTE Confidence: 0.961996125333333

00:14:28.136 --> 00:14:30.173 conditions in which infant came into

NOTE Confidence: 0.961996125333333

00:14:30.173 --> 00:14:32.991 the lab and they listened to a person

NOTE Confidence: 0.961996125333333

00:14:32.991 --> 00:14:35.273 just verify the name of an object.

NOTE Confidence: 0.961996125333333

00:14:35.280 --> 00:14:38.073 For example, in the first condition the

NOTE Confidence: 0.961996125333333

00:14:38.073 --> 00:14:40.680 tarka would speak in a normal accent,

NOTE Confidence: 0.961996125333333

00:14:40.680 --> 00:14:42.600 they'd hold up the the block

NOTE Confidence: 0.961996125333333

00:14:42.600 --> 00:14:43.880 and they'd say block.

NOTE Confidence: 0.961996125333333

00:14:43.880 --> 00:14:46.676 In another condition for other infants,

NOTE Confidence: 0.961996125333333

00:14:46.680 --> 00:14:49.344 when they came into the lab a a

NOTE Confidence: 0.961996125333333

00:14:49.344 --> 00:14:51.120 different tarka would hold up

NOTE Confidence: 0.961996125333333

00:14:51.120 --> 00:14:53.196 the block and would say black.

NOTE Confidence: 0.961996125333333

00:14:53.200 --> 00:14:54.600 And the question then is,

NOTE Confidence: 0.961996125333333

00:14:54.600 --> 00:14:57.450 after a brief exposure to the

NOTE Confidence: 0.961996125333333

00:14:57.450 --> 00:15:00.623 accent of this this novel talker,

NOTE Confidence: 0.961996125333333

00:15:00.623 --> 00:15:02.947 would infants respond appropriately

NOTE Confidence: 0.961996125333333

00:15:02.947 --> 00:15:05.576 when that mispronounced word was

NOTE Confidence: 0.961996125333333

00:15:05.576 --> 00:15:07.596 used to identify that object?

NOTE Confidence: 0.961996125333333

00:15:07.600 --> 00:15:09.399 And so they have a canonical representation

NOTE Confidence: 0.961996125333333

00:15:09.399 --> 00:15:11.278 of what that word should sound like.

NOTE Confidence: 0.961996125333333

00:15:11.280 --> 00:15:13.415 But now they're getting new information that

NOTE Confidence: 0.961996125333333

00:15:13.415 --> 00:15:15.599 this talker speaks a little bit differently.

NOTE Confidence: 0.961996125333333

00:15:15.600 --> 00:15:18.696 And the answer is that 18 month olds would

NOTE Confidence: 0.961996125333333

00:15:18.696 --> 00:15:20.797 readily look at the object that was labeled,

NOTE Confidence: 0.961996125333333

00:15:20.800 --> 00:15:23.356 even when it was labeled by

NOTE Confidence: 0.961996125333333

00:15:23.356 --> 00:15:24.634 this incorrect pronunciation,

NOTE Confidence: 0.961996125333333

00:15:24.640 --> 00:15:26.536 only in the condition in which they had

NOTE Confidence: 0.961996125333333

00:15:26.536 --> 00:15:28.600 heard it used by that particular talker.

NOTE Confidence: 0.961996125333333

00:15:28.600 --> 00:15:29.340 And moreover,

NOTE Confidence: 0.961996125333333

00:15:29.340 --> 00:15:31.560 even though they had not been

NOTE Confidence: 0.961996125333333

00:15:31.560 --> 00:15:33.400 exposed to this word here,

NOTE Confidence: 0.961996125333333

00:15:33.400 --> 00:15:35.076 which is canonical bottle,

NOTE Confidence: 0.961996125333333

00:15:35.076 --> 00:15:37.590 even though they had not heard

NOTE Confidence: 0.961996125333333

00:15:37.665 --> 00:15:40.080 the talker who spoke in the funny

NOTE Confidence: 0.961996125333333

00:15:40.080 --> 00:15:42.399 accent by calling a block a black,

NOTE Confidence: 0.961996125333333

00:15:42.400 --> 00:15:44.353 they had not heard them say the word battle.

NOTE Confidence: 0.961996125333333

00:15:44.360 --> 00:15:46.440 When they were tested with the word battle,

NOTE Confidence: 0.961996125333333

00:15:46.440 --> 00:15:48.120 they generalized to that,

NOTE Confidence: 0.961996125333333

00:15:48.120 --> 00:15:51.163 so they rapidly are able to adapt

NOTE Confidence: 0.961996125333333

00:15:51.163 --> 00:15:53.340 their representation of the talkers

NOTE Confidence: 0.961996125333333

00:15:53.340 --> 00:15:55.950 spoken word and matching it to

NOTE Confidence: 0.961996125333333

00:15:56.031 --> 00:15:57.916 objects in the real world.

NOTE Confidence: 0.961996125333333

00:15:57.920 --> 00:15:59.000 And finally you can ask,

NOTE Confidence: 0.961996125333333

00:15:59.000 --> 00:16:01.106 well what about what you might

NOTE Confidence: 0.961996125333333

00:16:01.106 --> 00:16:02.159 call semantic competition?

NOTE Confidence: 0.961996125333333

00:16:02.160 --> 00:16:04.771 Is it the case that infants have

NOTE Confidence: 0.961996125333333

00:16:04.771 --> 00:16:06.823 semantic categories of objects and

NOTE Confidence: 0.961996125333333

00:16:06.823 --> 00:16:08.963 that that influences how readily

NOTE Confidence: 0.961996125333333

00:16:08.963 --> 00:16:11.047 they can recognize the spoken

NOTE Confidence: 0.961996125333333

00:16:11.047 --> 00:16:13.237 word that refers to that object?

NOTE Confidence: 0.961996125333333

00:16:13.240 --> 00:16:15.502 So Elica Bergeson did this really

NOTE Confidence: 0.961996125333333

00:16:15.502 --> 00:16:17.359 interesting experiment in which half

NOTE Confidence: 0.961996125333333

00:16:17.359 --> 00:16:19.190 of the objects pairs were related.

NOTE Confidence: 0.961996125333333

00:16:19.190 --> 00:16:21.446 For example, foot and hand right, they're,

NOTE Confidence: 0.961996125333333

00:16:21.446 --> 00:16:23.032 they're kind of body parts, right?

NOTE Confidence: 0.961996125333333

00:16:23.032 --> 00:16:24.440 Or juice and milk.

NOTE Confidence: 0.961996125333333

00:16:24.440 --> 00:16:26.120 They're both things that you can

NOTE Confidence: 0.961996125333333

00:16:26.120 --> 00:16:27.964 drink compared to random pairings

NOTE Confidence: 0.961996125333333

00:16:27.964 --> 00:16:29.919 on the right hand side.

NOTE Confidence: 0.961996125333333

00:16:29.920 --> 00:16:30.956 And what we found,

NOTE Confidence: 0.961996125333333

00:16:30.956 --> 00:16:33.006 even in six month old infants who have

NOTE Confidence: 0.961996125333333

00:16:33.006 --> 00:16:34.895 a very, very rudimentary vocabulary,

NOTE Confidence: 0.961996125333333

00:16:34.895 --> 00:16:37.320 even at that early age,

NOTE Confidence: 0.961996125333333

00:16:37.320 --> 00:16:39.342 they were more readily able to

NOTE Confidence: 0.961996125333333

00:16:39.342 --> 00:16:41.732 look to the object that was labeled

NOTE Confidence: 0.961996125333333

00:16:41.732 --> 00:16:43.993 when it was in the presence of

NOTE Confidence: 0.961996125333333

00:16:44.068 --> 00:16:45.718 an unrelated competitor.

NOTE Confidence: 0.961996125333333

00:16:45.720 --> 00:16:47.292 When it was in the presence

NOTE Confidence: 0.961996125333333

00:16:47.292 --> 00:16:48.078 of related competitor,

NOTE Confidence: 0.961996125333333

00:16:48.080 --> 00:16:49.304 they had more difficulty,

NOTE Confidence: 0.961996125333333

00:16:49.304 --> 00:16:51.024 just as in the previous case

NOTE Confidence: 0.961996125333333

00:16:51.024 --> 00:16:51.760 that I referred to,

NOTE Confidence: 0.961996125333333

00:16:51.760 --> 00:16:53.560 where if they sound alike,

NOTE Confidence: 0.961996125333333

00:16:53.560 --> 00:16:55.720 that is a competition effect.

NOTE Confidence: 0.961996125333333

00:16:55.720 --> 00:16:57.688 So it's both at the phonological

NOTE Confidence: 0.961996125333333

00:16:57.688 --> 00:17:00.080 level and at the semantic level.

NOTE Confidence: 0.961996125333333

00:17:00.080 --> 00:17:00.512 Moreover,

NOTE Confidence: 0.961996125333333

00:17:00.512 --> 00:17:02.672 Elica did this heroic study

NOTE Confidence: 0.961996125333333

00:17:02.672 --> 00:17:04.400 called the Seedlings Project,

NOTE Confidence: 0.961996125333333

00:17:04.400 --> 00:17:05.680 in which she studied infants

NOTE Confidence: 0.961996125333333

00:17:05.680 --> 00:17:07.700 from 6 to 18 months of age in

NOTE Confidence: 0.961996125333333

00:17:07.700 --> 00:17:09.303 the home by using what's called a

NOTE Confidence: 0.904897652727273

00:17:09.360 --> 00:17:10.000 head camera.

NOTE Confidence: 0.904897652727273

00:17:10.000 --> 00:17:12.673 And it was a clever design at the time.

NOTE Confidence: 0.904897652727273

00:17:12.680 --> 00:17:16.150 Technology is much better now to use

NOTE Confidence: 0.904897652727273

00:17:16.150 --> 00:17:18.355 two different cameras at the same time.

NOTE Confidence: 0.904897652727273

00:17:18.360 --> 00:17:20.280 So there's one camera that's looking

NOTE Confidence: 0.904897652727273

00:17:20.280 --> 00:17:22.290 tilted down so you can see what

NOTE Confidence: 0.904897652727273

00:17:22.290 --> 00:17:23.760 the baby's holding in their hands,

NOTE Confidence: 0.904897652727273

00:17:23.760 --> 00:17:26.358 and another camera that's tilted up

NOTE Confidence: 0.904897652727273

00:17:26.360 --> 00:17:28.095 because typically adults are higher

NOTE Confidence: 0.904897652727273

00:17:28.095 --> 00:17:30.440 in in posture than in the baby.

NOTE Confidence: 0.904897652727273

00:17:30.440 --> 00:17:32.148 So we could see both what the

NOTE Confidence: 0.904897652727273

00:17:32.148 --> 00:17:33.813 mother was doing and what the

NOTE Confidence: 0.904897652727273

00:17:33.813 --> 00:17:35.679 baby was doing with their hands.

NOTE Confidence: 0.904897652727273

00:17:35.680 --> 00:17:37.132 And then the babies were brought

NOTE Confidence: 0.904897652727273

00:17:37.132 --> 00:17:38.836 back into the laboratory so we could

NOTE Confidence: 0.904897652727273

00:17:38.836 --> 00:17:39.981 look at the relationship between

NOTE Confidence: 0.904897652727273

00:17:39.981 --> 00:17:41.475 what they saw in their natural

NOTE Confidence: 0.904897652727273

00:17:41.475 --> 00:17:42.951 environment and how they performed on

NOTE Confidence: 0.904897652727273

00:17:42.960 --> 00:17:45.840 one of these word recognition tasks.

NOTE Confidence: 0.904897652727273

00:17:45.840 --> 00:17:47.436 And what we wanted to know is

NOTE Confidence: 0.904897652727273

00:17:47.436 --> 00:17:48.600 what predicts word learning.

NOTE Confidence: 0.904897652727273

00:17:48.600 --> 00:17:50.679 So for particular objects in the environment,

NOTE Confidence: 0.904897652727273

00:17:50.680 --> 00:17:52.410 what allowed babies to perform

NOTE Confidence: 0.904897652727273

00:17:52.410 --> 00:17:53.794 well in the lab?

NOTE Confidence: 0.904897652727273

00:17:53.800 --> 00:17:56.649 And the answer is that what was

NOTE Confidence: 0.904897652727273

00:17:56.649 --> 00:17:59.413 present in the field of view of

NOTE Confidence: 0.904897652727273

00:17:59.413 --> 00:18:01.171 the infant while the mother spoke

NOTE Confidence: 0.904897652727273

00:18:01.171 --> 00:18:03.037 a particular word was the best

NOTE Confidence: 0.904897652727273

00:18:03.037 --> 00:18:04.277 predictor of them learning.

NOTE Confidence: 0.904897652727273

00:18:04.280 --> 00:18:06.302 So it's the joint attention while

NOTE Confidence: 0.904897652727273

00:18:06.302 --> 00:18:08.316 they were listening to the word

NOTE Confidence: 0.904897652727273

00:18:08.316 --> 00:18:10.122 that the mother was speaking that

NOTE Confidence: 0.904897652727273

00:18:10.122 --> 00:18:12.470 had the best prediction for their

NOTE Confidence: 0.904897652727273

00:18:12.470 --> 00:18:14.154 performance in the laboratory.

NOTE Confidence: 0.904897652727273

00:18:14.160 --> 00:18:16.128 So I'm gonna segue now from

NOTE Confidence: 0.904897652727273

00:18:16.128 --> 00:18:17.112 these behavioral results,

NOTE Confidence: 0.904897652727273

00:18:17.120 --> 00:18:18.758 which I think are incredibly powerful,

NOTE Confidence: 0.904897652727273

00:18:18.760 --> 00:18:20.320 but they have some limitations.

NOTE Confidence: 0.904897652727273

00:18:20.320 --> 00:18:22.640 Why would we want to study the brain?

NOTE Confidence: 0.904897652727273

00:18:22.640 --> 00:18:23.146 Well,

NOTE Confidence: 0.904897652727273

00:18:23.146 --> 00:18:26.182 we can infer that there's some

NOTE Confidence: 0.904897652727273

00:18:26.182 --> 00:18:28.376 brain mechanism that must

NOTE Confidence: 0.904897652727273

00:18:28.376 --> 00:18:30.720 be controlling the behavior.

NOTE Confidence: 0.904897652727273

00:18:30.720 --> 00:18:31.972 And the behavior is,

NOTE Confidence: 0.904897652727273

00:18:31.972 --> 00:18:32.598 you know,

NOTE Confidence: 0.904897652727273

00:18:32.600 --> 00:18:34.796 it's an existence proof that that

NOTE Confidence: 0.904897652727273

00:18:34.796 --> 00:18:36.260 brain mechanism is functioning

NOTE Confidence: 0.904897652727273

00:18:36.323 --> 00:18:37.639 at that particular age.

NOTE Confidence: 0.904897652727273

00:18:37.640 --> 00:18:39.584 And in invasive neuroscience,

NOTE Confidence: 0.904897652727273

00:18:39.584 --> 00:18:40.556 animal studies,

NOTE Confidence: 0.904897652727273

00:18:40.560 --> 00:18:43.440 for example our studies of patients,

NOTE Confidence: 0.904897652727273

00:18:43.440 --> 00:18:44.905 under some circumstances you can

NOTE Confidence: 0.904897652727273

00:18:44.905 --> 00:18:46.752 do things that are just simply

NOTE Confidence: 0.904897652727273

00:18:46.752 --> 00:18:48.726 not possible to do with your

NOTE Confidence: 0.904897652727273

00:18:48.726 --> 00:18:50.352 typically developing infant for

NOTE Confidence: 0.904897652727273

00:18:50.352 --> 00:18:52.880 ethical reasons among others.

NOTE Confidence: 0.904897652727273

00:18:52.880 --> 00:18:55.568 So we have to use non invasive

NOTE Confidence: 0.904897652727273

00:18:55.568 --> 00:18:57.360 imaging techniques with infants,

NOTE Confidence: 0.904897652727273

00:18:57.360 --> 00:19:00.745 and each one of these imaging

NOTE Confidence: 0.904897652727273

00:19:00.745 --> 00:19:02.840 techniques has its pros and cons.

NOTE Confidence: 0.904897652727273

00:19:02.840 --> 00:19:04.384 So we have EEG,

NOTE Confidence: 0.904897652727273

00:19:04.384 --> 00:19:06.314 very easy to record EEG,

NOTE Confidence: 0.904897652727273

00:19:06.320 --> 00:19:08.812 very difficult to make it clear EEG

NOTE Confidence: 0.904897652727273

00:19:08.812 --> 00:19:11.199 signals because of movement artifacts.

NOTE Confidence: 0.904897652727273

00:19:11.200 --> 00:19:13.265 We have Meg which is super expensive

NOTE Confidence: 0.904897652727273

00:19:13.265 --> 00:19:15.574 and there are very few labs that

NOTE Confidence: 0.904897652727273

00:19:15.574 --> 00:19:17.279 have infant friendly Meg systems.

NOTE Confidence: 0.904897652727273

00:19:17.280 --> 00:19:19.560 Brain works in 100 college

NOTE Confidence: 0.904897652727273

00:19:19.560 --> 00:19:21.840 will be one such place.

NOTE Confidence: 0.904897652727273

00:19:21.840 --> 00:19:24.150 We have MRI which is great because

NOTE Confidence: 0.904897652727273

00:19:24.150 --> 00:19:26.439 it has exquisite spatial resolution,

NOTE Confidence: 0.904897652727273

00:19:26.440 --> 00:19:29.200 not so good temporal resolution.

NOTE Confidence: 0.904897652727273

00:19:29.200 --> 00:19:30.930 Lots of complicating factors for

NOTE Confidence: 0.904897652727273

00:19:30.930 --> 00:19:32.314 studying infancy young children,

NOTE Confidence: 0.904897652727273

00:19:32.320 --> 00:19:35.560 but I'll comment on that in a few minutes.

NOTE Confidence: 0.904897652727273

00:19:35.560 --> 00:19:37.060 And nears which is near

NOTE Confidence: 0.904897652727273

00:19:37.060 --> 00:19:38.200 infrared spectroscopy,

NOTE Confidence: 0.904897652727273

00:19:38.200 --> 00:19:40.228 which has certain advantages in terms

NOTE Confidence: 0.904897652727273

00:19:40.228 --> 00:19:42.407 of recording from babies while they're

NOTE Confidence: 0.904897652727273

00:19:42.407 --> 00:19:44.317 sort of in naturalistic conditions.

NOTE Confidence: 0.904897652727273

00:19:44.320 --> 00:19:47.462 So you have to think about why

NOTE Confidence: 0.904897652727273

00:19:47.462 --> 00:19:49.447 would we want to expend a lot

NOTE Confidence: 0.904897652727273

00:19:49.447 --> 00:19:51.235 of time and energy studying the

NOTE Confidence: 0.904897652727273

00:19:51.235 --> 00:19:53.496 brains of infants when behavior has

NOTE Confidence: 0.904897652727273

00:19:53.496 --> 00:19:55.396 revealed so many interesting things.

NOTE Confidence: 0.904897652727273

00:19:55.400 --> 00:19:55.693 Well,

NOTE Confidence: 0.904897652727273

00:19:55.693 --> 00:19:58.037 I think for me one of the fundamental

NOTE Confidence: 0.904897652727273

00:19:58.037 --> 00:19:59.888 reasons for studying the brain and

NOTE Confidence: 0.904897652727273

00:19:59.888 --> 00:20:02.480 when I started doing this work 15 years ago.

NOTE Confidence: 0.904897652727273

00:20:02.480 --> 00:20:04.568 Is that you can imagine some

NOTE Confidence: 0.904897652727273

00:20:04.568 --> 00:20:06.868 qualitative change that occurs at the

NOTE Confidence: 0.904897652727273

00:20:06.868 --> 00:20:08.560 behavioral level during development.

NOTE Confidence: 0.933096833

00:20:08.560 --> 00:20:10.224 And it's, for example,

NOTE Confidence: 0.933096833

00:20:10.224 --> 00:20:12.720 babies go from crawling to walking.

NOTE Confidence: 0.933096833

00:20:12.720 --> 00:20:14.120 What allows that to happen?

NOTE Confidence: 0.933096833

00:20:14.120 --> 00:20:15.205 And it's sort of seductive

NOTE Confidence: 0.933096833

00:20:15.205 --> 00:20:16.073 to think that well,

NOTE Confidence: 0.933096833

00:20:16.080 --> 00:20:18.796 that they have this huge qualitative change.

NOTE Confidence: 0.933096833

00:20:18.800 --> 00:20:20.530 It must be because something

NOTE Confidence: 0.933096833

00:20:20.530 --> 00:20:21.914 in the brain changed.

NOTE Confidence: 0.933096833

00:20:21.920 --> 00:20:24.116 Now what is it that changed in the brain?

NOTE Confidence: 0.933096833

00:20:24.120 --> 00:20:26.100 Maybe there's a new mechanism that

NOTE Confidence: 0.933096833

00:20:26.100 --> 00:20:28.519 was latent and that suddenly appears.

NOTE Confidence: 0.933096833

00:20:28.520 --> 00:20:29.948 Or maybe it's the case that

NOTE Confidence: 0.933096833

00:20:29.948 --> 00:20:31.280 the brain is just noisy.

NOTE Confidence: 0.933096833

00:20:31.280 --> 00:20:32.240 Well, how would you know that?

NOTE Confidence: 0.933096833

00:20:32.240 --> 00:20:34.920 You'd have to study the brain, right?

NOTE Confidence: 0.933096833

00:20:34.920 --> 00:20:36.430 Similarly, what if there's an

NOTE Confidence: 0.933096833

00:20:36.430 --> 00:20:37.638 absence of qualitative change?

NOTE Confidence: 0.933096833

00:20:37.640 --> 00:20:39.452 What if it looks like a

NOTE Confidence: 0.933096833

00:20:39.452 --> 00:20:40.358 just continuous development?

NOTE Confidence: 0.933096833

00:20:40.360 --> 00:20:41.680 Well, then a sort of seductive to think,

NOTE Confidence: 0.933096833

00:20:41.680 --> 00:20:43.560 well, there's really not a

NOTE Confidence: 0.933096833

00:20:43.560 --> 00:20:45.440 fundamental change in the brain.

NOTE Confidence: 0.933096833

00:20:45.440 --> 00:20:46.612 It's just getting better.

NOTE Confidence: 0.933096833

00:20:46.612 --> 00:20:48.287 But you don't know that, right?

NOTE Confidence: 0.933096833

00:20:48.287 --> 00:20:49.736 The only way you would know you

NOTE Confidence: 0.933096833

00:20:49.736 --> 00:20:50.960 could have the same behavior.

NOTE Confidence: 0.933096833

00:20:50.960 --> 00:20:52.906 It could be mediated by two different

NOTE Confidence: 0.933096833

00:20:52.906 --> 00:20:54.520 brain mechanisms at different ages.

NOTE Confidence: 0.933096833

00:20:54.520 --> 00:20:55.535 And the only way to know that

NOTE Confidence: 0.933096833

00:20:55.535 --> 00:20:56.360 is to study the brain.

NOTE Confidence: 0.933096833

00:20:56.360 --> 00:20:57.400 I mean, it seems obvious,

NOTE Confidence: 0.933096833

00:20:57.400 --> 00:20:59.200 but that's a rationale

NOTE Confidence: 0.933096833

00:20:59.200 --> 00:21:01.000 for studying the brain.

NOTE Confidence: 0.933096833

00:21:01.000 --> 00:21:02.746 And another reason which is more

NOTE Confidence: 0.933096833

00:21:02.746 --> 00:21:04.500 practical is that typically you would

NOTE Confidence: 0.933096833

00:21:04.500 --> 00:21:06.397 expect the development of the brain to

NOTE Confidence: 0.933096833

00:21:06.397 --> 00:21:08.078 precede the development of behavior,

NOTE Confidence: 0.933096833

00:21:08.080 --> 00:21:08.352 right?

NOTE Confidence: 0.933096833

00:21:08.352 --> 00:21:09.984 Behavior has to be assembled from

NOTE Confidence: 0.933096833

00:21:09.984 --> 00:21:11.838 a whole series of brain mechanisms,

NOTE Confidence: 0.933096833

00:21:11.840 --> 00:21:14.136 and therefore if you could find a

NOTE Confidence: 0.933096833

00:21:14.136 --> 00:21:16.203 brain mechanism that's predictive of

NOTE Confidence: 0.933096833

00:21:16.203 --> 00:21:18.235 the subsequent behavioral development,

NOTE Confidence: 0.933096833

00:21:18.240 --> 00:21:20.262 then that allows you not only

NOTE Confidence: 0.933096833

00:21:20.262 --> 00:21:21.273 to intervene earlier,

NOTE Confidence: 0.933096833

00:21:21.280 --> 00:21:22.900 but to understand the mechanism

NOTE Confidence: 0.933096833

00:21:22.900 --> 00:21:25.120 itself that led to the behavior.

NOTE Confidence: 0.933096833

00:21:25.120 --> 00:21:27.626 So how have these neural methods been

NOTE Confidence: 0.933096833

00:21:27.626 --> 00:21:29.520 applied to language development?

NOTE Confidence: 0.933096833

00:21:29.520 --> 00:21:29.872 I'm,

NOTE Confidence: 0.933096833

00:21:29.872 --> 00:21:31.632 I'm gonna review some really

NOTE Confidence: 0.933096833

00:21:31.632 --> 00:21:33.040 kind of quickly here.

NOTE Confidence: 0.933096833

00:21:33.040 --> 00:21:33.874 Phonetic discrimination,

NOTE Confidence: 0.933096833

00:21:33.874 --> 00:21:35.959 which we've already talked about.

NOTE Confidence: 0.933096833

00:21:35.960 --> 00:21:36.554 Statistical learning,

NOTE Confidence: 0.933096833

00:21:36.554 --> 00:21:38.039 which we've already talked about,

NOTE Confidence: 0.933096833

00:21:38.040 --> 00:21:39.120 Spoken word recognition,

NOTE Confidence: 0.933096833

00:21:39.120 --> 00:21:40.920 which you've already talked about.

NOTE Confidence: 0.933096833

00:21:40.920 --> 00:21:43.920 And then talk about some really

NOTE Confidence: 0.933096833

00:21:43.920 --> 00:21:45.920 interesting work that's being

NOTE Confidence: 0.933096833

00:21:45.920 --> 00:21:47.905 conducted that use sort of

NOTE Confidence: 0.933096833

00:21:47.905 --> 00:21:49.890 modern neuro imaging and machine

NOTE Confidence: 0.933096833

00:21:49.959 --> 00:21:51.843 learning techniques to understand

NOTE Confidence: 0.933096833

00:21:51.843 --> 00:21:54.198 the functioning of the brain.

NOTE Confidence: 0.933096833

00:21:54.200 --> 00:21:55.148 And importantly,

NOTE Confidence: 0.933096833

00:21:55.148 --> 00:21:57.518 because infants and young children

NOTE Confidence: 0.933096833

00:21:57.518 --> 00:22:00.479 are not terribly cooperative subjects,

NOTE Confidence: 0.933096833

00:22:00.480 --> 00:22:01.920 at least not all the time.

NOTE Confidence: 0.933096833

00:22:01.920 --> 00:22:04.048 Using naturalistic viewing conditions,

NOTE Confidence: 0.933096833

00:22:04.048 --> 00:22:06.708 particularly movie watching as a

NOTE Confidence: 0.933096833

00:22:06.708 --> 00:22:09.296 way to extend our data collection

NOTE Confidence: 0.933096833

00:22:09.296 --> 00:22:11.408 from typical behavioral laboratory

NOTE Confidence: 0.933096833

00:22:11.408 --> 00:22:14.230 experiments where you might get four

NOTE Confidence: 0.933096833

00:22:14.230 --> 00:22:16.408 or five minutes worth of data to

NOTE Confidence: 0.933096833

00:22:16.408 --> 00:22:18.144 longer periods of time when we can

NOTE Confidence: 0.933096833

00:22:18.144 --> 00:22:20.356 make sense of the underlying brain signals.

NOTE Confidence: 0.933096833

00:22:20.360 --> 00:22:24.028 So the classic EEG or ERP event

NOTE Confidence: 0.933096833

00:22:24.028 --> 00:22:26.560 related potential approach is to repeat

NOTE Confidence: 0.933096833

00:22:26.560 --> 00:22:28.480 a stimulus some number of times,

NOTE Confidence: 0.933096833

00:22:28.480 --> 00:22:31.276 typically in the dozens of times,

NOTE Confidence: 0.933096833

00:22:31.280 --> 00:22:33.662 and do some sort of stimulus

NOTE Confidence: 0.933096833

00:22:33.662 --> 00:22:35.780 manipulation and find a component

NOTE Confidence: 0.933096833

00:22:35.780 --> 00:22:38.480 in the average waveform that is

NOTE Confidence: 0.933096833

00:22:38.480 --> 00:22:40.680 indicative of the underlying

NOTE Confidence: 0.933096833

00:22:40.680 --> 00:22:42.871 process that you believe is it is

NOTE Confidence: 0.933096833

00:22:42.871 --> 00:22:44.600 being triggered by the stimuli.

NOTE Confidence: 0.933096833

00:22:44.600 --> 00:22:46.910 So for example you can do a

NOTE Confidence: 0.933096833

00:22:46.910 --> 00:22:49.660 classic ERP study in which you show

NOTE Confidence: 0.933096833

00:22:49.660 --> 00:22:50.920 a mismatch negativity,

NOTE Confidence: 0.933096833

00:22:50.920 --> 00:22:53.584 a response to the odd stimulus

NOTE Confidence: 0.933096833

00:22:53.584 --> 00:22:55.360 among series of stimuli,

NOTE Confidence: 0.933096833

00:22:55.360 --> 00:22:57.760 and that's been quite powerful.

NOTE Confidence: 0.933096833

00:22:57.760 --> 00:22:59.696 It's been used by Pat Cool and others

NOTE Confidence: 0.933096833

00:22:59.696 --> 00:23:01.233 to study phonetic discrimination

NOTE Confidence: 0.933096833

00:23:01.233 --> 00:23:03.718 discrimination of different speech sounds,

NOTE Confidence: 0.933096833

00:23:03.720 --> 00:23:07.256 showing that natives speech sounds

NOTE Confidence: 0.933096833

00:23:07.256 --> 00:23:10.096 are discriminated better by this

NOTE Confidence: 0.933096833

00:23:10.096 --> 00:23:11.800 ERP component than

NOTE Confidence: 0.92012878

00:23:11.893 --> 00:23:14.080 non-native speech sounds,

NOTE Confidence: 0.92012878

00:23:14.080 --> 00:23:16.700 and moreover that that difference

NOTE Confidence: 0.92012878

00:23:16.700 --> 00:23:19.320 between native and non-native responding

NOTE Confidence: 0.92012878

00:23:19.320 --> 00:23:22.230 from the ERP signal is predictive

NOTE Confidence: 0.92012878

00:23:22.230 --> 00:23:24.170 of their subsequent vocabulary

NOTE Confidence: 0.92012878

00:23:24.246 --> 00:23:26.640 development in terms of word production.

NOTE Confidence: 0.92012878

00:23:26.640 --> 00:23:29.538 So it's it's a converging operation

NOTE Confidence: 0.92012878

00:23:29.538 --> 00:23:32.047 between the behavioral results and

NOTE Confidence: 0.92012878

00:23:32.047 --> 00:23:34.333 the underlying brain mechanism within

NOTE Confidence: 0.92012878

00:23:34.333 --> 00:23:35.798 the domain of statistical learning.

NOTE Confidence: 0.92012878

00:23:35.800 --> 00:23:37.280 Of interesting technique that's

NOTE Confidence: 0.92012878

00:23:37.280 --> 00:23:40.003 been used again with EEG is called

NOTE Confidence: 0.92012878

00:23:40.003 --> 00:23:42.744 frequency tagging and the basic idea is

NOTE Confidence: 0.92012878

00:23:42.744 --> 00:23:44.880 illustrated here in a visual example.

NOTE Confidence: 0.92012878

00:23:44.880 --> 00:23:46.844 Let's imagine we're interested

NOTE Confidence: 0.92012878

00:23:46.844 --> 00:23:48.317 in face discrimination.

NOTE Confidence: 0.92012878

00:23:48.320 --> 00:23:51.256 Well, what you can do is present a

NOTE Confidence: 0.92012878

00:23:51.256 --> 00:23:54.462 series of images very rapidly and notice

NOTE Confidence: 0.92012878

00:23:54.462 --> 00:23:57.599 that every 5th stimulus is a phase.

NOTE Confidence: 0.92012878

00:23:57.600 --> 00:23:59.595 And So what that means is you're

NOTE Confidence: 0.92012878

00:23:59.595 --> 00:24:01.638 going to get a component in the

NOTE Confidence: 0.92012878

00:24:01.638 --> 00:24:04.320 EEG that is oscillating at the

NOTE Confidence: 0.92012878

00:24:04.320 --> 00:24:06.720 rate of each individual stimulus,

NOTE Confidence: 0.92012878

00:24:06.720 --> 00:24:09.048 which is that fairly high rate

NOTE Confidence: 0.92012878

00:24:09.048 --> 00:24:10.600 of 6 per second.

NOTE Confidence: 0.92012878

00:24:10.600 --> 00:24:12.124 But every 5th stimulus,

NOTE Confidence: 0.92012878

00:24:12.124 --> 00:24:14.410 there's going to be a component

NOTE Confidence: 0.92012878

00:24:14.486 --> 00:24:16.356 that is specific to phases,

NOTE Confidence: 0.92012878

00:24:16.360 --> 00:24:17.920 and if that component is present,

NOTE Confidence: 0.92012878

00:24:17.920 --> 00:24:19.948 then you can conclude that the

NOTE Confidence: 0.92012878

00:24:19.948 --> 00:24:21.300 faces have been discriminated

NOTE Confidence: 0.92012878

00:24:21.364 --> 00:24:23.086 from all of the other stimuli

NOTE Confidence: 0.92012878

00:24:23.086 --> 00:24:24.919 that are presented in the stream.

NOTE Confidence: 0.92012878

00:24:24.920 --> 00:24:26.635 And this has been used in in

NOTE Confidence: 0.92012878

00:24:26.635 --> 00:24:28.125 a very interesting series of

NOTE Confidence: 0.92012878

00:24:28.125 --> 00:24:29.517 experiments by Laura Battering

NOTE Confidence: 0.933474171111111

00:24:31.760 --> 00:24:33.980 and colleagues in which they

NOTE Confidence: 0.933474171111111

00:24:33.980 --> 00:24:35.756 looked at statistical learning.

NOTE Confidence: 0.933474171111111

00:24:35.760 --> 00:24:37.762 These are the same kinds of stimuli

NOTE Confidence: 0.933474171111111

00:24:37.762 --> 00:24:39.455 that I described earlier with

NOTE Confidence: 0.933474171111111

00:24:39.455 --> 00:24:40.999 regard to behavioral studies.

NOTE Confidence: 0.933474171111111

00:24:41.000 --> 00:24:43.000 So these are syllables that

NOTE Confidence: 0.933474171111111

00:24:43.000 --> 00:24:44.600 are grouped into triples.

NOTE Confidence: 0.933474171111111

00:24:44.600 --> 00:24:46.120 And the question then is,

NOTE Confidence: 0.933474171111111

00:24:46.120 --> 00:24:48.180 in the EEG signal,

NOTE Confidence: 0.933474171111111

00:24:48.180 --> 00:24:51.740 you're going to see a component at

NOTE Confidence: 0.933474171111111

00:24:51.740 --> 00:24:53.700 each individual syllable, right?

NOTE Confidence: 0.933474171111111

00:24:53.700 --> 00:24:56.000 That's a relatively high rate.

NOTE Confidence: 0.933474171111111

00:24:56.000 --> 00:24:57.204 But the question is,

NOTE Confidence: 0.933474171111111

00:24:57.204 --> 00:24:59.010 will you see a component at

NOTE Confidence: 0.933474171111111

00:24:59.076 --> 00:25:00.860 the level of the triple which

NOTE Confidence: 0.933474171111111

00:25:00.860 --> 00:25:03.210 will be 1/3 of that that rate?

NOTE Confidence: 0.933474171111111

00:25:03.210 --> 00:25:04.835 And the answer is yes,

NOTE Confidence: 0.933474171111111

00:25:04.840 --> 00:25:06.412 you see a big component at

NOTE Confidence: 0.933474171111111

00:25:06.412 --> 00:25:07.198 the syllable frequency,

NOTE Confidence: 0.933474171111111

00:25:07.200 --> 00:25:08.982 but you also see a reliable

NOTE Confidence: 0.933474171111111

00:25:08.982 --> 00:25:10.840 component at the word frequency,

NOTE Confidence: 0.933474171111111

00:25:10.840 --> 00:25:13.084 which tells you that that word

NOTE Confidence: 0.933474171111111

00:25:13.084 --> 00:25:14.580 information has been extracted

NOTE Confidence: 0.933474171111111

00:25:14.643 --> 00:25:16.358 from this stream of stimuli.

NOTE Confidence: 0.933474171111111

00:25:16.360 --> 00:25:18.243 And the nice thing about this is

NOTE Confidence: 0.933474171111111

00:25:18.243 --> 00:25:19.600 there's no behavioral component.

NOTE Confidence: 0.933474171111111

00:25:19.600 --> 00:25:21.800 It doesn't require looking time.

NOTE Confidence: 0.933474171111111

00:25:21.800 --> 00:25:23.444 It's just simply passive

NOTE Confidence: 0.933474171111111

00:25:23.444 --> 00:25:24.677 listening to stimuli,

NOTE Confidence: 0.933474171111111

00:25:24.680 --> 00:25:27.080 which can have some clinical importance.

NOTE Confidence: 0.908943111428571

00:25:29.160 --> 00:25:32.536 As I alluded to, there are other techniques

NOTE Confidence: 0.908943111428571

00:25:32.536 --> 00:25:36.064 that can be used to study both MRI and EEG.

NOTE Confidence: 0.908943111428571

00:25:36.064 --> 00:25:40.040 So let me give you an example from MRI first.

NOTE Confidence: 0.908943111428571

00:25:40.040 --> 00:25:41.944 So imagine that you're interested in two

NOTE Confidence: 0.908943111428571

00:25:41.944 --> 00:25:43.439 different categories of visual stimuli.

NOTE Confidence: 0.908943111428571

00:25:43.440 --> 00:25:46.800 This is just a simple example here

NOTE Confidence: 0.908943111428571

00:25:46.800 --> 00:25:50.248 from from Jim Haxby where you have one

NOTE Confidence: 0.908943111428571

00:25:50.248 --> 00:25:52.540 class of stimuli, the bottle class,

NOTE Confidence: 0.908943111428571

00:25:52.540 --> 00:25:55.122 and another class of stimuli, the shoe class.

NOTE Confidence: 0.908943111428571

00:25:55.122 --> 00:25:57.862 Now you you've got a whole set of voxels

NOTE Confidence: 0.908943111428571

00:25:57.862 --> 00:26:00.318 in the brain that you can record from,

NOTE Confidence: 0.908943111428571

00:26:00.320 --> 00:26:01.946 and what you're doing is you're

NOTE Confidence: 0.908943111428571

00:26:01.946 --> 00:26:03.800 looking for a pattern of activation.

NOTE Confidence: 0.908943111428571

00:26:03.800 --> 00:26:05.096 You're not looking for a hot

NOTE Confidence: 0.908943111428571

00:26:05.096 --> 00:26:05.960 spot in the brain,

NOTE Confidence: 0.908943111428571

00:26:05.960 --> 00:26:08.242 but you're looking for a pattern of

NOTE Confidence: 0.908943111428571

00:26:08.242 --> 00:26:10.883 activation across a number of voxels that

NOTE Confidence: 0.908943111428571

00:26:10.883 --> 00:26:14.098 discriminates reliably between the first

NOTE Confidence: 0.908943111428571

00:26:14.098 --> 00:26:18.719 category bottle and the second category shoe.

NOTE Confidence: 0.908943111428571

00:26:18.720 --> 00:26:21.708 And so you train the model to look for

NOTE Confidence: 0.908943111428571

00:26:21.708 --> 00:26:24.199 that discriminating pair of patterns

NOTE Confidence: 0.908943111428571

00:26:24.199 --> 00:26:26.950 and then apply that to novel data that

NOTE Confidence: 0.908943111428571

00:26:26.950 --> 00:26:29.400 are not involved in the training set.

NOTE Confidence: 0.908943111428571

00:26:29.400 --> 00:26:32.160 And you can employ that very

NOTE Confidence: 0.908943111428571

00:26:32.160 --> 00:26:34.000 same technique with EEG.

NOTE Confidence: 0.908943111428571

00:26:34.000 --> 00:26:35.596 So instead of looking at voxels,

NOTE Confidence: 0.908943111428571

00:26:35.600 --> 00:26:38.148 you can look at patterns of activation

NOTE Confidence: 0.908943111428571

00:26:38.148 --> 00:26:39.670 across different channels from

NOTE Confidence: 0.908943111428571

00:26:39.670 --> 00:26:41.520 different electrodes on the scalp.

NOTE Confidence: 0.908943111428571

00:26:41.520 --> 00:26:44.467 And the additional advantage of EEG is

NOTE Confidence: 0.908943111428571

00:26:44.467 --> 00:26:47.268 you can do this at each time point.

NOTE Confidence: 0.908943111428571

00:26:47.268 --> 00:26:49.560 So in the in the MRI example,

NOTE Confidence: 0.908943111428571

00:26:49.560 --> 00:26:52.409 you're taking one moment in time and

NOTE Confidence: 0.908943111428571

00:26:52.409 --> 00:26:54.878 recording the patterns that are present.

NOTE Confidence: 0.908943111428571

00:26:54.880 --> 00:26:55.768 But with EEG,

NOTE Confidence: 0.908943111428571

00:26:55.768 --> 00:26:57.248 because it has much better

NOTE Confidence: 0.908943111428571

00:26:57.248 --> 00:26:57.840 temporal resolution,

NOTE Confidence: 0.908943111428571

00:26:57.840 --> 00:26:59.565 you can do that literally

NOTE Confidence: 0.908943111428571

00:26:59.565 --> 00:27:00.600 at every millisecond.

NOTE Confidence: 0.908943111428571

00:27:00.600 --> 00:27:03.008 And what you would expect is that

NOTE Confidence: 0.908943111428571

00:27:03.008 --> 00:27:04.960 if this pattern is reliable,

NOTE Confidence: 0.908943111428571

00:27:04.960 --> 00:27:05.498 then in,

NOTE Confidence: 0.908943111428571

00:27:05.498 --> 00:27:07.650 let's say the 1st 50 milliseconds before the

NOTE Confidence: 0.908943111428571

00:27:07.705 --> 00:27:09.840 information is even gotten into the brain,

NOTE Confidence: 0.908943111428571

00:27:09.840 --> 00:27:11.676 it's going to be a chance,

NOTE Confidence: 0.908943111428571

00:27:11.680 --> 00:27:14.074 and then it's gonna grow in amplitude.

NOTE Confidence: 0.908943111428571

00:27:14.080 --> 00:27:16.240 That is, you're gonna be able to more

NOTE Confidence: 0.908943111428571

00:27:16.240 --> 00:27:17.760 reliably detect those differences.

NOTE Confidence: 0.908943111428571

00:27:17.760 --> 00:27:19.956 And then presumably as memory declines,

NOTE Confidence: 0.908943111428571

00:27:19.960 --> 00:27:21.280 right, that's gonna fade away.

NOTE Confidence: 0.908943111428571

00:27:21.280 --> 00:27:23.680 So you would expect a pattern like this.

NOTE Confidence: 0.908943111428571

00:27:23.680 --> 00:27:25.780 And that's exactly what Laurie Byette

NOTE Confidence: 0.908943111428571

00:27:25.780 --> 00:27:27.880 and and colleagues did in our lab,

NOTE Confidence: 0.908943111428571

00:27:27.880 --> 00:27:30.519 where took EEG data from 12 to

NOTE Confidence: 0.908943111428571

00:27:30.519 --> 00:27:32.360 15 month old babies,

NOTE Confidence: 0.908943111428571

00:27:32.360 --> 00:27:34.016 8 different visual stimuli,

NOTE Confidence: 0.908943111428571

00:27:34.016 --> 00:27:36.909 and asked whether or not there's a

NOTE Confidence: 0.908943111428571

00:27:36.909 --> 00:27:39.226 pattern that is uniquely linked to each

NOTE Confidence: 0.908943111428571

00:27:39.226 --> 00:27:42.038 one of those eight different stimuli.

NOTE Confidence: 0.908943111428571

00:27:42.040 --> 00:27:44.812 The pattern in the EEG and in

NOTE Confidence: 0.908943111428571

00:27:44.812 --> 00:27:46.516 adults that's definitely present.

NOTE Confidence: 0.908943111428571

00:27:46.520 --> 00:27:49.257 You can see here that you're getting

NOTE Confidence: 0.908943111428571

00:27:49.257 --> 00:27:50.811 accuracies of discriminating one

NOTE Confidence: 0.908943111428571

00:27:50.811 --> 00:27:52.768 of those stimuli, like the dog,

NOTE Confidence: 0.908943111428571

00:27:52.768 --> 00:27:55.120 from all of the other stimuli with

NOTE Confidence: 0.908943111428571

00:27:55.197 --> 00:27:57.282 an accuracy of about 75% correct.

NOTE Confidence: 0.908943111428571

00:27:57.282 --> 00:27:59.669 That means on each trial you can

NOTE Confidence: 0.908943111428571

00:27:59.669 --> 00:28:01.564 say with pretty high reliability

NOTE Confidence: 0.908943111428571

00:28:01.564 --> 00:28:04.552 that that was a dog that the person

NOTE Confidence: 0.908943111428571

00:28:04.552 --> 00:28:06.530 was was seeing the the results

NOTE Confidence: 0.908943111428571

00:28:06.530 --> 00:28:08.080 from the infants were noisier,

NOTE Confidence: 0.908943111428571

00:28:08.080 --> 00:28:11.480 not unexpectedly, but highly reliable.

NOTE Confidence: 0.908943111428571

00:28:11.480 --> 00:28:13.640 So we have a technique where we can

NOTE Confidence: 0.908943111428571

00:28:13.640 --> 00:28:15.116 identify from the brain patterns

NOTE Confidence: 0.908943111428571

00:28:15.116 --> 00:28:16.868 alone in the EEG what stimulus

NOTE Confidence: 0.908943111428571

00:28:16.868 --> 00:28:18.600 the baby is being exposed to,

NOTE Confidence: 0.908943111428571

00:28:18.600 --> 00:28:21.354 and it doesn't have to be a visual stimulus.

NOTE Confidence: 0.908943111428571

00:28:21.360 --> 00:28:24.480 So with Bob McMurray and colleagues,

NOTE Confidence: 0.908943111428571

00:28:24.480 --> 00:28:26.643 we asked whether or not we could

NOTE Confidence: 0.908943111428571

00:28:26.643 --> 00:28:29.160 do the same kind of EEG based

NOTE Confidence: 0.908943111428571

00:28:29.160 --> 00:28:31.434 decoding but in the auditory domain,

NOTE Confidence: 0.880921250625

00:28:31.440 --> 00:28:32.740 in the speech domain.

NOTE Confidence: 0.880921250625

00:28:32.740 --> 00:28:35.555 So the goal was to determine on a

NOTE Confidence: 0.880921250625

00:28:35.555 --> 00:28:37.155 millisecond by millisecond basis

NOTE Confidence: 0.880921250625

00:28:37.160 --> 00:28:39.365 what is the speech signal that you're

NOTE Confidence: 0.880921250625

00:28:39.365 --> 00:28:41.954 hearing and how does it relate to

NOTE Confidence: 0.880921250625

00:28:41.954 --> 00:28:44.062 other stimuli either similar sounding

NOTE Confidence: 0.880921250625

00:28:44.062 --> 00:28:46.637 to that particular target stimulus.

NOTE Confidence: 0.880921250625

00:28:46.640 --> 00:28:48.944 And here I have to take a pause and

NOTE Confidence: 0.880921250625

00:28:48.944 --> 00:28:51.518 just review briefly what we know

NOTE Confidence: 0.880921250625

00:28:51.518 --> 00:28:53.314 about this phenomenon behaviorally.

NOTE Confidence: 0.880921250625

00:28:53.320 --> 00:28:55.408 Basically because it's been studied a

NOTE Confidence: 0.880921250625

00:28:55.408 --> 00:28:57.678 lot and the paradigm that's been used to

NOTE Confidence: 0.880921250625

00:28:57.678 --> 00:29:00.437 study it is called the Visual World paradigm.

NOTE Confidence: 0.880921250625

00:29:00.440 --> 00:29:01.880 In the visual World paradigm,

NOTE Confidence: 0.880921250625

00:29:01.880 --> 00:29:04.118 there are typically 4 stimuli present,

NOTE Confidence: 0.880921250625

00:29:04.120 --> 00:29:05.652 so these are pictures.

NOTE Confidence: 0.880921250625

00:29:05.652 --> 00:29:08.480 And then there's a word that spoke.

NOTE Confidence: 0.880921250625

00:29:08.480 --> 00:29:09.920 So it's just like the paradigm

NOTE Confidence: 0.880921250625

00:29:09.920 --> 00:29:10.880 I described with babies,

NOTE Confidence: 0.880921250625

00:29:10.880 --> 00:29:12.476 except it's a little bit more complicated.

NOTE Confidence: 0.880921250625

00:29:12.480 --> 00:29:13.755 So for example,

NOTE Confidence: 0.880921250625

00:29:13.755 --> 00:29:17.480 where is the bug in this particular example?

NOTE Confidence: 0.880921250625

00:29:17.480 --> 00:29:19.958 And your eyes will fairly automatically,

NOTE Confidence: 0.880921250625

00:29:19.960 --> 00:29:21.235 as an adult,

NOTE Confidence: 0.880921250625

00:29:21.235 --> 00:29:23.360 land on the bug stimulus.

NOTE Confidence: 0.880921250625

00:29:23.360 --> 00:29:25.562 Notice that there is another stimulus

NOTE Confidence: 0.880921250625

00:29:25.562 --> 00:29:28.066 in this array that sounds like bug

NOTE Confidence: 0.880921250625

00:29:28.066 --> 00:29:30.313 at the beginning of the word bus,

NOTE Confidence: 0.880921250625

00:29:30.320 --> 00:29:32.637 but of course it's not the same.

NOTE Confidence: 0.880921250625

00:29:32.640 --> 00:29:34.812 The ending is different and then

NOTE Confidence: 0.880921250625

00:29:34.812 --> 00:29:37.079 there is 2 unrelated stimuli and

NOTE Confidence: 0.880921250625

00:29:37.080 --> 00:29:38.760 across a whole series of trials.

NOTE Confidence: 0.880921250625

00:29:38.760 --> 00:29:40.056 Then you can ask,

NOTE Confidence: 0.880921250625

00:29:40.056 --> 00:29:42.421 well where do the eyes go when

NOTE Confidence: 0.880921250625

00:29:42.421 --> 00:29:44.116 you hear the word bug?

NOTE Confidence: 0.880921250625

00:29:44.120 --> 00:29:46.675 And every trials can be slightly different.

NOTE Confidence: 0.880921250625

00:29:46.680 --> 00:29:48.138 Sometimes you will immediately look at

NOTE Confidence: 0.880921250625

00:29:48.138 --> 00:29:50.278 the bug as in the first example there.

NOTE Confidence: 0.880921250625

00:29:50.280 --> 00:29:52.968 Sometimes you will actually go to the to

NOTE Confidence: 0.880921250625

00:29:52.968 --> 00:29:55.480 the bus and then correct and go to the bug,

NOTE Confidence: 0.880921250625

00:29:55.480 --> 00:29:56.797 like in the third case, etcetera.

NOTE Confidence: 0.880921250625

00:29:56.797 --> 00:29:58.219 But if you sum across a

NOTE Confidence: 0.880921250625

00:29:58.219 --> 00:29:59.320 whole series of trials,

NOTE Confidence: 0.880921250625

00:29:59.320 --> 00:30:00.920 you get a probability function.

NOTE Confidence: 0.880921250625

00:30:00.920 --> 00:30:03.360 It'll look roughly like this.

NOTE Confidence: 0.880921250625

00:30:03.360 --> 00:30:03.784 Obviously,

NOTE Confidence: 0.880921250625

00:30:03.784 --> 00:30:06.110 this is a cartoon illustrating the

NOTE Confidence: 0.880921250625

00:30:06.110 --> 00:30:08.315 fact that across a series of trials,

NOTE Confidence: 0.880921250625

00:30:08.320 --> 00:30:09.993 you more reliably will look at the

NOTE Confidence: 0.880921250625

00:30:09.993 --> 00:30:11.759 target of the word that is spoken.

NOTE Confidence: 0.880921250625

00:30:11.760 --> 00:30:13.286 But occasionally you look at the one

NOTE Confidence: 0.880921250625

00:30:13.286 --> 00:30:14.797 that sounded like it at the beginning,

NOTE Confidence: 0.880921250625

00:30:14.800 --> 00:30:16.918 which is that red line there.

NOTE Confidence: 0.880921250625

00:30:16.920 --> 00:30:18.380 Those are cartoon data.

NOTE Confidence: 0.880921250625

00:30:18.380 --> 00:30:19.840 These are real data.

NOTE Confidence: 0.880921250625

00:30:19.840 --> 00:30:21.682 It's exactly that out of adults

NOTE Confidence: 0.880921250625

00:30:21.682 --> 00:30:23.791 you get this kind of behavioral

NOTE Confidence: 0.880921250625

00:30:23.791 --> 00:30:26.233 performance across a series of trials.

NOTE Confidence: 0.880921250625

00:30:26.240 --> 00:30:28.032 Now 1 limitation of this is that

NOTE Confidence: 0.880921250625

00:30:28.032 --> 00:30:30.140 you have to have pictures, right?

NOTE Confidence: 0.880921250625

00:30:30.140 --> 00:30:32.856 If we wanted to understand your

NOTE Confidence: 0.880921250625

00:30:32.856 --> 00:30:34.520 spoken knowledge of democracy,

NOTE Confidence: 0.880921250625

00:30:34.520 --> 00:30:35.498 what would the picture be that

NOTE Confidence: 0.880921250625

00:30:35.498 --> 00:30:36.992 we would put up there, right.

NOTE Confidence: 0.880921250625

00:30:36.992 --> 00:30:40.342 Well, we can imagine anti democracy.

NOTE Confidence: 0.880921250625

00:30:40.342 --> 00:30:42.797 We could imagine a picture.

NOTE Confidence: 0.880921250625

00:30:42.800 --> 00:30:44.280 So it has that limitation.

NOTE Confidence: 0.880921250625

00:30:44.280 --> 00:30:46.289 It also has a limitation that the

NOTE Confidence: 0.880921250625

00:30:46.289 --> 00:30:47.815 eye movements themselves are a

NOTE Confidence: 0.880921250625

00:30:47.815 --> 00:30:49.035 behavior that some individuals,

NOTE Confidence: 0.880921250625

00:30:49.040 --> 00:30:50.300 particularly clinical populations,

NOTE Confidence: 0.880921250625

00:30:50.300 --> 00:30:52.400 might not have control over.

NOTE Confidence: 0.880921250625

00:30:52.400 --> 00:30:54.407 So it would be ideal if you could just

NOTE Confidence: 0.880921250625

00:30:54.407 --> 00:30:56.122 tap into the EEG responses of the

NOTE Confidence: 0.880921250625

00:30:56.122 --> 00:30:58.677 brain and get a function that look like that.

NOTE Confidence: 0.880921250625

00:30:58.680 --> 00:30:59.916 So that's exactly what we did.

NOTE Confidence: 0.880921250625

00:30:59.920 --> 00:31:01.225 And remember, we have already

NOTE Confidence: 0.880921250625

00:31:01.225 --> 00:31:02.920 shown that this works in babies.

NOTE Confidence: 0.880921250625

00:31:02.920 --> 00:31:04.385 It already works in toddlers

NOTE Confidence: 0.880921250625

00:31:04.385 --> 00:31:05.557 at the behavioral level.

NOTE Confidence: 0.880921250625

00:31:05.560 --> 00:31:06.286 The question is,

NOTE Confidence: 0.880921250625

00:31:06.286 --> 00:31:08.520 can we see it in the EEG pattern?

NOTE Confidence: 0.880921250625

00:31:08.520 --> 00:31:10.398 So these are all adult data.

NOTE Confidence: 0.880921250625

00:31:10.400 --> 00:31:12.360 You have EEG channels off.

NOTE Confidence: 0.880921250625

00:31:12.360 --> 00:31:14.088 The adult brain got a lot

NOTE Confidence: 0.880921250625

00:31:14.088 --> 00:31:15.240 of wiggles that come

NOTE Confidence: 0.907324267142857

00:31:15.303 --> 00:31:16.679 off of those channels.

NOTE Confidence: 0.907324267142857

00:31:16.680 --> 00:31:18.120 And at each time step,

NOTE Confidence: 0.907324267142857

00:31:18.120 --> 00:31:19.720 after the stimulus is spoken,

NOTE Confidence: 0.907324267142857

00:31:19.720 --> 00:31:21.088 we're going to ask,

NOTE Confidence: 0.907324267142857

00:31:21.088 --> 00:31:23.701 is there a pattern in that EEG

NOTE Confidence: 0.907324267142857

00:31:23.701 --> 00:31:26.116 that predicts that particular word?

NOTE Confidence: 0.907324267142857

00:31:26.120 --> 00:31:28.232 And we chose words that sounded

NOTE Confidence: 0.907324267142857

00:31:28.232 --> 00:31:29.640 alike at the beginning,

NOTE Confidence: 0.907324267142857

00:31:29.640 --> 00:31:31.440 like badger and baggage and

NOTE Confidence: 0.907324267142857

00:31:31.440 --> 00:31:32.799 muscle and mushroom. OK.

NOTE Confidence: 0.907324267142857

00:31:32.799 --> 00:31:35.031 And then what we're doing is they're just

NOTE Confidence: 0.907324267142857

00:31:35.031 --> 00:31:37.040 simply having adults passively listen.

NOTE Confidence: 0.907324267142857

00:31:37.040 --> 00:31:38.531 There's no task,

NOTE Confidence: 0.907324267142857

00:31:38.531 --> 00:31:40.519 there's no visual referent,

NOTE Confidence: 0.907324267142857

00:31:40.520 --> 00:31:42.152 and we're going to train the

NOTE Confidence: 0.907324267142857

00:31:42.152 --> 00:31:43.547 statistical model at each time

NOTE Confidence: 0.907324267142857

00:31:43.547 --> 00:31:45.792 point to predict as best it can

NOTE Confidence: 0.907324267142857

00:31:45.792 --> 00:31:47.919 which of those words is spoken,

NOTE Confidence: 0.907324267142857

00:31:47.920 --> 00:31:49.480 and these are the results.

NOTE Confidence: 0.907324267142857

00:31:49.480 --> 00:31:52.400 It looks a lot like the behavioral results.

NOTE Confidence: 0.907324267142857

00:31:52.400 --> 00:31:53.540 There's no eye movements,

NOTE Confidence: 0.907324267142857

00:31:53.540 --> 00:31:54.680 that there's no task.

NOTE Confidence: 0.907324267142857

00:31:54.680 --> 00:31:56.812 It's just passive listening.

NOTE Confidence: 0.907324267142857

00:31:56.812 --> 00:31:57.878 And moreover,

NOTE Confidence: 0.8884814425

00:32:00.120 --> 00:32:01.920 moreover, it happens at the

NOTE Confidence: 0.8884814425

00:32:01.920 --> 00:32:03.000 individual subject level.

NOTE Confidence: 0.8884814425

00:32:03.000 --> 00:32:04.860 So there's enough data at each

NOTE Confidence: 0.8884814425

00:32:04.860 --> 00:32:06.100 individual subject level to

NOTE Confidence: 0.8884814425

00:32:06.156 --> 00:32:07.760 make this clinically relevant.

NOTE Confidence: 0.8884814425

00:32:07.760 --> 00:32:10.290 And we can see in most of these cases that

NOTE Confidence: 0.8884814425

00:32:10.351 --> 00:32:12.636 they're showing the canonical pattern,

NOTE Confidence: 0.8884814425

00:32:12.640 --> 00:32:15.964 greater accuracy to the target

NOTE Confidence: 0.8884814425

00:32:15.964 --> 00:32:19.918 than to the the non targets.

NOTE Confidence: 0.8884814425

00:32:19.920 --> 00:32:21.268 And in an interesting

NOTE Confidence: 0.8884814425

00:32:21.268 --> 00:32:22.279 experiment that's ongoing,

NOTE Confidence: 0.8884814425

00:32:22.280 --> 00:32:23.258 Elizabeth Simmons,

NOTE Confidence: 0.8884814425

00:32:23.258 --> 00:32:26.192 who is at Sacred Heart University

NOTE Confidence: 0.8884814425

00:32:26.192 --> 00:32:28.999 but affiliated with Child Study Center,

NOTE Confidence: 0.8884814425

00:32:29.000 --> 00:32:31.170 there's a grant in which we are

NOTE Confidence: 0.8884814425

00:32:31.170 --> 00:32:32.960 looking at this in toddlers.

NOTE Confidence: 0.8884814425

00:32:32.960 --> 00:32:35.360 So these are so-called late talkers.

NOTE Confidence: 0.8884814425

00:32:35.360 --> 00:32:37.418 These are children who we don't know

NOTE Confidence: 0.8884814425

00:32:37.418 --> 00:32:39.519 much about their speech comprehension,

NOTE Confidence: 0.8884814425

00:32:39.520 --> 00:32:41.760 but we know that they do not speak

NOTE Confidence: 0.8884814425

00:32:41.760 --> 00:32:43.224 at the canonical age of which

NOTE Confidence: 0.8884814425

00:32:43.224 --> 00:32:44.679 you would expect them to speak.

NOTE Confidence: 0.8884814425

00:32:44.680 --> 00:32:46.660 And in addition to getting eye

NOTE Confidence: 0.8884814425

00:32:46.660 --> 00:32:48.778 tracking data on for example

NOTE Confidence: 0.8884814425

00:32:48.778 --> 00:32:50.830 Kitty versus kitchen that would

NOTE Confidence: 0.8884814425

00:32:50.830 --> 00:32:52.600 be a a child friendly example.

NOTE Confidence: 0.8884814425

00:32:52.600 --> 00:32:56.320 We'll also be gathering EEG data.

NOTE Confidence: 0.8884814425

00:32:56.320 --> 00:32:56.786 OK.

NOTE Confidence: 0.8884814425

00:32:56.786 --> 00:32:59.748 So let me just mention near infrared

NOTE Confidence: 0.8884814425

00:32:59.748 --> 00:33:01.318 spectroscopy and how it works.

NOTE Confidence: 0.8884814425

00:33:01.320 --> 00:33:03.750 It's basically an optical imaging

NOTE Confidence: 0.8884814425

00:33:03.750 --> 00:33:08.484 technique that is amenable to like

NOTE Confidence: 0.8884814425

00:33:08.484 --> 00:33:12.722 EGA cap that is placed on the baby's

NOTE Confidence: 0.8884814425

00:33:12.722 --> 00:33:17.270 head and that cap is contains a

NOTE Confidence: 0.8884814425

00:33:17.270 --> 00:33:20.490 set of optical emitters in the near

NOTE Confidence: 0.8884814425

00:33:20.490 --> 00:33:22.872 infrared range which are able to

NOTE Confidence: 0.8884814425

00:33:22.872 --> 00:33:24.992 penetrate the biological tissue through

NOTE Confidence: 0.8884814425

00:33:24.992 --> 00:33:28.198 the scalp and the skull into the brain.

NOTE Confidence: 0.8884814425

00:33:28.200 --> 00:33:32.296 And photons coming back out from that light

NOTE Confidence: 0.8884814425

00:33:32.296 --> 00:33:35.912 emitting into the brain modulate with

NOTE Confidence: 0.8884814425

00:33:35.912 --> 00:33:38.828 the absorption of oxygenated hemoglobin.

NOTE Confidence: 0.8884814425

00:33:38.828 --> 00:33:40.724 And that is comparable

NOTE Confidence: 0.8884814425

00:33:40.724 --> 00:33:43.159 to the signal in F MRI,

NOTE Confidence: 0.8884814425

00:33:43.160 --> 00:33:45.398 the BOLD signal in F MRI.

NOTE Confidence: 0.8884814425

00:33:45.400 --> 00:33:49.061 So typically these are arrays of emitters

NOTE Confidence: 0.8884814425

00:33:49.061 --> 00:33:51.668 and detectors called channels and

NOTE Confidence: 0.8884814425

00:33:51.668 --> 00:33:54.080 they're placed on a cap on the baby's head,

NOTE Confidence: 0.8884814425

00:33:54.080 --> 00:33:55.886 so we can cover the entire head

NOTE Confidence: 0.8884814425

00:33:55.886 --> 00:33:57.920 of the baby with these channels,

NOTE Confidence: 0.8884814425

00:33:57.920 --> 00:33:59.952 roughly 100 channels covering

NOTE Confidence: 0.8884814425

00:33:59.952 --> 00:34:01.476 the entire head.

NOTE Confidence: 0.8884814425

00:34:01.480 --> 00:34:01.928 Now,

NOTE Confidence: 0.8884814425

00:34:01.928 --> 00:34:05.064 there's been kind of the classic approach

NOTE Confidence: 0.8884814425

00:34:05.064 --> 00:34:07.644 to studying brain activation using nears,

NOTE Confidence: 0.8884814425

00:34:07.644 --> 00:34:10.880 and that's to look for a hotspot.

NOTE Confidence: 0.8884814425

00:34:10.880 --> 00:34:13.134 And this is an early study out

NOTE Confidence: 0.8884814425

00:34:13.134 --> 00:34:14.560 of Jacques Mailer's group,

NOTE Confidence: 0.8884814425

00:34:14.560 --> 00:34:16.390 in which the contrast was simply

NOTE Confidence: 0.8884814425

00:34:16.390 --> 00:34:18.253 listening to speech that goes in

NOTE Confidence: 0.8884814425

00:34:18.253 --> 00:34:19.723 the forward direction versus the

NOTE Confidence: 0.8884814425

00:34:19.723 --> 00:34:21.519 speech that is simply reversed.

NOTE Confidence: 0.8884814425

00:34:21.520 --> 00:34:23.879 And of course, reverse speech sounds weird.

NOTE Confidence: 0.8884814425

00:34:23.880 --> 00:34:24.984 It doesn't contain meaning.

NOTE Confidence: 0.8884814425

00:34:24.984 --> 00:34:27.240 The phonemes are all kind of screwed up.

NOTE Confidence: 0.8884814425

00:34:27.240 --> 00:34:29.320 So it's a it's a kind of a crude contrast,

NOTE Confidence: 0.8884814425

00:34:29.320 --> 00:34:31.546 but it gives you some insight about

NOTE Confidence: 0.8884814425

00:34:31.546 --> 00:34:33.960 what's going on in the brain of these

NOTE Confidence: 0.8884814425

00:34:33.960 --> 00:34:35.880 were newborns just to be clear,

NOTE Confidence: 0.8884814425

00:34:35.880 --> 00:34:38.520 newborn babies in the first week.

NOTE Confidence: 0.8884814425

00:34:38.520 --> 00:34:41.243 And generally speaking you see a left

NOTE Confidence: 0.8884814425

00:34:41.243 --> 00:34:43.201 hemisphere dominance which is what

NOTE Confidence: 0.8884814425

00:34:43.201 --> 00:34:45.385 you would expect from the canonical

NOTE Confidence: 0.8884814425

00:34:45.385 --> 00:34:47.518 language related brain areas in adults.

NOTE Confidence: 0.97348912125

00:34:49.560 --> 00:34:51.555 But you can go beyond this sort

NOTE Confidence: 0.97348912125

00:34:51.555 --> 00:34:53.592 of standard approach and ask,

NOTE Confidence: 0.97348912125

00:34:53.592 --> 00:34:57.359 just as we asked in the case of EEG,

NOTE Confidence: 0.97348912125

00:34:57.360 --> 00:35:01.332 whether you can do this multivariate

NOTE Confidence: 0.97348912125

00:35:01.332 --> 00:35:04.224 voxel type analysis to identify

NOTE Confidence: 0.97348912125

00:35:04.224 --> 00:35:06.032 particular types of stimuli

NOTE Confidence: 0.97348912125

00:35:06.032 --> 00:35:08.760 from the pattern of activation.

NOTE Confidence: 0.97348912125

00:35:08.760 --> 00:35:10.584 And so Ben Zinzer and colleagues

NOTE Confidence: 0.97348912125

00:35:10.584 --> 00:35:11.800 did an interesting study.

NOTE Confidence: 0.97348912125

00:35:11.800 --> 00:35:14.383 This is an adult study now using

NOTE Confidence: 0.97348912125

00:35:14.383 --> 00:35:16.880 those same baby friendly stimuli.

NOTE Confidence: 0.97348912125

00:35:16.880 --> 00:35:19.435 So we have these eight different stimuli.

NOTE Confidence: 0.97348912125

00:35:19.440 --> 00:35:22.200 And now the question is,

NOTE Confidence: 0.97348912125

00:35:22.200 --> 00:35:24.876 can we use nears, not EEG?

NOTE Confidence: 0.97348912125

00:35:24.880 --> 00:35:27.391 Can we use nears to identify which one of

NOTE Confidence: 0.97348912125

00:35:27.391 --> 00:35:29.636 these eight stimuli has been presented

NOTE Confidence: 0.97348912125

00:35:29.640 --> 00:35:32.076 by looking at the pattern of activation?

NOTE Confidence: 0.97348912125

00:35:32.080 --> 00:35:34.180 Whoop, the pattern of activation

NOTE Confidence: 0.97348912125

00:35:34.180 --> 00:35:36.230 where we have, you know,

NOTE Confidence: 0.97348912125

00:35:36.230 --> 00:35:38.995 Bunny versus foot and Bunny versus teddy

NOTE Confidence: 0.97348912125

00:35:38.995 --> 00:35:41.385 bear etcetera and seeing whether or not

NOTE Confidence: 0.97348912125

00:35:41.385 --> 00:35:43.069 there's a reliable pattern for each

NOTE Confidence: 0.97348912125

00:35:43.069 --> 00:35:44.797 one of those eight different stimuli.

NOTE Confidence: 0.97348912125

00:35:44.800 --> 00:35:45.880 And the answer is yes.

NOTE Confidence: 0.97348912125

00:35:45.880 --> 00:35:47.300 The overall decoding accuracy as

NOTE Confidence: 0.97348912125

00:35:47.300 --> 00:35:49.320 you can see on the right hand

NOTE Confidence: 0.97348912125

00:35:49.320 --> 00:35:51.426 side here is about 70% correct,

NOTE Confidence: 0.97348912125

00:35:51.426 --> 00:35:53.478 which is pretty good.

NOTE Confidence: 0.97348912125

00:35:53.480 --> 00:35:55.320 There were 44 news channels.

NOTE Confidence: 0.97348912125

00:35:55.320 --> 00:35:57.024 It wasn't even the whole head

NOTE Confidence: 0.97348912125

00:35:57.024 --> 00:35:58.160 in this particular study,

NOTE Confidence: 0.97348912125

00:35:58.160 --> 00:35:59.960 but you can also see individual

NOTE Confidence: 0.97348912125

00:35:59.960 --> 00:36:01.160 differences in the performance.

NOTE Confidence: 0.97348912125

00:36:01.160 --> 00:36:03.375 So some participants are better

NOTE Confidence: 0.97348912125

00:36:03.375 --> 00:36:06.080 than others in terms of their

NOTE Confidence: 0.97348912125

00:36:06.080 --> 00:36:08.600 their decoding accuracy.

NOTE Confidence: 0.97348912125

00:36:08.600 --> 00:36:11.516 So of course doing it adults is one thing,

NOTE Confidence: 0.97348912125

00:36:11.520 --> 00:36:12.840 doing it in infants is another.

NOTE Confidence: 0.97348912125

00:36:12.840 --> 00:36:14.996 We did a follow up experiment Lauren

NOTE Confidence: 0.97348912125

00:36:14.996 --> 00:36:17.432 Emerson and colleagues in which we asked

NOTE Confidence: 0.97348912125

00:36:17.432 --> 00:36:20.599 of a more rudimentary question of of infants.

NOTE Confidence: 0.97348912125

00:36:20.600 --> 00:36:22.328 And so it was a two stimuli,

NOTE Confidence: 0.97348912125

00:36:22.328 --> 00:36:24.512 this is just the that's the

NOTE Confidence: 0.97348912125

00:36:24.512 --> 00:36:26.279 same cartoon to Orient you.

NOTE Confidence: 0.97348912125

00:36:26.280 --> 00:36:28.680 So we have a set of nearest channels,

NOTE Confidence: 0.97348912125

00:36:28.680 --> 00:36:30.918 and we have two different stimuli.

NOTE Confidence: 0.97348912125

00:36:30.920 --> 00:36:34.216 We have an auditory visual pair of stimuli

NOTE Confidence: 0.97348912125

00:36:34.216 --> 00:36:37.558 and another auditory visual pair of stimuli.

NOTE Confidence: 0.97348912125

00:36:37.560 --> 00:36:39.600 So both stimuli have auditory and

NOTE Confidence: 0.97348912125

00:36:39.600 --> 00:36:41.180 visual information, but they differ

NOTE Confidence: 0.97348912125

00:36:41.180 --> 00:36:43.280 in the pairing of those of those.

NOTE Confidence: 0.97348912125

00:36:43.280 --> 00:36:44.426 So it's subtle.

NOTE Confidence: 0.97348912125

00:36:44.426 --> 00:36:46.718 And the answer is and and.

NOTE Confidence: 0.97348912125

00:36:46.720 --> 00:36:47.000 And.

NOTE Confidence: 0.97348912125

00:36:47.000 --> 00:36:49.240 One of the problems that you run into

NOTE Confidence: 0.97348912125

00:36:49.240 --> 00:36:51.020 when you're doing infinite experiments

NOTE Confidence: 0.97348912125

00:36:51.020 --> 00:36:53.768 is you need quite a number of trials

NOTE Confidence: 0.97348912125

00:36:53.768 --> 00:36:55.912 of each one of the stimuli to train

NOTE Confidence: 0.97348912125

00:36:55.920 --> 00:36:57.820 the machine learning algorithm.

NOTE Confidence: 0.97348912125

00:36:57.820 --> 00:37:00.670 Infants are notoriously not cooperative in

NOTE Confidence: 0.97348912125

00:37:00.736 --> 00:37:03.240 terms of giving lots of trials of data.

NOTE Confidence: 0.97348912125

00:37:03.240 --> 00:37:05.333 You have an advantage with the EEG

NOTE Confidence: 0.97348912125

00:37:05.333 --> 00:37:07.558 because the stimuli can occur very rapidly.

NOTE Confidence: 0.97348912125

00:37:07.560 --> 00:37:09.672 So in 5 minutes with a baby you

NOTE Confidence: 0.97348912125

00:37:09.672 --> 00:37:11.598 can have several 100 stimuli.

NOTE Confidence: 0.97348912125

00:37:11.600 --> 00:37:14.036 But in nears the signal is slow.

NOTE Confidence: 0.97348912125

00:37:14.040 --> 00:37:16.196 It's like the F MRI BOLD signal.

NOTE Confidence: 0.97348912125

00:37:16.200 --> 00:37:17.604 And so we couldn't get enough

NOTE Confidence: 0.97348912125

00:37:17.604 --> 00:37:18.880 data from each individual infant.

NOTE Confidence: 0.97348912125

00:37:18.880 --> 00:37:22.435 So we did an interesting only

NOTE Confidence: 0.97348912125

00:37:22.435 --> 00:37:23.500 in in retrospect.

NOTE Confidence: 0.97348912125

00:37:23.500 --> 00:37:25.300 Interesting because it worked manipulation.

NOTE Confidence: 0.97348912125

00:37:25.300 --> 00:37:28.340 What we did is we aggregated all of

NOTE Confidence: 0.97348912125

00:37:28.340 --> 00:37:30.942 the data across all of the trials

NOTE Confidence: 0.97348912125

00:37:30.942 --> 00:37:33.598 from all the infants except 1 infant.

NOTE Confidence: 0.97348912125

00:37:33.600 --> 00:37:35.938 And then we trained the model on

NOTE Confidence: 0.97348912125

00:37:35.938 --> 00:37:38.697 all of the infants except one and

NOTE Confidence: 0.97348912125

00:37:38.697 --> 00:37:40.372 then determined whether or not

NOTE Confidence: 0.97348912125

00:37:40.372 --> 00:37:42.250 we could predict the behavior of

NOTE Confidence: 0.97348912125

00:37:42.313 --> 00:37:43.717 the withheld infants data.

NOTE Confidence: 0.97348912125

00:37:43.720 --> 00:37:45.638 And the answer is that it could.

NOTE Confidence: 0.97348912125

00:37:45.640 --> 00:37:48.320 It was 72% decoding accuracy.

NOTE Confidence: 0.97348912125

00:37:48.320 --> 00:37:50.445 So the subtle auditory visual

NOTE Confidence: 0.97348912125

00:37:50.445 --> 00:37:51.720 pair of stimuli,

NOTE Confidence: 0.890020649629629

00:37:51.720 --> 00:37:54.288 we could on a trial by trial basis

NOTE Confidence: 0.890020649629629

00:37:54.288 --> 00:37:56.898 for that withheld babies data tell

NOTE Confidence: 0.890020649629629

00:37:56.898 --> 00:37:59.724 you with fairly high reliability that

NOTE Confidence: 0.890020649629629

00:37:59.805 --> 00:38:02.199 it was pair one versus pair two.

NOTE Confidence: 0.890020649629629

00:38:02.200 --> 00:38:05.280 These babies were six months of age,

NOTE Confidence: 0.890020649629629

00:38:05.280 --> 00:38:08.246 so quite young. OK.

NOTE Confidence: 0.890020649629629

00:38:08.246 --> 00:38:10.460 So if we segue then to F MRI sort

NOTE Confidence: 0.890020649629629

00:38:10.528 --> 00:38:12.922 of the gold standard of spatial

NOTE Confidence: 0.890020649629629

00:38:12.922 --> 00:38:15.126 resolution and imaging the classic

NOTE Confidence: 0.890020649629629

00:38:15.126 --> 00:38:17.641 approach the classic because it

NOTE Confidence: 0.890020649629629

00:38:17.641 --> 00:38:20.600 has been around for a long time.

NOTE Confidence: 0.890020649629629

00:38:20.600 --> 00:38:22.550 One example is out of Gislyn

NOTE Confidence: 0.890020649629629

00:38:22.550 --> 00:38:24.360 de Haan's lab in Paris,

NOTE Confidence: 0.890020649629629

00:38:24.360 --> 00:38:26.310 again using that forward versus

NOTE Confidence: 0.890020649629629

00:38:26.310 --> 00:38:27.480 backward speech contrast.

NOTE Confidence: 0.890020649629629

00:38:27.480 --> 00:38:31.266 It's a crude manipulation, but believe me,

NOTE Confidence: 0.890020649629629

00:38:31.266 --> 00:38:34.717 in 2002 this is a heroic experiment.

NOTE Confidence: 0.890020649629629

00:38:34.720 --> 00:38:36.640 And what they found again was

NOTE Confidence: 0.890020649629629

00:38:36.640 --> 00:38:37.920 a left hemisphere bias,

NOTE Confidence: 0.890020649629629

00:38:37.920 --> 00:38:40.608 as you would see in adults where

NOTE Confidence: 0.890020649629629

00:38:40.608 --> 00:38:42.217 there's greater activation to

NOTE Confidence: 0.890020649629629

00:38:42.217 --> 00:38:44.137 the forward going speech than

NOTE Confidence: 0.890020649629629

00:38:44.137 --> 00:38:45.673 the backward going speech.

NOTE Confidence: 0.890020649629629

00:38:45.680 --> 00:38:47.846 In subsequent work that's come out

NOTE Confidence: 0.890020649629629

00:38:47.846 --> 00:38:49.800 of Rebecca Sachs's lab at MIT,

NOTE Confidence: 0.890020649629629

00:38:49.800 --> 00:38:52.236 they've been interested in visual stimuli.

NOTE Confidence: 0.890020649629629

00:38:52.240 --> 00:38:54.635 There's a classic distinction in

NOTE Confidence: 0.890020649629629

00:38:54.635 --> 00:38:57.600 the ventral pathway in the visual

NOTE Confidence: 0.890020649629629

00:38:57.600 --> 00:38:59.478 extra trite areas of the brain

NOTE Confidence: 0.890020649629629

00:38:59.480 --> 00:39:02.024 between an area that is responsive

NOTE Confidence: 0.890020649629629

00:39:02.024 --> 00:39:04.920 to faces versus an adjacent area

NOTE Confidence: 0.890020649629629

00:39:04.920 --> 00:39:07.160 that's responsive to scenes,

NOTE Confidence: 0.890020649629629

00:39:07.160 --> 00:39:11.472 right Outdoor scenes, for example.

NOTE Confidence: 0.890020649629629

00:39:11.472 --> 00:39:12.996 And interestingly enough,

NOTE Confidence: 0.890020649629629

00:39:13.000 --> 00:39:14.375 in this experiment that was

NOTE Confidence: 0.890020649629629

00:39:14.375 --> 00:39:16.000 published a number of years ago,

NOTE Confidence: 0.890020649629629

00:39:16.000 --> 00:39:18.828 you see that same kind of dissociation

NOTE Confidence: 0.890020649629629

00:39:18.828 --> 00:39:20.931 between scenes and faces in

NOTE Confidence: 0.890020649629629

00:39:20.931 --> 00:39:22.567 approximately the same regions

NOTE Confidence: 0.890020649629629

00:39:22.567 --> 00:39:24.892 of the brain in young infants.

NOTE Confidence: 0.890020649629629

00:39:24.892 --> 00:39:27.440 These were roughly 6 to 18 month

NOTE Confidence: 0.890020649629629

00:39:27.518 --> 00:39:28.782 old infants and adults.

NOTE Confidence: 0.890020649629629

00:39:28.782 --> 00:39:30.630 So those red and blue bars on the

NOTE Confidence: 0.890020649629629

00:39:30.689 --> 00:39:32.439 bottom on the left of the infants,

NOTE Confidence: 0.890020649629629

00:39:32.440 --> 00:39:33.280 on the right of the adults.

NOTE Confidence: 0.890020649629629

00:39:33.280 --> 00:39:35.432 And you can see that the canonical areas

NOTE Confidence: 0.890020649629629

00:39:35.432 --> 00:39:37.755 are being activated in a very similar way.

NOTE Confidence: 0.890020649629629

00:39:37.760 --> 00:39:40.226 So these two results suggest that

NOTE Confidence: 0.890020649629629

00:39:40.226 --> 00:39:42.204 the the fundamental architecture of

NOTE Confidence: 0.890020649629629

00:39:42.204 --> 00:39:44.300 the brain in early infancy is set up

NOTE Confidence: 0.890020649629629

00:39:44.300 --> 00:39:46.557 in a way that's similar to adults,

NOTE Confidence: 0.890020649629629

00:39:46.560 --> 00:39:50.277 both for speech and for visual stimuli.

NOTE Confidence: 0.890020649629629

00:39:50.280 --> 00:39:54.130 But the limitation of F MRI with

NOTE Confidence: 0.890020649629629

00:39:54.130 --> 00:39:56.568 awake infants is quite severe.

NOTE Confidence: 0.890020649629629

00:39:56.568 --> 00:39:59.400 And our colleague Nick Turk Brown

NOTE Confidence: 0.890020649629629

00:39:59.400 --> 00:40:01.458 has been a pioneer in trying to

NOTE Confidence: 0.890020649629629

00:40:01.458 --> 00:40:03.469 set up situations in the scanner

NOTE Confidence: 0.890020649629629

00:40:03.469 --> 00:40:05.239 environment that maximize the amount

NOTE Confidence: 0.890020649629629

00:40:05.239 --> 00:40:07.756 of data that you can get from babies.

NOTE Confidence: 0.890020649629629

00:40:07.760 --> 00:40:09.167 And here is just a summary slide

NOTE Confidence: 0.890020649629629

00:40:09.167 --> 00:40:10.777 that they put together a number of

NOTE Confidence: 0.890020649629629

00:40:10.777 --> 00:40:12.217 years ago showing that the average

NOTE Confidence: 0.890020649629629

00:40:12.267 --> 00:40:13.674 baby is giving you about 10 minutes

NOTE Confidence: 0.890020649629629

00:40:13.674 --> 00:40:14.816 of data in the scanner.

NOTE Confidence: 0.890020649629629

00:40:14.816 --> 00:40:16.960 And one of the things that they used,

NOTE Confidence: 0.890020649629629

00:40:16.960 --> 00:40:18.160 it's really powerful.

NOTE Confidence: 0.890020649629629

00:40:18.160 --> 00:40:18.960 I'm sorry.

NOTE Confidence: 0.890020649629629

00:40:18.960 --> 00:40:20.984 Let let me just talk about a results

NOTE Confidence: 0.890020649629629

00:40:20.984 --> 00:40:23.293 1st and then tell you about the why

NOTE Confidence: 0.890020649629629

00:40:23.293 --> 00:40:26.597 they got such good evidence of of data.

NOTE Confidence: 0.890020649629629

00:40:26.600 --> 00:40:28.896 They were able to study a structure

NOTE Confidence: 0.890020649629629

00:40:28.896 --> 00:40:31.049 in the brain that you cannot

NOTE Confidence: 0.890020649629629

00:40:31.049 --> 00:40:33.239 access with either EEG or nears,

NOTE Confidence: 0.890020649629629

00:40:33.240 --> 00:40:34.380 and that's the hippocampus.

NOTE Confidence: 0.890020649629629

00:40:34.380 --> 00:40:36.090 And their adult work had shown

NOTE Confidence: 0.890020649629629

00:40:36.145 --> 00:40:37.925 that the hippocampus was involved

NOTE Confidence: 0.890020649629629

00:40:37.925 --> 00:40:38.993 in statistical learning.

NOTE Confidence: 0.890020649629629

00:40:39.000 --> 00:40:41.076 And there also is suggestive evidence

NOTE Confidence: 0.890020649629629

00:40:41.076 --> 00:40:43.229 that the hippocampus is really not

NOTE Confidence: 0.890020649629629

00:40:43.229 --> 00:40:45.353 functioning very well early in infancy.

NOTE Confidence: 0.890020649629629

00:40:45.360 --> 00:40:46.090 And yet,

NOTE Confidence: 0.890020649629629

00:40:46.090 --> 00:40:48.280 Nick and his colleagues Cameron Ellis

NOTE Confidence: 0.890020649629629

00:40:48.280 --> 00:40:52.158 showed that in the statistical learning task,

NOTE Confidence: 0.890020649629629

00:40:52.160 --> 00:40:54.488 infants as young as 12 months of age

NOTE Confidence: 0.890020649629629

00:40:54.488 --> 00:40:57.080 are showing reliable hippocampal activation,

NOTE Confidence: 0.870380979333333

00:40:57.080 --> 00:40:59.208 which you would not be able to see

NOTE Confidence: 0.870380979333333

00:40:59.208 --> 00:41:01.477 with any technique other than F MRI,

NOTE Confidence: 0.870380979333333

00:41:01.480 --> 00:41:03.565 suggesting that the hippocampus is

NOTE Confidence: 0.870380979333333

00:41:03.565 --> 00:41:07.160 in fact more involved in in early

NOTE Confidence: 0.870380979333333

00:41:07.160 --> 00:41:09.400 learning effects in infants than

NOTE Confidence: 0.870380979333333

00:41:09.400 --> 00:41:11.192 was previously thought possible.

NOTE Confidence: 0.870380979333333

00:41:11.200 --> 00:41:14.640 But let me go back to this issue here about

NOTE Confidence: 0.870380979333333

00:41:14.640 --> 00:41:16.520 how much data you can get out of an infant.

NOTE Confidence: 0.870380979333333

00:41:16.520 --> 00:41:19.280 As I said, infants are not the most

NOTE Confidence: 0.870380979333333

00:41:19.280 --> 00:41:20.839 cooperative subjects in the world,

NOTE Confidence: 0.870380979333333

00:41:20.840 --> 00:41:22.568 no matter how much we motivate

NOTE Confidence: 0.870380979333333

00:41:22.568 --> 00:41:23.720 them or their parents.

NOTE Confidence: 0.870380979333333

00:41:23.720 --> 00:41:25.220 And so setting up an environment

NOTE Confidence: 0.870380979333333

00:41:25.220 --> 00:41:27.113 in which you get the most amount

NOTE Confidence: 0.870380979333333

00:41:27.113 --> 00:41:28.513 of data is really important.

NOTE Confidence: 0.870380979333333

00:41:28.520 --> 00:41:30.536 And the MRI scanner environment is

NOTE Confidence: 0.870380979333333

00:41:30.536 --> 00:41:32.640 not a terribly friendly environment.

NOTE Confidence: 0.870380979333333

00:41:32.640 --> 00:41:34.752 So what Nick has discovered and

NOTE Confidence: 0.870380979333333

00:41:34.752 --> 00:41:36.793 other people have discovered as well

NOTE Confidence: 0.870380979333333

00:41:36.793 --> 00:41:38.802 is that putting them in a situation

NOTE Confidence: 0.870380979333333

00:41:38.802 --> 00:41:40.560 which you have a naturalistic,

NOTE Confidence: 0.870380979333333

00:41:40.560 --> 00:41:42.498 seemingly complicated kind

NOTE Confidence: 0.870380979333333

00:41:42.498 --> 00:41:44.436 of stimulus situation,

NOTE Confidence: 0.870380979333333

00:41:44.440 --> 00:41:46.296 which seems kind of counterintuitive, right?

NOTE Confidence: 0.870380979333333

00:41:46.296 --> 00:41:47.800 The typical way scientists

NOTE Confidence: 0.870380979333333

00:41:47.800 --> 00:41:49.680 proceed is to simplify everything,

NOTE Confidence: 0.870380979333333

00:41:49.680 --> 00:41:52.032 make it just like 1 variable that

NOTE Confidence: 0.870380979333333

00:41:52.032 --> 00:41:54.532 you're studying and you know prune away

NOTE Confidence: 0.870380979333333

00:41:54.532 --> 00:41:56.397 all the other distracting variables.

NOTE Confidence: 0.870380979333333

00:41:56.400 --> 00:41:57.552 The problem with that is the

NOTE Confidence: 0.870380979333333

00:41:57.552 --> 00:41:58.320 stimuli are so simple,

NOTE Confidence: 0.870380979333333

00:41:58.320 --> 00:41:59.646 the babies are bored and they

NOTE Confidence: 0.870380979333333

00:41:59.646 --> 00:42:01.158 don't give you a lot of data.

NOTE Confidence: 0.870380979333333

00:42:01.160 --> 00:42:03.335 So by using a naturalistic

NOTE Confidence: 0.870380979333333

00:42:03.335 --> 00:42:05.075 task like movie watching,

NOTE Confidence: 0.870380979333333

00:42:05.080 --> 00:42:06.880 babies are much more engaged,

NOTE Confidence: 0.870380979333333

00:42:06.880 --> 00:42:08.290 are able to maintain their attention

NOTE Confidence: 0.870380979333333

00:42:08.290 --> 00:42:09.480 for longer periods of time,

NOTE Confidence: 0.870380979333333

00:42:09.480 --> 00:42:11.478 and you can gather more data.

NOTE Confidence: 0.870380979333333

00:42:11.480 --> 00:42:13.384 Then you have to parse that data in

NOTE Confidence: 0.870380979333333

00:42:13.384 --> 00:42:15.730 such a way that you can interpret it

NOTE Confidence: 0.870380979333333

00:42:15.730 --> 00:42:17.960 because the stimuli are very complicated.

NOTE Confidence: 0.870380979333333

00:42:17.960 --> 00:42:19.724 So two kinds of metrics that you

NOTE Confidence: 0.870380979333333

00:42:19.724 --> 00:42:22.036 can get in addition to where in the

NOTE Confidence: 0.870380979333333

00:42:22.036 --> 00:42:23.908 brain there's a hotspot of activation

NOTE Confidence: 0.870380979333333

00:42:23.908 --> 00:42:26.120 is how are the different areas in

NOTE Confidence: 0.870380979333333

00:42:26.120 --> 00:42:27.744 the brain connected to each other?

NOTE Confidence: 0.870380979333333

00:42:27.744 --> 00:42:28.236 That is,

NOTE Confidence: 0.870380979333333

00:42:28.240 --> 00:42:30.556 how are they correlated with each

NOTE Confidence: 0.870380979333333

00:42:30.556 --> 00:42:32.799 other while you're watching the movie?

NOTE Confidence: 0.870380979333333

00:42:32.800 --> 00:42:34.425 Or how different two different

NOTE Confidence: 0.870380979333333

00:42:34.425 --> 00:42:36.437 brains watching the same movie are

NOTE Confidence: 0.870380979333333

00:42:36.437 --> 00:42:38.080 correlated with each other, right.

NOTE Confidence: 0.870380979333333

00:42:38.080 --> 00:42:40.000 So it's not the internal connectivity,

NOTE Confidence: 0.870380979333333

00:42:40.000 --> 00:42:42.475 but it's the correspondence between

NOTE Confidence: 0.870380979333333

00:42:42.475 --> 00:42:46.542 the two brains activity And Sarah

NOTE Confidence: 0.870380979333333

00:42:46.542 --> 00:42:48.999 Central and Alonso has done a really

NOTE Confidence: 0.870380979333333

00:42:48.999 --> 00:42:50.746 interesting analysis of a large

NOTE Confidence: 0.870380979333333

00:42:50.746 --> 00:42:52.744 data set that was available through

NOTE Confidence: 0.870380979333333

00:42:52.806 --> 00:42:54.956 the healthy brain network in which

NOTE Confidence: 0.870380979333333

00:42:54.956 --> 00:42:57.500 children now these are 6 to 18 year

NOTE Confidence: 0.870380979333333

00:42:57.573 --> 00:43:01.000 old children are watching the same movie.

NOTE Confidence: 0.870380979333333

00:43:01.000 --> 00:43:03.076 So it's this movie watching paradigm

NOTE Confidence: 0.870380979333333

00:43:03.076 --> 00:43:04.114 in the scanner.

NOTE Confidence: 0.870380979333333

00:43:04.120 --> 00:43:06.920 Parcelate the brain into a a a

NOTE Confidence: 0.870380979333333

00:43:06.920 --> 00:43:08.760 relatively small number of regions

NOTE Confidence: 0.870380979333333

00:43:08.760 --> 00:43:10.600 parcels compared to the number

NOTE Confidence: 0.870380979333333

00:43:10.658 --> 00:43:11.958 of voxels in the brain.

NOTE Confidence: 0.870380979333333

00:43:11.960 --> 00:43:15.425 And then ask how do these functional

NOTE Confidence: 0.870380979333333

00:43:15.425 --> 00:43:16.990 connectivity analysis differentiate

NOTE Confidence: 0.870380979333333

00:43:16.990 --> 00:43:19.665 between when you're watching the

NOTE Confidence: 0.870380979333333

00:43:19.665 --> 00:43:22.280 movie versus when you're at rest,

NOTE Confidence: 0.870380979333333

00:43:22.280 --> 00:43:25.040 right when there's no stimulation

NOTE Confidence: 0.870380979333333

00:43:25.040 --> 00:43:26.615 and without going through all

NOTE Confidence: 0.870380979333333

00:43:26.615 --> 00:43:27.875 of the gory details,

NOTE Confidence: 0.870380979333333

00:43:27.880 --> 00:43:29.842 There are different regions of the

NOTE Confidence: 0.870380979333333

00:43:29.842 --> 00:43:31.794 brain that show different functional

NOTE Confidence: 0.870380979333333

00:43:31.794 --> 00:43:33.440 connectivity patterns during

NOTE Confidence: 0.870380979333333

00:43:33.440 --> 00:43:35.840 rest and during movie watching.

NOTE Confidence: 0.870380979333333

00:43:35.840 --> 00:43:38.129 And those are so reliable that with

NOTE Confidence: 0.870380979333333

00:43:38.129 --> 00:43:41.278 only a 3 minute movie you can decode,

NOTE Confidence: 0.870380979333333

00:43:41.280 --> 00:43:43.272 that is tell whether the person

NOTE Confidence: 0.870380979333333

00:43:43.272 --> 00:43:45.698 is watching a movie or in a

NOTE Confidence: 0.870380979333333

00:43:45.698 --> 00:43:48.010 resting state with 89% accuracy.

NOTE Confidence: 0.870380979333333

00:43:48.010 --> 00:43:51.440 So there's a very robust decoding

NOTE Confidence: 0.870380979333333

00:43:51.440 --> 00:43:54.488 that you can do from these brain

NOTE Confidence: 0.870380979333333

00:43:54.488 --> 00:43:56.432 functional connectivity networks.

NOTE Confidence: 0.870380979333333

00:43:56.432 --> 00:43:57.080 Moreover,

NOTE Confidence: 0.963774846

00:43:57.080 --> 00:43:59.816 that relationship between rest and movie

NOTE Confidence: 0.963774846

00:43:59.816 --> 00:44:02.744 watching changes with age because of course

NOTE Confidence: 0.963774846

00:44:02.744 --> 00:44:04.952 the child is acquiring more knowledge,

NOTE Confidence: 0.963774846

00:44:04.960 --> 00:44:06.272 both linguistically 'cause they're

NOTE Confidence: 0.963774846

00:44:06.272 --> 00:44:07.912 listening to the audio track,

NOTE Confidence: 0.963774846

00:44:07.920 --> 00:44:10.853 but also visually in terms of interpreting

NOTE Confidence: 0.963774846

00:44:10.853 --> 00:44:13.382 the visual stimuli in in the movie.

NOTE Confidence: 0.963774846

00:44:13.382 --> 00:44:15.984 And as a result, that developmental

NOTE Confidence: 0.963774846

00:44:15.984 --> 00:44:20.128 function can be predictive of the relative

NOTE Confidence: 0.963774846

00:44:20.128 --> 00:44:24.360 maturational state of a particular child.

NOTE Confidence: 0.963774846

00:44:24.360 --> 00:44:26.080 We've extended that with Isabel,

NOTE Confidence: 0.963774846

00:44:26.080 --> 00:44:28.712 Nickerson and and Sarah over the last

NOTE Confidence: 0.963774846

00:44:28.712 --> 00:44:32.072 couple of years in which we wanted to

NOTE Confidence: 0.963774846

00:44:32.072 --> 00:44:34.232 target the language stimuli themselves.

NOTE Confidence: 0.963774846

00:44:34.240 --> 00:44:38.484 And so we switched from MRI to NEARS.

NOTE Confidence: 0.963774846

00:44:38.484 --> 00:44:42.046 These again are adults and we created

NOTE Confidence: 0.963774846

00:44:42.046 --> 00:44:44.860 the we presented the very same movies

NOTE Confidence: 0.963774846

00:44:44.940 --> 00:44:47.880 that were used in that previous study.

NOTE Confidence: 0.963774846

00:44:47.880 --> 00:44:49.959 Happens to be the movie Despicable Me.

NOTE Confidence: 0.963774846

00:44:49.960 --> 00:44:52.040 I highly recommend it.

NOTE Confidence: 0.963774846

00:44:52.040 --> 00:44:54.973 But we dubbed into the three into

NOTE Confidence: 0.963774846

00:44:54.973 --> 00:44:58.232 the movie 3 different audio tracks.

NOTE Confidence: 0.963774846

00:44:58.232 --> 00:45:00.280 One is in English,

NOTE Confidence: 0.963774846

00:45:00.280 --> 00:45:02.512 the one that the movie was made in English,

NOTE Confidence: 0.963774846

00:45:02.520 --> 00:45:03.654 another is Spanish,

NOTE Confidence: 0.963774846

00:45:03.654 --> 00:45:06.300 and the third is a non speech

NOTE Confidence: 0.963774846

00:45:06.379 --> 00:45:09.079 stimulus that you can't understand.

NOTE Confidence: 0.963774846

00:45:09.080 --> 00:45:10.880 And so the question is can we look at

NOTE Confidence: 0.963774846

00:45:10.880 --> 00:45:12.971 the nearest responses and adults while

NOTE Confidence: 0.963774846

00:45:12.971 --> 00:45:14.439 they're watching this naturalistic

NOTE Confidence: 0.963774846

00:45:14.439 --> 00:45:16.447 movie with the three audio tracks

NOTE Confidence: 0.963774846

00:45:16.447 --> 00:45:18.037 and discriminate between their native

NOTE Confidence: 0.963774846

00:45:18.040 --> 00:45:20.880 language and a non-native language.

NOTE Confidence: 0.963774846

00:45:20.880 --> 00:45:23.750 So it's more subtle than movie versus

NOTE Confidence: 0.963774846

00:45:23.750 --> 00:45:25.756 rest and and the answer is yes,

NOTE Confidence: 0.963774846

00:45:25.760 --> 00:45:27.305 you have greater left hemisphere

NOTE Confidence: 0.963774846

00:45:27.305 --> 00:45:29.253 activation when you're listening to your

NOTE Confidence: 0.963774846

00:45:29.253 --> 00:45:30.998 native language than non-native language.

NOTE Confidence: 0.963774846

00:45:31.000 --> 00:45:32.152 Perhaps not surprising,

NOTE Confidence: 0.963774846

00:45:32.152 --> 00:45:32.920 but moreover,

NOTE Confidence: 0.963774846

00:45:32.920 --> 00:45:34.652 the functional connectivity network

NOTE Confidence: 0.963774846

00:45:34.652 --> 00:45:35.518 is different.

NOTE Confidence: 0.963774846

00:45:35.520 --> 00:45:37.123 If you start with a seed region

NOTE Confidence: 0.963774846

00:45:37.123 --> 00:45:38.720 that's in the canonical language area

NOTE Confidence: 0.963774846

00:45:38.720 --> 00:45:40.715 and ask what is it connected to?

NOTE Confidence: 0.963774846

00:45:40.720 --> 00:45:42.358 It's connected in a much richer

NOTE Confidence: 0.963774846

00:45:42.358 --> 00:45:44.063 way when you're listening to your

NOTE Confidence: 0.963774846

00:45:44.063 --> 00:45:45.731 native language than when when you're

NOTE Confidence: 0.963774846

00:45:45.731 --> 00:45:47.399 listening to a non-native language.

NOTE Confidence: 0.963774846

00:45:47.400 --> 00:45:50.470 So we're in the process with Virginia

NOTE Confidence: 0.963774846

00:45:50.470 --> 00:45:52.480 Chambers and others in the lab

NOTE Confidence: 0.963774846

00:45:52.480 --> 00:45:54.832 to begin to do this with children

NOTE Confidence: 0.963774846

00:45:54.832 --> 00:45:56.679 moving from adults to children.

NOTE Confidence: 0.963774846

00:45:56.680 --> 00:46:01.148 So in the last five or six minutes,

NOTE Confidence: 0.963774846

00:46:01.148 --> 00:46:03.956 I just want to talk briefly about

NOTE Confidence: 0.963774846

00:46:03.956 --> 00:46:05.773 some applications to particular

NOTE Confidence: 0.963774846

00:46:05.773 --> 00:46:09.070 problems that have to do with special

NOTE Confidence: 0.963774846

00:46:09.149 --> 00:46:11.848 populations and how these neural

NOTE Confidence: 0.963774846

00:46:11.848 --> 00:46:14.680 methods can inform us about them.

NOTE Confidence: 0.963774846

00:46:14.680 --> 00:46:17.749 So I want to talk about this notion of

NOTE Confidence: 0.963774846

00:46:17.749 --> 00:46:20.304 prediction and and and its relationship

NOTE Confidence: 0.963774846

00:46:20.304 --> 00:46:21.907 to prematurity to storybook reading,

NOTE Confidence: 0.963774846

00:46:21.907 --> 00:46:23.401 which I think is kind of

NOTE Confidence: 0.963774846

00:46:23.401 --> 00:46:24.880 an interesting phenomenon,

NOTE Confidence: 0.963774846

00:46:24.880 --> 00:46:27.406 hyper scanning that is looking at

NOTE Confidence: 0.963774846

00:46:27.406 --> 00:46:29.090 the social interaction between

NOTE Confidence: 0.963774846

00:46:29.156 --> 00:46:32.560 individuals and the bilingual brain.

NOTE Confidence: 0.963774846

00:46:32.560 --> 00:46:34.180 So prediction is something that

NOTE Confidence: 0.963774846

00:46:34.180 --> 00:46:35.800 we do all the time.

NOTE Confidence: 0.963774846

00:46:35.800 --> 00:46:38.560 It's extremely important it what it's

NOTE Confidence: 0.963774846

00:46:38.560 --> 00:46:42.008 what allows you to interpret my perhaps

NOTE Confidence: 0.963774846

00:46:42.008 --> 00:46:45.760 overly rapid speech behavior at the moment.

NOTE Confidence: 0.963774846

00:46:45.760 --> 00:46:47.258 Didn't to know what the next word

NOTE Confidence: 0.963774846

00:46:47.258 --> 00:46:49.093 is that I'm going to say before I've

NOTE Confidence: 0.963774846

00:46:49.093 --> 00:46:50.824 even said it because we have learned

NOTE Confidence: 0.963774846

00:46:50.824 --> 00:46:52.426 all sorts of structures to our

NOTE Confidence: 0.963774846

00:46:52.426 --> 00:46:54.204 language and prediction is a really

NOTE Confidence: 0.963774846

00:46:54.204 --> 00:46:55.759 important process in doing that.

NOTE Confidence: 0.963774846

00:46:55.760 --> 00:46:58.361 Imagine that we had to wait to the end

NOTE Confidence: 0.963774846

00:46:58.361 --> 00:47:01.393 of every word before we knew what it was.

NOTE Confidence: 0.963774846

00:47:01.400 --> 00:47:03.758 We would continually fall behind our

NOTE Confidence: 0.963774846

00:47:03.758 --> 00:47:06.800 interpretation of of a speaker's utterances.

NOTE Confidence: 0.963774846

00:47:06.800 --> 00:47:08.500 So there's a really interesting

NOTE Confidence: 0.963774846

00:47:08.500 --> 00:47:10.200 case you know in an

NOTE Confidence: 0.793433413125

00:47:10.275 --> 00:47:12.675 epilepsy patient that was studied by

NOTE Confidence: 0.793433413125

00:47:12.680 --> 00:47:18.238 by Hughes ET al in 2001 and these were

NOTE Confidence: 0.793433413125

00:47:18.240 --> 00:47:20.614 direct recordings from the brain pre

NOTE Confidence: 0.793433413125

00:47:20.614 --> 00:47:23.098 surgical epilepsy patient and the the

NOTE Confidence: 0.793433413125

00:47:23.098 --> 00:47:25.720 the paradigm was really, really simple.

NOTE Confidence: 0.793433413125

00:47:25.720 --> 00:47:27.320 They're just hearing tone,

NOTE Confidence: 0.793433413125

00:47:27.320 --> 00:47:29.296 tone, tone, tone, right?

NOTE Confidence: 0.793433413125

00:47:29.296 --> 00:47:32.960 It's a it's a double tone burst.

NOTE Confidence: 0.793433413125

00:47:32.960 --> 00:47:35.284 But then every once in a while

NOTE Confidence: 0.793433413125

00:47:35.284 --> 00:47:37.200 they omitted the second tone.

NOTE Confidence: 0.793433413125

00:47:37.200 --> 00:47:39.076 And what they found is that of

NOTE Confidence: 0.793433413125

00:47:39.076 --> 00:47:40.718 course if there's just one tone,

NOTE Confidence: 0.793433413125

00:47:40.720 --> 00:47:42.799 as in that first little squiggle there,

NOTE Confidence: 0.793433413125

00:47:42.800 --> 00:47:43.820 you get one bump.

NOTE Confidence: 0.793433413125

00:47:43.820 --> 00:47:46.164 If there's two tones, you get 2 bumps.

NOTE Confidence: 0.793433413125

00:47:46.164 --> 00:47:48.792 But if you occasionally omit that

NOTE Confidence: 0.793433413125

00:47:48.792 --> 00:47:51.440 second tone, you still get 2 bumps.

NOTE Confidence: 0.793433413125

00:47:51.440 --> 00:47:52.940 That's a prediction effect.

NOTE Confidence: 0.793433413125

00:47:52.940 --> 00:47:54.784 And Lauren Emberson thought, wow,

NOTE Confidence: 0.793433413125

00:47:54.784 --> 00:47:57.536 this is a great paradigm to use with

NOTE Confidence: 0.793433413125

00:47:57.536 --> 00:47:59.904 babies because what we can do is we can

NOTE Confidence: 0.793433413125

00:47:59.904 --> 00:48:02.437 pair an auditory and a visual stimulus.

NOTE Confidence: 0.793433413125

00:48:02.440 --> 00:48:04.120 We can record from the temporal

NOTE Confidence: 0.793433413125

00:48:04.120 --> 00:48:05.553 cortex where the auditory signal

NOTE Confidence: 0.793433413125

00:48:05.553 --> 00:48:07.345 is going and from the visual cortex

NOTE Confidence: 0.793433413125

00:48:07.345 --> 00:48:09.039 where the visual signal is going.

NOTE Confidence: 0.793433413125

00:48:09.040 --> 00:48:09.920 And we can ask, well,

NOTE Confidence: 0.793433413125

00:48:09.920 --> 00:48:12.020 what happens after we paired the

NOTE Confidence: 0.793433413125

00:48:12.020 --> 00:48:13.880 stimuli over and over again.

NOTE Confidence: 0.793433413125

00:48:13.880 --> 00:48:15.580 And then occasionally we just

NOTE Confidence: 0.793433413125

00:48:15.580 --> 00:48:17.280 don't present the visual stimulus.

NOTE Confidence: 0.793433413125

00:48:17.280 --> 00:48:20.080 So it's analogous to the Hughes study.

NOTE Confidence: 0.793433413125

00:48:20.080 --> 00:48:22.198 So they get 80%, I'm sorry,

NOTE Confidence: 0.793433413125

00:48:22.200 --> 00:48:24.448 they get 100% pairing and then they go

NOTE Confidence: 0.793433413125

00:48:24.448 --> 00:48:26.959 into a test phase where they have 80%

NOTE Confidence: 0.793433413125

00:48:26.960 --> 00:48:32.196 pairing and 20% omitting the visual stimulus.

NOTE Confidence: 0.793433413125

00:48:32.200 --> 00:48:33.200 And So what you see,

NOTE Confidence: 0.793433413125

00:48:33.200 --> 00:48:34.640 this is a cartoon, trust me,

NOTE Confidence: 0.793433413125

00:48:34.640 --> 00:48:36.540 the data looked just like

NOTE Confidence: 0.793433413125

00:48:36.540 --> 00:48:37.720 this for simplicity.

NOTE Confidence: 0.793433413125

00:48:37.720 --> 00:48:40.120 When you're testing them on the

NOTE Confidence: 0.793433413125

00:48:40.120 --> 00:48:42.488 80% of the trials where they get

NOTE Confidence: 0.793433413125

00:48:42.488 --> 00:48:43.800 auditory and visual information,

NOTE Confidence: 0.793433413125

00:48:43.800 --> 00:48:46.008 well then you get temporal cortex

NOTE Confidence: 0.793433413125

00:48:46.008 --> 00:48:48.160 activation and occipital cortex activation.

NOTE Confidence: 0.793433413125

00:48:48.160 --> 00:48:49.848 That's that's not surprising.

NOTE Confidence: 0.793433413125

00:48:49.848 --> 00:48:51.958 What's surprising is that when

NOTE Confidence: 0.793433413125

00:48:51.958 --> 00:48:53.975 you on those 20% of the trials,

NOTE Confidence: 0.793433413125

00:48:53.975 --> 00:48:55.200 you present the auditory stimulus,

NOTE Confidence: 0.793433413125

00:48:55.200 --> 00:48:57.314 but you don't present the visual stimulus,

NOTE Confidence: 0.793433413125

00:48:57.320 --> 00:48:58.960 you get the same response.

NOTE Confidence: 0.793433413125

00:48:58.960 --> 00:49:01.042 So the occipital cortex is responding

NOTE Confidence: 0.793433413125

00:49:01.042 --> 00:49:03.355 even though there's no physical stimulus

NOTE Confidence: 0.793433413125

00:49:03.355 --> 00:49:05.953 present because it's a predicted response.

NOTE Confidence: 0.793433413125

00:49:05.960 --> 00:49:07.888 And we ran a control condition in which

NOTE Confidence: 0.793433413125

00:49:07.888 --> 00:49:09.718 they never got the two stimuli paired.

NOTE Confidence: 0.793433413125

00:49:09.720 --> 00:49:11.280 They were just always in just random order,

NOTE Confidence: 0.793433413125

00:49:11.280 --> 00:49:11.830 no pairing.

NOTE Confidence: 0.793433413125

00:49:11.830 --> 00:49:13.782 And then you get this effect, right?

NOTE Confidence: 0.793433413125

00:49:13.782 --> 00:49:15.594 When you present an auditory stimulus,

NOTE Confidence: 0.793433413125

00:49:15.600 --> 00:49:17.950 you get an auditory temporal

NOTE Confidence: 0.793433413125

00:49:17.950 --> 00:49:19.000 cortex response visual,

NOTE Confidence: 0.793433413125

00:49:19.000 --> 00:49:20.400 you get a visual.

NOTE Confidence: 0.793433413125

00:49:20.400 --> 00:49:22.998 So what's interesting here is that

NOTE Confidence: 0.793433413125

00:49:23.000 --> 00:49:26.240 that high bar on the left is the

NOTE Confidence: 0.793433413125

00:49:26.240 --> 00:49:28.840 unexpected absence of a stimulus,

NOTE Confidence: 0.793433413125

00:49:28.840 --> 00:49:31.288 and the low bar on the right is the

NOTE Confidence: 0.793433413125

00:49:31.288 --> 00:49:33.356 expected absence of a stimulus right.

NOTE Confidence: 0.793433413125

00:49:33.360 --> 00:49:35.516 So one is expected, one is unexpected,

NOTE Confidence: 0.793433413125

00:49:35.520 --> 00:49:37.632 and you get a hugely different

NOTE Confidence: 0.793433413125

00:49:37.632 --> 00:49:39.040 response in the brain.

NOTE Confidence: 0.793433413125

00:49:39.040 --> 00:49:41.224 Now the reason I'm raising this is

NOTE Confidence: 0.793433413125

00:49:41.224 --> 00:49:42.487 because prediction effects have

NOTE Confidence: 0.793433413125

00:49:42.487 --> 00:49:44.384 been shown to be kind of interesting

NOTE Confidence: 0.793433413125

00:49:44.384 --> 00:49:46.158 with regard to special populations.

NOTE Confidence: 0.793433413125

00:49:46.160 --> 00:49:48.645 Lauren did a follow up study with

NOTE Confidence: 0.793433413125

00:49:48.645 --> 00:49:50.560 about 100 prematurely born infants

NOTE Confidence: 0.793433413125

00:49:50.560 --> 00:49:52.325 and showed that that prediction

NOTE Confidence: 0.793433413125

00:49:52.325 --> 00:49:54.759 response is not present to the brain.

NOTE Confidence: 0.793433413125

00:49:54.760 --> 00:49:55.274 Now,

NOTE Confidence: 0.793433413125

00:49:55.274 --> 00:49:58.358 these babies appear to be behaviorally

NOTE Confidence: 0.793433413125

00:49:58.360 --> 00:49:59.040 typically developing,

NOTE Confidence: 0.793433413125

00:49:59.040 --> 00:50:01.420 but yet they have this neural problem

NOTE Confidence: 0.793433413125

00:50:01.420 --> 00:50:03.628 and the question is will they have

NOTE Confidence: 0.793433413125

00:50:03.628 --> 00:50:06.160 a cascading effect later, right?

NOTE Confidence: 0.793433413125

00:50:06.160 --> 00:50:08.722 But we also did follow up experience

NOTE Confidence: 0.793433413125

00:50:08.722 --> 00:50:09.820 with our colleagues

NOTE Confidence: 0.833802306666667

00:50:09.891 --> 00:50:12.080 in Taiwan in which we asked whether

NOTE Confidence: 0.833802306666667

00:50:12.080 --> 00:50:16.572 this prediction effect is predictive

NOTE Confidence: 0.833802306666667

00:50:16.572 --> 00:50:18.996 of subsequent language development.

NOTE Confidence: 0.833802306666667

00:50:19.000 --> 00:50:20.701 And the answer is that if you look at

NOTE Confidence: 0.833802306666667

00:50:20.701 --> 00:50:22.558 this prediction effect in six month olds,

NOTE Confidence: 0.833802306666667

00:50:22.560 --> 00:50:24.600 just like in the original study,

NOTE Confidence: 0.833802306666667

00:50:24.600 --> 00:50:27.400 and then ask how is it related to

NOTE Confidence: 0.833802306666667

00:50:27.400 --> 00:50:28.960 subsequent language development,

NOTE Confidence: 0.833802306666667

00:50:28.960 --> 00:50:32.054 the answer is that it is reliably

NOTE Confidence: 0.833802306666667

00:50:32.054 --> 00:50:33.864 related to productive language

NOTE Confidence: 0.833802306666667

00:50:33.864 --> 00:50:37.080 behavior at 12 and 18 months of age.

NOTE Confidence: 0.833802306666667

00:50:37.080 --> 00:50:39.558 In addition, in a follow up experiment,

NOTE Confidence: 0.833802306666667

00:50:39.560 --> 00:50:41.224 Shin then asked, well,

NOTE Confidence: 0.833802306666667

00:50:41.224 --> 00:50:44.340 what is it about the language environment

NOTE Confidence: 0.833802306666667

00:50:44.340 --> 00:50:47.424 that is causing better language performance?

NOTE Confidence: 0.833802306666667

00:50:47.424 --> 00:50:50.840 One thing that has been known behaviorally

NOTE Confidence: 0.833802306666667

00:50:50.840 --> 00:50:52.891 is that storybook reading seems to be

NOTE Confidence: 0.833802306666667

00:50:52.891 --> 00:50:54.959 a predictor of subsequent language,

NOTE Confidence: 0.833802306666667

00:50:54.960 --> 00:50:57.280 and that's what's shown in this diagram here.

NOTE Confidence: 0.833802306666667

00:50:57.280 --> 00:50:59.362 The mothers who read more storybooks

NOTE Confidence: 0.833802306666667

00:50:59.362 --> 00:51:01.368 to their infants between 6:00 and

NOTE Confidence: 0.833802306666667

00:51:01.368 --> 00:51:03.321 12:00 months of age the more likely

NOTE Confidence: 0.833802306666667

00:51:03.321 --> 00:51:05.396 they were to have a better language

NOTE Confidence: 0.833802306666667

00:51:05.396 --> 00:51:07.564 outcome at 18 months of age.

NOTE Confidence: 0.833802306666667

00:51:07.564 --> 00:51:08.568 But moreover,

NOTE Confidence: 0.833802306666667

00:51:08.568 --> 00:51:10.576 that predictive effect in

NOTE Confidence: 0.833802306666667

00:51:10.576 --> 00:51:12.440 the nearest response,

NOTE Confidence: 0.833802306666667

00:51:12.440 --> 00:51:14.960 the visual omission effect,

NOTE Confidence: 0.833802306666667

00:51:14.960 --> 00:51:17.480 also predicted vocabulary development,

NOTE Confidence: 0.833802306666667

00:51:17.480 --> 00:51:19.736 and it had a separate additive

NOTE Confidence: 0.833802306666667

00:51:19.736 --> 00:51:21.720 component to the prediction.

NOTE Confidence: 0.833802306666667

00:51:21.720 --> 00:51:23.286 So it's not just the experience

NOTE Confidence: 0.833802306666667

00:51:23.286 --> 00:51:24.959 that they get with the mother,

NOTE Confidence: 0.833802306666667

00:51:24.960 --> 00:51:27.431 it's the kind of changes that it

NOTE Confidence: 0.833802306666667

00:51:27.431 --> 00:51:30.140 implements in the brain that causes

NOTE Confidence: 0.833802306666667

00:51:30.140 --> 00:51:32.240 this subsequent language behavior.

NOTE Confidence: 0.924775393333333

00:51:34.560 --> 00:51:36.870 And that suggests that this

NOTE Confidence: 0.924775393333333

00:51:36.870 --> 00:51:38.718 interactive nature of mothers,

NOTE Confidence: 0.924775393333333

00:51:38.720 --> 00:51:40.720 typically mothers and and infants,

NOTE Confidence: 0.924775393333333

00:51:40.720 --> 00:51:42.320 sometimes fathers, of course,

NOTE Confidence: 0.924775393333333

00:51:42.320 --> 00:51:43.520 could be important.

NOTE Confidence: 0.924775393333333

00:51:43.520 --> 00:51:45.515 And there is a paradigm called hyperscanning,

NOTE Confidence: 0.924775393333333

00:51:45.520 --> 00:51:47.832 which many of you might know that Joy

NOTE Confidence: 0.924775393333333

00:51:47.832 --> 00:51:49.771 Hirsch's lab studies here at Yale.

NOTE Confidence: 0.924775393333333

00:51:49.771 --> 00:51:52.205 And this is the first study that I

NOTE Confidence: 0.924775393333333

00:51:52.205 --> 00:51:54.235 know of out of Elise Piazza's lab,

NOTE Confidence: 0.924775393333333

00:51:54.240 --> 00:51:55.840 actually Casey Lou Williams

NOTE Confidence: 0.924775393333333

00:51:55.840 --> 00:51:57.440 lab at at Princeton.

NOTE Confidence: 0.924775393333333

00:51:57.440 --> 00:51:59.480 But Elise Piazza is now in

NOTE Confidence: 0.924775393333333

00:51:59.480 --> 00:52:00.840 her own faculty position,

NOTE Confidence: 0.924775393333333

00:52:00.840 --> 00:52:02.490 showing nears in a hyperscanning

NOTE Confidence: 0.924775393333333

00:52:02.490 --> 00:52:04.140 paradigm where the mother is

NOTE Confidence: 0.924775393333333

00:52:04.195 --> 00:52:05.905 wearing an apparatus and the

NOTE Confidence: 0.924775393333333

00:52:05.905 --> 00:52:07.273 baby's wearing an apparatus.

NOTE Confidence: 0.924775393333333

00:52:07.280 --> 00:52:09.366 And the question is what is the

NOTE Confidence: 0.924775393333333

00:52:09.366 --> 00:52:10.992 relationship between the back and

NOTE Confidence: 0.924775393333333

00:52:10.992 --> 00:52:12.336 forth and social communication

NOTE Confidence: 0.924775393333333

00:52:12.336 --> 00:52:13.680 between the two brains.

NOTE Confidence: 0.924775393333333

00:52:13.680 --> 00:52:15.276 And the answer is that they are.

NOTE Confidence: 0.924775393333333

00:52:15.280 --> 00:52:16.936 They are statistically

NOTE Confidence: 0.924775393333333

00:52:16.936 --> 00:52:18.040 significantly correlated.

NOTE Confidence: 0.924775393333333

00:52:18.040 --> 00:52:18.546 Now,

NOTE Confidence: 0.924775393333333

00:52:18.546 --> 00:52:21.582 what that correlation implies for other

NOTE Confidence: 0.924775393333333

00:52:21.582 --> 00:52:24.920 aspects of behavior are are not yet known,

NOTE Confidence: 0.924775393333333

00:52:24.920 --> 00:52:26.996 because this paradigm really hasn't been

NOTE Confidence: 0.924775393333333

00:52:26.996 --> 00:52:29.404 used very much with young infants yet.

NOTE Confidence: 0.924775393333333

00:52:29.404 --> 00:52:31.450 But it's suggestive of the fact

NOTE Confidence: 0.924775393333333

00:52:31.519 --> 00:52:33.484 that that synchrony between the

NOTE Confidence: 0.924775393333333

00:52:33.484 --> 00:52:36.120 brains may have causal effects on

NOTE Confidence: 0.924775393333333

00:52:36.120 --> 00:52:38.360 a variety of subsequent behaviors,

NOTE Confidence: 0.924775393333333

00:52:38.360 --> 00:52:41.639 including language development.

NOTE Confidence: 0.924775393333333

00:52:41.640 --> 00:52:45.798 Just two more things and then I will stop.

NOTE Confidence: 0.924775393333333

00:52:45.800 --> 00:52:48.752 I wanted to mention briefly a a study

NOTE Confidence: 0.924775393333333

00:52:48.752 --> 00:52:51.496 that just came out from a a grant

NOTE Confidence: 0.924775393333333

00:52:51.496 --> 00:52:54.400 that we got from the Gates Foundation.

NOTE Confidence: 0.924775393333333

00:52:54.400 --> 00:52:56.360 And this is a study in which

NOTE Confidence: 0.924775393333333

00:52:56.360 --> 00:52:59.760 infants from low resource countries,

NOTE Confidence: 0.924775393333333

00:52:59.760 --> 00:53:03.240 in this particular case was Bangladesh,

NOTE Confidence: 0.924775393333333

00:53:03.240 --> 00:53:04.650 were studied at two different

NOTE Confidence: 0.924775393333333

00:53:04.650 --> 00:53:06.520 ages 6 and 12 months of age,

NOTE Confidence: 0.924775393333333

00:53:06.520 --> 00:53:08.856 6 and 24 months of age using

NOTE Confidence: 0.924775393333333

00:53:08.856 --> 00:53:11.320 nears and the task.

NOTE Confidence: 0.924775393333333

00:53:11.320 --> 00:53:11.800 I'm sorry.

NOTE Confidence: 0.924775393333333

00:53:11.800 --> 00:53:13.240 And and half of the baby,

NOTE Confidence: 0.924775393333333

00:53:13.240 --> 00:53:14.325 roughly half of the babies

NOTE Confidence: 0.924775393333333

00:53:14.325 --> 00:53:15.193 were from low income,

NOTE Confidence: 0.924775393333333

00:53:15.200 --> 00:53:18.020 low income in Bangladesh versus

NOTE Confidence: 0.924775393333333

00:53:18.020 --> 00:53:20.276 middle income in Bangladesh.

NOTE Confidence: 0.924775393333333

00:53:20.280 --> 00:53:22.278 And the stimuli were social stimuli.

NOTE Confidence: 0.924775393333333

00:53:22.280 --> 00:53:24.920 They're depicted on a on a video screen.

NOTE Confidence: 0.924775393333333

00:53:24.920 --> 00:53:26.630 One is a person who's interacting

NOTE Confidence: 0.924775393333333

00:53:26.630 --> 00:53:28.686 with the baby and the other is

NOTE Confidence: 0.924775393333333

00:53:28.686 --> 00:53:30.116 an inanimate object that is,

NOTE Confidence: 0.924775393333333

00:53:30.120 --> 00:53:30.864 you know,

NOTE Confidence: 0.924775393333333

00:53:30.864 --> 00:53:32.724 dynamic but doesn't have social

NOTE Confidence: 0.924775393333333

00:53:32.724 --> 00:53:33.840 component to it.

NOTE Confidence: 0.924775393333333

00:53:33.840 --> 00:53:35.884 And what they studied was the functional

NOTE Confidence: 0.924775393333333

00:53:35.884 --> 00:53:37.240 connectivity network within the brain.

NOTE Confidence: 0.924775393333333

00:53:37.240 --> 00:53:39.975 At six months and 24 months between

NOTE Confidence: 0.924775393333333

00:53:39.975 --> 00:53:42.040 the low income and the medium income,

NOTE Confidence: 0.924775393333333

00:53:42.040 --> 00:53:44.240 there was a statistically significant

NOTE Confidence: 0.924775393333333

00:53:44.240 --> 00:53:44.680 difference.

NOTE Confidence: 0.924775393333333

00:53:44.680 --> 00:53:45.883 But interestingly enough,

NOTE Confidence: 0.924775393333333

00:53:45.883 --> 00:53:48.690 if you look at the change in

NOTE Confidence: 0.924775393333333

00:53:48.774 --> 00:53:50.560 functional connectivity,

NOTE Confidence: 0.924775393333333

00:53:50.560 --> 00:53:54.440 in the low income group,

NOTE Confidence: 0.924775393333333

00:53:54.440 --> 00:53:56.120 there's an increase in functional

NOTE Confidence: 0.924775393333333

00:53:56.120 --> 00:53:58.142 connectivity between 6 and 24 months

NOTE Confidence: 0.924775393333333

00:53:58.142 --> 00:53:59.876 and in the middle income group,

NOTE Confidence: 0.924775393333333

00:53:59.880 --> 00:54:01.292 there's a decrease in

NOTE Confidence: 0.924775393333333

00:54:01.292 --> 00:54:01.998 functional connectivity.

NOTE Confidence: 0.924775393333333

00:54:02.000 --> 00:54:03.701 We know that there are a variety

NOTE Confidence: 0.924775393333333

00:54:03.701 --> 00:54:05.479 of processes that go on the brain

NOTE Confidence: 0.924775393333333

00:54:05.479 --> 00:54:07.450 that involve like pruning and the

NOTE Confidence: 0.924775393333333

00:54:07.450 --> 00:54:09.390 reduction in connections because

NOTE Confidence: 0.924775393333333

00:54:09.390 --> 00:54:11.668 of maturation and noise reduction.

NOTE Confidence: 0.924775393333333

00:54:11.668 --> 00:54:14.350 And so this suggests that perhaps

NOTE Confidence: 0.924775393333333

00:54:14.427 --> 00:54:16.862 these low income infants are immature,

NOTE Confidence: 0.924775393333333

00:54:16.862 --> 00:54:17.644 that is,

NOTE Confidence: 0.924775393333333

00:54:17.644 --> 00:54:20.560 they will show the same decrease effect,

NOTE Confidence: 0.924775393333333

00:54:20.560 --> 00:54:22.360 but they'll they'll show it at a later age.

NOTE Confidence: 0.924775393333333

00:54:22.360 --> 00:54:24.310 And so Chuck Nelson's group is

NOTE Confidence: 0.924775393333333

00:54:24.310 --> 00:54:26.120 following up with his babies.

NOTE Confidence: 0.924775393333333

00:54:26.120 --> 00:54:26.552 And finally,

NOTE Confidence: 0.924775393333333

00:54:26.552 --> 00:54:28.064 I just want to say one thing

NOTE Confidence: 0.924775393333333

00:54:28.064 --> 00:54:29.159 about bilingual infants.

NOTE Confidence: 0.924775393333333

00:54:29.160 --> 00:54:31.362 It's it's long been thought that

NOTE Confidence: 0.924775393333333

00:54:31.362 --> 00:54:32.830 individuals who are confronted

NOTE Confidence: 0.924775393333333

00:54:32.888 --> 00:54:34.704 with two native language

NOTE Confidence: 0.924775393333333

00:54:34.704 --> 00:54:36.063 simultaneously have certain kinds

NOTE Confidence: 0.924775393333333

00:54:36.063 --> 00:54:37.568 of cognitive processes that are

NOTE Confidence: 0.924775393333333

00:54:37.568 --> 00:54:39.159 more flexible because they do a

NOTE Confidence: 0.924775393333333

00:54:39.159 --> 00:54:40.569 lot of switching between the two

NOTE Confidence: 0.965460578181818

00:54:40.619 --> 00:54:41.559 different languages.

NOTE Confidence: 0.965460578181818

00:54:41.560 --> 00:54:44.455 And one instance of that behaviorally

NOTE Confidence: 0.965460578181818

00:54:44.455 --> 00:54:46.945 is that they're able to deploy

NOTE Confidence: 0.965460578181818

00:54:46.945 --> 00:54:48.840 their attention more flexibly.

NOTE Confidence: 0.965460578181818

00:54:48.840 --> 00:54:50.316 I'm not going to go through the results here,

NOTE Confidence: 0.965460578181818

00:54:50.320 --> 00:54:51.976 but that was definitely true in

NOTE Confidence: 0.965460578181818

00:54:51.976 --> 00:54:53.721 a study with Maria Arredondo and

NOTE Confidence: 0.965460578181818

00:54:53.721 --> 00:54:55.473 Janet Worker in which it was

NOTE Confidence: 0.965460578181818

00:54:55.473 --> 00:54:57.687 shown that the bilinguals have a

NOTE Confidence: 0.965460578181818

00:54:57.687 --> 00:54:59.647 reaction time advantage under these

NOTE Confidence: 0.965460578181818

00:54:59.647 --> 00:55:01.798 circumstances behaviorally and that

NOTE Confidence: 0.965460578181818

00:55:01.798 --> 00:55:04.880 it's correlated with how often the

NOTE Confidence: 0.965460578181818

00:55:04.880 --> 00:55:06.640 parent does language switching.

NOTE Confidence: 0.965460578181818

00:55:06.640 --> 00:55:08.038 That's behavioral results.

NOTE Confidence: 0.965460578181818

00:55:08.038 --> 00:55:09.436 But in addition,

NOTE Confidence: 0.965460578181818

00:55:09.440 --> 00:55:11.696 there was a near study on a on

NOTE Confidence: 0.965460578181818

00:55:11.696 --> 00:55:13.476 a follow up in which recordings

NOTE Confidence: 0.965460578181818

00:55:13.476 --> 00:55:15.468 were made from the babies brains

NOTE Confidence: 0.965460578181818

00:55:15.468 --> 00:55:17.439 at six and ten months of age.

NOTE Confidence: 0.965460578181818

00:55:17.440 --> 00:55:19.264 And interestingly enough,

NOTE Confidence: 0.965460578181818

00:55:19.264 --> 00:55:22.304 the bilingual infants show this

NOTE Confidence: 0.965460578181818

00:55:22.304 --> 00:55:24.880 greater frontal left frontal

NOTE Confidence: 0.965460578181818

00:55:24.880 --> 00:55:27.088 activation on these mismatched trials

NOTE Confidence: 0.965460578181818

00:55:27.088 --> 00:55:29.440 that I didn't describe very well.

NOTE Confidence: 0.965460578181818

00:55:29.440 --> 00:55:31.960 But basically the behavioral results

NOTE Confidence: 0.965460578181818

00:55:31.960 --> 00:55:36.086 show a neural difference that you

NOTE Confidence: 0.965460578181818

00:55:36.086 --> 00:55:37.401 wouldn't ordinarily have seen by

NOTE Confidence: 0.965460578181818

00:55:37.401 --> 00:55:39.118 just looking at the behavior alone.

NOTE Confidence: 0.965460578181818

00:55:39.120 --> 00:55:41.087 That is that there is a particular

NOTE Confidence: 0.965460578181818

00:55:41.087 --> 00:55:43.536 brain region that seems to be different

NOTE Confidence: 0.965460578181818

00:55:43.536 --> 00:55:45.080 between bilinguals and monolingues.

NOTE Confidence: 0.965460578181818

00:55:45.080 --> 00:55:47.438 So let me just wrap up.

NOTE Confidence: 0.965460578181818

00:55:47.440 --> 00:55:49.640 These behavioral studies in infant

NOTE Confidence: 0.965460578181818

00:55:49.640 --> 00:55:51.440 language development have been

NOTE Confidence: 0.965460578181818

00:55:51.440 --> 00:55:54.320 very powerful with a long history,

NOTE Confidence: 0.965460578181818

00:55:54.320 --> 00:55:55.086 neural development,

NOTE Confidence: 0.965460578181818

00:55:55.086 --> 00:55:57.384 infants adds and I think important

NOTE Confidence: 0.965460578181818

00:55:57.384 --> 00:55:59.600 insights about these behavioral changes.

NOTE Confidence: 0.965460578181818

00:55:59.600 --> 00:56:01.148 These more modern multivariate

NOTE Confidence: 0.965460578181818

00:56:01.148 --> 00:56:02.696 and machine learning techniques

NOTE Confidence: 0.965460578181818

00:56:02.696 --> 00:56:05.034 I think are now being used much

NOTE Confidence: 0.965460578181818

00:56:05.034 --> 00:56:06.238 more widely with infants.

NOTE Confidence: 0.965460578181818

00:56:06.240 --> 00:56:08.064 And we've been,

NOTE Confidence: 0.965460578181818

00:56:08.064 --> 00:56:09.280 you know,

NOTE Confidence: 0.965460578181818

00:56:09.280 --> 00:56:10.885 limited in terms of practical

NOTE Confidence: 0.965460578181818

00:56:10.885 --> 00:56:13.220 constraints on how much data we can

NOTE Confidence: 0.965460578181818

00:56:13.220 --> 00:56:14.905 get from Maybe's naturalistic viewing

NOTE Confidence: 0.965460578181818

00:56:14.905 --> 00:56:16.918 as one potential solution to that.

NOTE Confidence: 0.965460578181818

00:56:16.920 --> 00:56:19.440 And all of these things conspire to,

NOTE Confidence: 0.965460578181818

00:56:19.440 --> 00:56:20.750 I think be reasonably optimistic

NOTE Confidence: 0.965460578181818

00:56:20.750 --> 00:56:22.581 that we can look at individual

NOTE Confidence: 0.965460578181818

00:56:22.581 --> 00:56:24.437 differences in special populations.

NOTE Confidence: 0.965460578181818

00:56:24.440 --> 00:56:25.187 So with that,

NOTE Confidence: 0.965460578181818

00:56:25.187 --> 00:56:26.930 let me conclude by saying that Nick

NOTE Confidence: 0.965460578181818

00:56:26.989 --> 00:56:28.845 Sharp Brown and I have a paper coming

NOTE Confidence: 0.965460578181818

00:56:28.845 --> 00:56:31.312 out next month with in trends and

NOTE Confidence: 0.965460578181818

00:56:31.312 --> 00:56:33.585 neuroscience that summarize a lot of

NOTE Confidence: 0.965460578181818

00:56:33.585 --> 00:56:35.380 methodological things that I talked

NOTE Confidence: 0.965460578181818

00:56:35.380 --> 00:56:37.598 about today in much more detail.

NOTE Confidence: 0.965460578181818

00:56:37.600 --> 00:56:38.266 And with that,

NOTE Confidence: 0.965460578181818

00:56:38.266 --> 00:56:39.598 thanks very much for your attention,

NOTE Confidence: 0.836848349166667

00:56:46.760 --> 00:56:49.084 right. So now we're going to take

NOTE Confidence: 0.836848349166667

00:56:49.084 --> 00:56:50.959 some questions from the audience.

NOTE Confidence: 0.836848349166667

00:56:50.960 --> 00:56:51.719 If you're awesome,

NOTE Confidence: 0.6480576

00:56:56.000 --> 00:56:58.520 Professor Lefkowitz,

NOTE Confidence: 0.6480576

00:56:58.520 --> 00:57:01.800 Professor Aslan, wonderful talk.

NOTE Confidence: 0.94871272

00:57:01.800 --> 00:57:03.820 Thank you so much, So much to

NOTE Confidence: 0.94871272

00:57:03.820 --> 00:57:06.184 think about one one question that

NOTE Confidence: 0.94871272

00:57:06.184 --> 00:57:09.500 came to mind was find the the work

NOTE Confidence: 0.94871272

00:57:09.500 --> 00:57:10.800 on prediction very interesting.

NOTE Confidence: 0.6880498

00:57:10.800 --> 00:57:12.720 And of course, prediction is so

NOTE Confidence: 0.6880498

00:57:12.720 --> 00:57:14.720 fundamental to learning and all of that.

NOTE Confidence: 0.95086762625

00:57:15.680 --> 00:57:18.585 And I wondered whether you have ever

NOTE Confidence: 0.95086762625

00:57:18.585 --> 00:57:21.655 looked at the ability of babies to

NOTE Confidence: 0.95086762625

00:57:21.655 --> 00:57:23.680 predict babies or even children,

NOTE Confidence: 0.95086762625

00:57:23.680 --> 00:57:27.040 especially in light of multi

NOTE Confidence: 0.890602033333333

00:57:27.040 --> 00:57:29.596 sensory information. That is to say,

NOTE Confidence: 0.890602033333333

00:57:29.600 --> 00:57:31.517 one of the things that we know is that

NOTE Confidence: 0.8618952375

00:57:32.080 --> 00:57:34.330 multi sensory integration is a

NOTE Confidence: 0.8618952375

00:57:34.330 --> 00:57:35.960 very long developmental process,

NOTE Confidence: 0.8618952375

00:57:35.960 --> 00:57:38.640 takes a long time for babies and

NOTE Confidence: 0.8618952375

00:57:38.640 --> 00:57:40.120 then children to begin to learn

NOTE Confidence: 0.941745024

00:57:40.120 --> 00:57:41.400 how to connect what they

NOTE Confidence: 0.941745024

00:57:41.400 --> 00:57:42.680 see with what they hear,

NOTE Confidence: 0.941745024

00:57:42.680 --> 00:57:44.440 particularly in the social domain.

NOTE Confidence: 0.967121686

00:57:45.000 --> 00:57:48.186 So I'm just wondering whether if you

NOTE Confidence: 0.967121686

00:57:48.186 --> 00:57:50.200 were to use multi sensory stimuli,

NOTE Confidence: 0.967121686

00:57:50.200 --> 00:57:52.360 auditory and visual in particular,

NOTE Confidence: 0.967121686

00:57:52.360 --> 00:57:54.200 whether you would get different patterns

NOTE Confidence: 0.967121686

00:57:54.200 --> 00:57:56.876 of prediction that would be visible

NOTE Confidence: 0.678641878571429

00:57:56.880 --> 00:57:58.679 in the brain response. Just it's just

NOTE Confidence: 0.859866545294118

00:57:59.880 --> 00:58:02.010 So let me just for those of you on Zoom

NOTE Confidence: 0.859866545294118

00:58:02.065 --> 00:58:04.354 who might not have heard David's question.

NOTE Confidence: 0.859866545294118

00:58:04.360 --> 00:58:06.768 He's asking whether or not the the

NOTE Confidence: 0.859866545294118

00:58:06.768 --> 00:58:08.840 prediction effects have been studied in

NOTE Confidence: 0.859866545294118

00:58:08.840 --> 00:58:11.122 the multi sensory domain where you have

NOTE Confidence: 0.859866545294118

00:58:11.187 --> 00:58:13.677 combinations of sensory stimuli presented.

NOTE Confidence: 0.859866545294118

00:58:13.680 --> 00:58:17.299 And if I can make just two

NOTE Confidence: 0.859866545294118

00:58:17.299 --> 00:58:19.520 quick comments about that.

NOTE Confidence: 0.859866545294118

00:58:19.520 --> 00:58:21.836 Some of the studies we're doing

NOTE Confidence: 0.859866545294118

00:58:21.836 --> 00:58:23.380 involved simultaneous presentation of

NOTE Confidence: 0.859866545294118

00:58:23.445 --> 00:58:25.520 both auditory and visual information,

NOTE Confidence: 0.859866545294118

00:58:25.520 --> 00:58:28.208 and so in principle you could tease apart

NOTE Confidence: 0.859866545294118

00:58:28.208 --> 00:58:30.817 what aspect of that combination of stimuli

NOTE Confidence: 0.859866545294118

00:58:30.817 --> 00:58:33.200 is leading to the prediction effect.

NOTE Confidence: 0.859866545294118

00:58:33.200 --> 00:58:34.845 Moreover, it would be interesting

NOTE Confidence: 0.859866545294118

00:58:34.845 --> 00:58:37.308 if you could train one of these

NOTE Confidence: 0.859866545294118

00:58:37.308 --> 00:58:39.400 machine learning models to identify

NOTE Confidence: 0.859866545294118

00:58:39.400 --> 00:58:41.800 which of those two stimuli,

NOTE Confidence: 0.859866545294118

00:58:41.800 --> 00:58:43.168 or possibly both,

NOTE Confidence: 0.859866545294118

00:58:43.168 --> 00:58:46.360 are driving the effect in the brain,

NOTE Confidence: 0.859866545294118

00:58:46.360 --> 00:58:48.040 because all we have you know,

NOTE Confidence: 0.859866545294118

00:58:48.040 --> 00:58:51.676 are these simple examples of prediction.

NOTE Confidence: 0.859866545294118

00:58:51.680 --> 00:58:54.280 And the third comment is that Alexis Black,

NOTE Confidence: 0.859866545294118

00:58:54.280 --> 00:58:55.197 who used to be in my lab,

NOTE Confidence: 0.859866545294118

00:58:55.200 --> 00:58:58.432 and I have long wanted to do prediction

NOTE Confidence: 0.859866545294118

00:58:58.432 --> 00:59:00.076 experiments in the language domain

NOTE Confidence: 0.859866545294118

00:59:00.076 --> 00:59:01.930 in which you're listening to a

NOTE Confidence: 0.859866545294118

00:59:01.991 --> 00:59:04.112 sentence and then the very last word

NOTE Confidence: 0.859866545294118

00:59:04.112 --> 00:59:06.208 of the sentence is omitted, right?

NOTE Confidence: 0.859866545294118

00:59:06.208 --> 00:59:07.720 It's not there.

NOTE Confidence: 0.859866545294118

00:59:07.720 --> 00:59:09.268 And see whether or not even

NOTE Confidence: 0.859866545294118

00:59:09.268 --> 00:59:10.760 in the absence of a word,

NOTE Confidence: 0.859866545294118

00:59:10.760 --> 00:59:12.540 you can identify the thought

NOTE Confidence: 0.859866545294118

00:59:12.540 --> 00:59:14.840 of that word in the brain.

NOTE Confidence: 0.859866545294118

00:59:14.840 --> 00:59:17.318 So that could be based on

NOTE Confidence: 0.859866545294118

00:59:17.318 --> 00:59:18.557 the auditory information,

NOTE Confidence: 0.859866545294118

00:59:18.560 --> 00:59:20.245 it could be based on

NOTE Confidence: 0.859866545294118

00:59:20.245 --> 00:59:21.241 orthographic information, right,

NOTE Confidence: 0.859866545294118

00:59:21.241 --> 00:59:21.883 Like text.

NOTE Confidence: 0.859866545294118

00:59:21.883 --> 00:59:24.606 Or it could be based on a a

NOTE Confidence: 0.859866545294118

00:59:24.606 --> 00:59:26.596 visual reference of that word.

NOTE Confidence: 0.859866545294118

00:59:26.600 --> 00:59:27.979 So I think there are clever ways

NOTE Confidence: 0.859866545294118

00:59:27.979 --> 00:59:29.376 that you could use these techniques

NOTE Confidence: 0.859866545294118

00:59:29.376 --> 00:59:30.636 to tease that apart either.

NOTE Confidence: 0.16373271

00:59:35.440 --> 00:59:39.680 Austin, I just wanna read.

NOTE Confidence: 0.38667117

00:59:39.680 --> 00:59:43.720 Hi, Dorothy. Stuby, you talked

NOTE Confidence: 0.38667117

00:59:43.720 --> 00:59:48.318 about premature babies and they are

NOTE Confidence: 0.972200866666667

00:59:48.320 --> 00:59:51.320 taking longer to mature.

NOTE Confidence: 0.97550136

00:59:51.880 --> 00:59:53.680 Do we know how that goes?

NOTE Confidence: 0.97550136

00:59:53.680 --> 00:59:57.550 And in terms of interventions, do we

NOTE Confidence: 0.97550136

00:59:57.550 --> 01:00:00.040 have ideas about interventions to help

NOTE Confidence: 0.893693435

01:00:00.040 --> 01:00:01.456 the language development? Yeah.

NOTE Confidence: 0.893693435

01:00:01.456 --> 01:00:04.012 So the question is about the premature

NOTE Confidence: 0.893693435

01:00:04.012 --> 01:00:06.238 babies and long term outcome with

NOTE Confidence: 0.893693435

01:00:06.238 --> 01:00:10.080 regard to language, language, delay.

NOTE Confidence: 0.893693435

01:00:10.080 --> 01:00:12.402 We know that statistically speaking they're

NOTE Confidence: 0.893693435

01:00:12.402 --> 01:00:15.120 more likely to have language problems,

NOTE Confidence: 0.893693435

01:00:15.120 --> 01:00:18.392 but that doesn't of course say for any

NOTE Confidence: 0.893693435

01:00:18.392 --> 01:00:21.038 given premature baby whether they will.

NOTE Confidence: 0.893693435

01:00:21.040 --> 01:00:23.560 We also did not have access to follow

NOTE Confidence: 0.893693435

01:00:23.560 --> 01:00:26.279 up of those babies that showed the

NOTE Confidence: 0.893693435

01:00:26.279 --> 01:00:28.880 absence of of a prediction effect.

NOTE Confidence: 0.893693435

01:00:28.880 --> 01:00:29.844 And to be clear,

NOTE Confidence: 0.893693435

01:00:29.844 --> 01:00:31.290 they showed the absence of that

NOTE Confidence: 0.893693435

01:00:31.345 --> 01:00:33.439 prediction effect at six months,

NOTE Confidence: 0.893693435

01:00:33.439 --> 01:00:34.934 a corrected age, right.

NOTE Confidence: 0.893693435

01:00:34.934 --> 01:00:37.220 So they so they actually were nine or ten

NOTE Confidence: 0.893693435

01:00:37.279 --> 01:00:39.399 months of the age when they were tested.

NOTE Confidence: 0.893693435

01:00:39.400 --> 01:00:41.948 So it's it's a highly reliable and

NOTE Confidence: 0.893693435

01:00:41.948 --> 01:00:43.518 prevalent absence of prediction

NOTE Confidence: 0.893693435

01:00:43.518 --> 01:00:45.960 in those babies in their brains.

NOTE Confidence: 0.893693435

01:00:45.960 --> 01:00:48.011 But we did test those babies on

NOTE Confidence: 0.893693435

01:00:48.011 --> 01:00:49.682 a behavioral task that involved

NOTE Confidence: 0.893693435

01:00:49.682 --> 01:00:51.507 prediction and they were no

NOTE Confidence: 0.893693435

01:00:51.507 --> 01:00:53.680 different than than full term babies.

NOTE Confidence: 0.893693435

01:00:53.680 --> 01:00:56.557 So if there is a lag effect,

NOTE Confidence: 0.893693435

01:00:56.560 --> 01:00:58.760 it obviously would happen later.

NOTE Confidence: 0.893693435

01:00:58.760 --> 01:01:01.214 And it's possible that there are

NOTE Confidence: 0.893693435

01:01:01.214 --> 01:01:03.323 compensatory mechanisms that have been

NOTE Confidence: 0.893693435

01:01:03.323 --> 01:01:05.584 triggered by the prematurity that's

NOTE Confidence: 0.893693435

01:01:05.584 --> 01:01:08.670 buffering them from that brain problem,

NOTE Confidence: 0.893693435

01:01:08.670 --> 01:01:11.468 if we can even call it a problem that

NOTE Confidence: 0.893693435

01:01:11.468 --> 01:01:13.676 allows their behavior to be typical.

NOTE Confidence: 0.893693435

01:01:13.680 --> 01:01:15.171 But it is possible that it could

NOTE Confidence: 0.893693435

01:01:15.171 --> 01:01:16.600 be what's called a sleeper effect,

NOTE Confidence: 0.893693435

01:01:16.600 --> 01:01:17.051 right,

NOTE Confidence: 0.893693435

01:01:17.051 --> 01:01:20.122 That that perhaps later in life there

NOTE Confidence: 0.893693435

01:01:20.122 --> 01:01:22.294 they might show a subtle deficit

NOTE Confidence: 0.893693435

01:01:22.294 --> 01:01:25.189 that is not obvious in these kind of

NOTE Confidence: 0.893693435

01:01:25.189 --> 01:01:27.799 crude tasks that we use in infancy.

NOTE Confidence: 0.893693435

01:01:27.800 --> 01:01:29.120 And so that's a possibility,

NOTE Confidence: 0.893693435

01:01:29.120 --> 01:01:29.560 but unfortunately,

NOTE Confidence: 0.893693435

01:01:29.560 --> 01:01:30.880 we haven't been able to follow

NOTE Confidence: 0.893693435

01:01:30.880 --> 01:01:32.480 up on those babies. Thank you.

NOTE Confidence: 0.52783601

01:01:34.880 --> 01:01:37.920 She'll be Is there a zoom?

NOTE Confidence: 0.52783601

01:01:37.920 --> 01:01:40.198 Zoom. No, there no, there's

NOTE Confidence: 0.52783601

01:01:40.198 --> 01:01:41.438 nothing to do. I was just

NOTE Confidence: 0.743323555714286

01:01:41.480 --> 01:01:42.600 going to ask a real quick question.

NOTE Confidence: 0.743323555714286

01:01:42.600 --> 01:01:44.400 It's unfair because you've presented

NOTE Confidence: 0.8512532725

01:01:44.400 --> 01:01:45.840 so much beautiful work from your own lab,

NOTE Confidence: 0.8512532725

01:01:45.840 --> 01:01:47.996 but the the work that you presented

NOTE Confidence: 0.8512532725

01:01:48.000 --> 01:01:50.480 from at least Piazza's group was it.

NOTE Confidence: 0.8512532725

01:01:50.480 --> 01:01:51.520 And looking at the

NOTE Confidence: 0.782398529

01:01:51.560 --> 01:01:52.696 dual mirrors data collection,

NOTE Confidence: 0.782398529

01:01:52.696 --> 01:01:54.400 I was just wondering if they

NOTE Confidence: 0.859770084545454

01:01:54.400 --> 01:01:55.552 had looked at that with a

NOTE Confidence: 0.859770084545454

01:01:55.552 --> 01:01:56.800 caregiver and a non caregiver.

NOTE Confidence: 0.58771936

01:01:57.120 --> 01:01:59.488 Differences in synchronic, Yeah.

NOTE Confidence: 0.58771936

01:01:59.488 --> 01:02:01.500 So Karen's question is whether or

NOTE Confidence: 0.58771936

01:02:01.500 --> 01:02:03.202 not the hyper scanning between mom

NOTE Confidence: 0.58771936

01:02:03.202 --> 01:02:04.600 and baby has been done between,

NOTE Confidence: 0.58771936

01:02:04.600 --> 01:02:07.320 for example, baby and caregiver,

NOTE Confidence: 0.58771936

01:02:07.320 --> 01:02:08.744 non caregiver, stranger, etcetera.

NOTE Confidence: 0.58771936

01:02:08.744 --> 01:02:11.225 To the best of my knowledge, no.

NOTE Confidence: 0.58771936

01:02:11.225 --> 01:02:13.640 But I'm sure they're working on that.

NOTE Confidence: 0.58771936

01:02:13.640 --> 01:02:16.720 What what I would personally be interested

NOTE Confidence: 0.58771936

01:02:16.720 --> 01:02:20.205 in is the kinds of social queuing that

NOTE Confidence: 0.58771936

01:02:20.205 --> 01:02:23.879 goes on in the commutative context.

NOTE Confidence: 0.58771936

01:02:23.880 --> 01:02:26.190 And you can introduce perturbations

NOTE Confidence: 0.58771936

01:02:26.190 --> 01:02:29.626 in the behavior of of the parent to

NOTE Confidence: 0.58771936

01:02:29.626 --> 01:02:31.434 see whether or not it has an effect

NOTE Confidence: 0.58771936

01:02:31.434 --> 01:02:33.208 on the the synchrony relationship

NOTE Confidence: 0.58771936

01:02:33.208 --> 01:02:35.073 that they would normally have.

NOTE Confidence: 0.58771936

01:02:35.080 --> 01:02:36.880 And I think that would be really interesting.

NOTE Confidence: 0.58771936

01:02:36.880 --> 01:02:37.040 Yeah.

NOTE Confidence: 0.71027471

01:02:40.280 --> 01:02:41.400 Well, thank you so much.

NOTE Confidence: 0.71027471

01:02:41.400 --> 01:02:42.520 OK, thanks everybody.

NOTE Confidence: 0.432144856

01:02:48.720 --> 01:02:50.000 We'll talk to our patient.