Transcript
VL2 Knowledge Festival
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BL2: Dr. Clifton Langdon

Hello everyone. As was mentioned, I'm Dr. Clifton Langdon, Assistant Director for the Brain Language and Learning Lab, working with Dr. Petitto there in her role as Science Director for BL2. Our lab was established in 2011 and since its opening has enjoyed burgeoning growth. We have now a lab director, a post-doc research assistant and directors. We also have PhD in Educational Neuroscience, also known as PEN students, now working in the lab that are comprised of both graduate and undergraduate students.

Since 2011, we've had a number of people you see before you on this screen. BL2 poses important questions about human cognition and human learning in three primary areas. We research basic questions about human language acquisition. Through this study, we hope to understand more about human cognition and its role in language acquisition. Language acquisition acts as a foundation for the further questions that we pose about bilingualism. Finally, building upon that foundation, we will explore more about how one learns to read.

For us to research these questions in innovative ways, we have been able to leverage the use of innovative technologies, such as the fNIRS neuroimaging, Functional Near Infrared Spectroscopy, to examine more about brain processes, human emotion and cognitive function. We are using not only the fNIRS system, but this allows us to explore these questions with a number of different populations that we would be unable to explore using other methods. Infants just newborn can use these neuroimaging technologies to simply rest on their heads to give us information about the entire lifespan of a human being from infancy to the time when a person is a senior citizen. We can still be studying these same questions in different contexts as well. The fact that it's a mobile platform allows us to take that research either in the lab or in the field as well.

In addition to that, we're using eye tracking technologies. Eye tracking allows us to understand more about attention and where we allocate attention, using eye tracking to track that attention in particular contexts. We are also able to use this remotely.

In addition to these two innovative technologies, we're also using thermal infrared imaging. These cameras allow us to measure skin temperature. We do so to measure emotional excitement and emotional attention and engagement.

Beyond even these technologies, we're also working in partnership with other labs that have expertise in robotics and avatars. In addition to that, we're partnering with the ML2 lab, which you'll be hearing about moments from now, and leveraging all of these laboratories and their findings to answer our underlying questions.

Language acquisition is an important domain. Babies are born with the challenge of learning and acquiring language in a dynamic world, whether that be spoken or sign

language, English or Finnish. What's more, when infants are born, they have no textbook to give them parsed-out segmented units of language.

Nonetheless, this Finnish language that is up on the screen is presented without any spacing between, without any of those cues that allow us to segment it and understand, understand its underlying meaning. Infants, however, are able to detect the smallest phonological units. Think of it as something like a letter unit or something around that scale. There are particular rhythms and patterns that infants are attuned to. We are using this knowledge to examine how brains learn language, whether it be signed or spoken.

Dr. Petitto's prior research examined how both deaf and hearing children examined the incoming stream of language, whether it be signed or spoken, and what areas of the brain might be involved in that. Her findings showed us that indeed the brain is perceiving phonological units, regardless of whether they be signed or spoken. It is processing those in the same manner in the same systems. That tells us that the brain is not looking for a particular signor a particular kind of speech, but rather some underlying function of language.

This is the means by which babies enter the world and immediately begin to acquire language. We want to investigate that. How are they doing it? One key clue is found in the fact that when one is engaging with infants, there is a syllabic pattern, 1.5 syllables per second, that seems to be the natural point at which infants cue into the pauses in between segments and are able then to parse them out and detect them on the level of the syllable. We're now using our systems, the fNIRS, thermal imaging and eye-tracking systems all in an integrated fashion to answer these questions. Early results tell us that, indeed, infants are primed to detect these units at 1.5 Hz per second. This measure is important in that it tells us at what point these segments are parsed in infants.

There are a number of other areas that pose important questions for us that we're looking into. Bilingualism poses the question of whether two languages ought to be presented to a child simultaneously or rather consecutively, whether one needs to master one before being able to master the other. The scientific findings from our lab show clearly that earlier exposure is far better, because children that have not yet learned to tie their shoes are not going to be overwhelmed as one might think. They mature on a biological timeline. Their brains are adapting from an early age and are ready for it. Whether they be deaf or hearing makes no difference. Children enter the world readily able to acquire a language, given a rich language environment. It makes no difference whether that language comes in a stream of a single language, two, three or four. They can learn the language. Their brain will respond the same way, no matter the type or number of languages. Whether there be a mixture of one signed/one spoken, two spoken/one signed or any other combination, the brain will acquire the languages quite easily. The exposure is what's most important.

With very young children who are acquiring language, we have to then ask how they're acquiring literacy skills, how they are understanding these squiggly lines on a page and deciphering meaning. Well, they have a process of mapping the language that they've

learned onto this written system. Our research has shown us — In fact, past research has shown us that phonological processes of breaking sound units into smallest meaning and mapping, those are important for spoken language users to acquire literacy. That's been well known for some time, but we wanted to examine whether that was true only for spoken language users.

In fact, we find that there are visual phonological systems that are at play. Visual language exposure, especially at an early age, provides children with tools to be able to segment the language input and detect the patterns in the language that they've observed and signed and mapped those onto the systems of writing and reading. Our lab's findings tell us, in fact, that these are important, important markers for early childhood language exposure.

Video available at https://youtu.be/J6PHhoFKWWA

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