The Inside Story Behind the Development of The Baobab, the 1st of VL2’s Bilingual Storybook Apps for the iPad

Recently featured in online news sources, Media Bistro and Digital Journal, VL2’s first ASL-English storybook app for the iPad is generating news! As we noted in the last newsletter, The Baobab incorporates findings from the science of learning on ASL-English bilingualism, but what many may not know is that the project is also a case study in how a passion for design and meaningful information sharing with the larger community can be brought together for the production of a beautiful, science-based, end product. As VL2’s Science Advisory Board member Steven Pinker noted, the end product of this intersection between the science of learning and a passion here at VL2 for translational products is “[a] gorgeous story app, perfect for Deaf or hearing kids (or adults) learning ASL.”

For this month’s cover feature, we go “behind the scenes” with VL2’s Digital Innovations and Media Strategies Manager Melissa Malzkuhn. Malzkuhn, an alumna of Gallaudet University, first joined VL2 as VL2’s Community Engagement Coordinator, and she became VL2’s Media Strategies and Digital Innovations Manager in 2012.

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“I’ve always been interested,” said Malzkuhn, “in the intersection of art and science to create information, the type that has great design and...enriches your knowledge.” Malzkuhn continues to develop her expertise and interests in the intersection of art, technology, design, and science through her studies in digital media at the Corcoran Gallery of Art in Washington, D.C.

While Community Engagement Coordinator for VL2, Malzkuhn joined forces with GU Deaf Studies faculty Benjamin Bahan and Dirksen Bauman in the creation and management of the groundbreaking and innovative Deaf Studies Digital Journal. The world’s only academic journal for sign language publications, DSDJ also incorporates ASL literature, visual arts, and commentary in a beautifully designed, interactive academic journal.

During that time, Malzkuhn noted, “my love for design, art, and creating things only took on more momentum...and I also worked to communicate [VL2] research findings to the community...so I was on a constant mission of thinking up new creative ways of how to do it...effectively. What we have done was mostly for educators, parents, other researchers but we haven’t really looked at children and asked ourselves: what can we give them that we know from research findings?”

When Malzkuhn first saw the potential of iPad apps, “it made perfect sense, like something ‘clicked’ in me...For the first time...we were able to put together video and text seamlessly, and we now have the technology and means to get it into children’s hands. The way tablets are designed, it’s very children friendly.”

But far from being a fun way to while away time with a child, the ASL-English storybook apps that Malzkuhn initially envisioned have critical importance for bilingual language acquisition. VL2 researcher Jill Morford noted, “For deaf children who are receiving little comprehensible language at home, The Baobab app offers a language model that is engaging and fun to watch. The app was designed with hearing parents in mind, who are not yet fully fluent in ASL. Suppose hearing parents would like to sign with their child, but they are not yet comfortable signing. The Baobab app provides a way for parents and children to learn together by watching the signed story as a narrative, or by moving sentence by sentence through the story with support for individual English words that they don't know how to sign in ASL.”

The Baobab did not happen overnight; it came about through Malzkuhn’s and VL2’s dedication to translational product development that built on VL2 findings in a principled manner. Importantly, during the development process, VL2 scientists were consulted in relation to the implications of their findings for the design of the app. Laura-Ann Petitto, VL2’s Science Director, Tom Allen, VL2’s Co-PI, and Jenny Singleton, VL2’s translational research strategic focus area team leader, all worked closely with Malzkuhn and her team on shaping the research foundation for the app.

Malzkuhn also reflected on some of the critical moments of the app’s development; for example, she remembered, “We were ready to start filming and Kristen [Harmon,
VL2’s Center Manager of Impact on Education and Creation/Distribution of Innovations] came up to me and said, “You know, I don’t think the story’s [ready]. So Kristen and I went over the plot, the story itself, and it occurred to me that the girl was simply dropped off by the elephant. And there was a lesson in there, but it was too subtle. That was when inspiration took hold...the girl would then give the fruit back to the elephant...[W]hen you take something that doesn’t belong to you, you should give it back. But, that’s a literal interpretation, while the underlying meaning was Earth has only so much to give, it’s us who...should give back. It’s about respecting others. We changed the story, and after that I never felt better. That was the best crisis to have happened, a honest opinion from one colleague to other.”

Early feedback has been very positive. Malzkuhn said that one representative example was her conversation with “a professional ASL interpreter, who said her (hearing) 7 year old daughter who knows a few signs LOVED the app and had so much fun learning the signs and even practiced signing and fingerspelling in front of a mirror. She said her daughter went through every vocabulary word and copied them back.” Malzkuhn also noted, “We’ve seen a couple of other parents tell us the same stories - their kids start to copy the signing. Their stories have inspired us so much and help us drive our passion back into creating more storybook apps with the same framework as established from The Baobab.”

Along with Melissa Herzig, VL2’s Translational Research Manager, Malzkuhn has demonstrated the use of the app for several different schools and units in the area. As part of one such demonstration for teachers and aides who work at the Columbia School for the Deaf (Maryland)—at a workshop hosted by Quest Visual Theatre/Teacher and Artist Institute (TAI)—one attendee noted that “[The workshop on The Baobab] helps me to learn how to help students with their reading and vocabulary comprehension...To integrate the video in all subjects – especially working with iPads—helps students to understand better.”

When asked her thoughts at the Feb. 4 launch of The Baobab, Malzkuhn said, “I believed in this project and I knew it would inspire, excite, and open up possibilities for others. What’s important [about this app] is the implications of VL2 research findings [and these] are embedded in the app design - fingerspelling, signs, and the approach to both languages.”

Also important, Malzkuhn added, are “the possibilities that this would welcome new signers to ASL, this would welcome parents to learn ASL with their children.”

The Baobab comes with an "easter egg" (or a hidden nugget for users of the app). (Hint: It has something to do with the iPad accelerometer when in the reading mode.) About the hidden surprise, Malzkuhn said, “I wanted to put in an element of surprise for young children, something they can discover on their own, or through their friends, and be delighted during the learning process. Our mantra is that learning is fun.” For more, see the video, “Dive into the Baobab!”

What’s next for Malzkuhn is “More apps, and even more exciting and creative projects!”

“English and ASL,” VL2 researcher Jill Morford said, “are separate languages with distinct vocabulary and grammar, so there’s no one-to-one match between every English word and every ASL sign, but the app can help parents to feel comfortable by providing enough signs to create a meaningful story for them to share with their child. Both parent and child can also sit back and be amazed by the beauty of the artistry and the expressive storytelling in the narrative mode - what better way to get motivated to learn more ASL!”
Greetings from VL2-Central (smile)!

It’s hard to believe that another month has gone by, as this past one has been a blur of preparations and planning that span those involved with our important Scientific Advisory Board meeting that was held on March 3-4, 2013, and those involved with the design of our VL2 Center’s future. No small feat on each account!

In between the above grand events, we had another extraordinary event occur. Drs. Melissa Herzig, Laura-Ann Petitto, and Tom Allen were invited to defend our exciting new interdisciplinary PhD in Educational Neuroscience (PEN) program to the Gallaudet University Senate (as we had already defended it two times earlier before the Gallaudet University Committee on Graduate Education). To our joy, on March 11, 2013, the Senate approved the new program in a unanimous vote. This is Gallaudet’s first interdisciplinary PhD program, and it includes our National Science Foundation, Science of Learning Center, Visual Language and Visual Learning, VL2 (the PhD program’s administrative home), and the Departments of Psychology, Linguistics, Interpretation, Education, and Hearing Speech and Language Sciences (HSLS). How thrilled we are at VL2 to be part of this wonderful team of colleagues! We extend our sincere thanks to our Committee for the Creation of the PhD Program in Educational Neuroscience for their wonderful support and hard work. In addition to Herzig, Petitto, and Allen from VL2, the Committee included Drs. Daniel Koo (Psychology), Deborah Chen Pichler (Linguistics), Brenda Nixodemus (Interpretation), Hile (Education), Karen Garrido-Nag (HSLS), as well as Dr. Christen Szymanski (Director of Research & Evaluation, Clerc Center), and Clifton Langdon (Graduate Student Representative). We wish to extend a very special thanks to Dr. Deborah Pichler.

The PEN program is also a major landmark in the discipline of Educational Neuroscience and places Gallaudet University at the forefront of this discipline in higher education in the United States – and on the world stage!

Although final (final) approval for the PhD in Educational Neuroscience is expected to come in early May from Gallaudet University’s Board of Trustees, we have been given permission to move forward with our (1) new Faculty search (please see the new job posting at the Gallaudet University site!) and with our (2) recruitment of new Graduate Students for the fall 2013! Please spread the good news and get those applications in! For potential Faculty applicants and new Graduate Students, please see our URL http://sites.google.com/site/gallaudetedneuroscience.

As for our Scientific Advisory Board meeting, much preparation occurred weeks before as we built up to the big event (largely on Monday, March 4), including discussions of our VL2 Center’s Year 7 “Legacy Science” (high impact scientific discoveries) and “Legacy Translation,” and Years 8 & 9 “Breakthrough Science & Translation” (lasting impact scientific discoveries and translational activities for the enduring benefit of science and society). In attendance was our truly remarkable team of world-renowned experts, including Drs. Steven Pinker, Bruce McCandliss, Colin Phillips, Ken Pugh, Larry Hedges, Ron Stern, David Poeppel, and Laurene Simms (with regrets: Dr. Anne Fernald). Our Board meeting proved to be a
fascinating day of discussion, one rich with ideas, and the Board left pleased with our VL2 progress.

As for the thrilling plans for VL2’s future...we’ll keep you in suspense for just a wee bit longer, as we need a bit more time to work through all the ocean of details for the course of this grand - grand VL2 ship!

Warmly,

Tom and Laura-Ann

Kudos to another amazing iSLC 2013 conference hosted by the Spatial Intelligence and Learning Center (SILC)! Fourteen of our own VL2 students attended the conference in Philadelphia on February 21-23. While it was great seeing the VL2 students catching up with each other, it was even more exciting to see the networking that went on between the 6 different science of learning centers- hence the name of the conference: inter-Science of Learning Centers Conference!

The vast range of topics covered during the conference shows the amazing diversity of the six centers of which VL2 students showed themselves as proud representatives. Students from all six centers presented their work during symposia on topics including: Neural Substrates and Learning, Learning and Sensory Processing, Mathematics and Mathematical Representation, and Language and Gesture. Our own Tanya Evans, from Dr. Guinevere Eden’s lab at Georgetown University, presented during one of the symposia on “Common neural substrates of reading and arithmetic.”

Several workshops were also hosted throughout both days of the conference. One of the most informative workshops was an iSLC alumni panel, at which several alumni shared their experiences and journeys from SLC students to careers in industry, education or academia. Our students got the opportunity to share their work on a more informal level during poster sessions engaging our fellow SLC students and representatives from the National Science Foundation.

Conversations regarding iSLC’s future were happening everywhere from informal after-hour chats to the keynote talk by Nora Newcomb, the PI of SILC. These discussions centered around sustainability for iSLC in the years to come. Ideas regarding the sustainability of each individual center as well as the field of the science of learning as a whole were discussed in depth in both collective group and smaller group meetings.

Knowing full well that all work and no play makes for very boring grumpy young scientists, the wise conference organizers arranged for the group to end our nights with wonderful dinners at Philadelphia Museum of Art and Palace at the Ben. (See picture above left).

--Contributed by Erica Israel
The main goal of The Cognitive Neurolinguistics Laboratory, under the direction of David P. Corina at UC Davis, is to investigate how the brain processes human language. We use the unique advantage point of studies of deaf users of sign language to answer fundamental questions regarding the enduring characteristics and modality-specific properties of human language.

Since the inception of VL2, Dr. Corina has pioneered studies examining how ASL phonology impacts the reading of English in deaf signers. We have established a database of over 150 signs and collected both frequency and age of acquisition ratings. We have completed a multiple-site research project investigating brain activation in skilled and less skilled deaf signers. We are currently collecting ERP data to assess the impact of sign language exposure on auditory cortex function in deaf infants who have both cochlear implants and maintain a rich sign language environment.

Dr. Corina is a staunch supporter of the rights for deaf and hard of hearing children to have early accessible language exposure. In addition to his efforts with VL2 he has provided systematic assessments of the differences between the processing of ASL and non-language gesture and is called upon to provide cutting edge neuropsychological assessments for neurosurgical procedures with deaf signers and deaf patients with acquired brain deficits.

Laurie Lawyer (pictured right) has a BA and MA in Linguistics, and is currently pursuing her PhD in Linguistics at UC Davis with an emphasis in mind and brain. In her five years in the lab, she has been primarily responsible for fMRI data collection and analysis, including recent VL2 projects on English orthographic processing by native signers. Her other research focuses on auditory linguistic processing in hearing individuals, particularly speech perception and the composition of linguistic word forms.

Deborah Cates (pictured left) is a PhD student in Linguistics at UC Davis and works as a graduate student researcher in the Lab. Currently she is working on an individual differences study looking at cognitive predictors of reading ability in deaf and hearing bilinguals. She holds a B.A. in Deaf Studies and an M.A. in Linguistics, both from Cal State University Northridge, and is a certified Sign Language...
Shane Blau (pictured below) is a first year PhD student in Linguistics, with an emphasis on psycholinguistics and sign languages. Previously, he completed a MA in linguistics at Gallaudet University. Currently, his research and training focuses on neural aspects of sign language processing, including plasticity and modality effects. He is working on coding and analyzing intraoperative brain mapping of a Deaf signer during neurosurgery, data collection on several projects examining the effects of sign exposure in infants, and is being trained in ERP and fMRI techniques. Shane hopes to do his dissertation research on the linguistic and cognitive effects of delayed first language exposure.

Michelle Cohn (pictured right) is a first year Ph.D student in the Linguistics Department at UC Davis. While this is her first quarter in the lab, she has recently been certified to run subjects using magnetic resonance imaging (MRI). In the coming months, she will be aiding in a number of neuroimaging studies on subjects with various degrees of hearing abilities.

Todd LaMarr (pictured top right) has a BA in Deaf Studies and is graduating May’13 with a MA in Child Development. His research interests include language and cognitive development with an emphasis on the psycholinguistics of bilingualism. He is currently a junior specialist in the lab and is working on various projects: cortical stimulation mapping, infant sign language development and bimodal bilingualism.

Diane Allshouse (pictured below) is an undergraduate student at CSU Sacramento, graduating in May’13 with a BA in Deaf Studies. Her interests include advocacy to education and psychology. She chose to volunteer with the Corina Lab to expose herself to areas of research in neurolinguistics, as she explores her post-graduate options. Her lab role includes data collection and analysis and is currently helping with the cortical stimulation project.

Belinda Bustillos (no picture available) is a third year UC Davis student, studying both Linguistics and Cognitive Science. Post graduation, she will be pursuing a career in Speech Language Pathology. She began working in the lab last year, with a hand in many projects, specifically doing video editing and helping with statistical analyses.

Krystina Ho (no picture available) is graduating this year with a B.S. in Pharmaceutical Chemistry. She joined the lab last summer as a research assistant and plays a key role in editing video stimuli and data analysis. As a Deaf native ASL signer, she also helps in data collection—she helped Deb collect data at CSUN last fall.

--Contributed by the Corina Lab

For more information on the Corina Lab at UC-Davis: http://mindbrain.ucdavis.edu/labs/Corina
Save the Date!
VL2 Spring Lecture Series

Thursday, March 14, Professor Beth Benedict of Gallaudet University presented “How Early Intervention can Make a Difference: Research and Trends.”

There is only one remaining VL2 lecture this spring, with Dr. Bruce McCandliss, of Vanderbilt University, on Wednesday, April 10.

Mark the date on your calender and join us either on campus or via live webcast. If you missed the other VL2 presentations this semester, the videos are archived online and can be found at the following links:

- (2012-2013) http://webcast.gallaudet.edu

All 2013 lectures will be held from 4-5:30 p.m., in GU’s MLC B111. Each is live-streamed.

Outreach in New Mexico

Teri Jaquez (pictured below), VL2 undergraduate research assistant in Professor Jill Morford’s lab, was invited as a guest speaker at Clovis High School in Clovis, New Mexico.

She shared her experiences as an undergraduate at the University of New Mexico and described her work with VL2.

The purpose of the talk was to inspire high school students who might otherwise not consider going to college to learn about the opportunities and benefits they will encounter and gain if they continue to further their education beyond high school.

Research Briefs

- #5: Eye Gaze and Joint Attention: Fundamental Skills for Successful Interaction in Home and School Environments
- #6: Bimodal Bilingual Approaches for Children with C. Implants
- #7: The Benefits of Bilingualism: Impacts on Language and Cognitive Development
- #8: ASL/English Bilingual Education: Models, Methodologies, and Strategies

FIND THEM AT http://vl2.gallaudet.edu
Welcome back from the spring break! We are looking forward to many exciting things that are happening as we start to wrap up the 2013-2014 academic year!

We would like to give recognition for our VL2 students for their hard work in representing our center at the inter-Science of Learning Center conference in Philadelphia. For some students, it was their first poster presentation at a conference-sponsored by the National Science Foundation. What an honor!

Additionally, we would like to give thanks to the Student Leadership Team for their hard work in helping with organizing the conference, especially to Deborah Cates who coordinated the interpreting team.

Speaking of iSLC, our VL2 meeting on March 15th, we will have two guest speakers from other Science of Learning Centers: Linda Phan Salamanca from Temporal Dynamics of Learning Center (TDLC), and Lauren Applebaum from Spatial Intelligence and Learning Center (SILC) to share their center’s research work with us. What an exciting opportunity to bring the three centers together!

There will be no VL2 meeting on March 22nd. The next VL2 meeting on March 29th, we will invite Jill Morford to give her SFA 2 presentation. Watch for an email from Rupert Dubler for more information about this!

If you are not receiving emails from your SFA leader, SLT, or Rupert, please contact your SFA leader to correct this! If you do not know who your SFA leader is, contact Erica (emi5332@rit.edu), and she will help you to solve this!

Happy St. Patty’s day!
Peter & Erica

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**SFA 5: Integration of Research and Education News**

We have a SRC travel grant FAQ (in the form of a Powerpoint) available in the VL2 Student Documents Folder; it is called "A Guide to Applying for SRC Travel Funds." It will answer most, if not all, of your questions!

We are excited to announce that we are now accepting applications for the VL2 Student Translation Workshop hosted by Jill Morford’s lab at the University of New Mexico on May 18-24, 2013. We will support travel, lodging, and food for seven students who reside outside of New Mexico. Please look at the VL2 Student Documents folder for the application form and instructions. Applications are due Friday, Mar 1.

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**Student Leadership Team (SLT)**

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Contributed by Adam Stone
BREAKING NEWS
Seeking Asst/Assoc. Professor for New Interdisciplinary PhD program at VL2/GU

Exciting news! The new interdisciplinary PhD Program in Educational Neuroscience (PEN) at Gallaudet University (Washington, D.C.) is seeking applicants at the assistant professor level for a tenure-track position beginning in fall, 2013.

The successful candidate will be housed in one home department based on his or her scholarly research and expertise (e.g., Psychology, Linguistics, Interpreting sciences, or Education). The new faculty member will have exciting opportunities to work collaboratively with members of these four departments in the PEN PhD program, as well as an extensive network of expertise available via the National Science Foundation’s Science of Learning Center at Gallaudet, Visual Language and Visual Learning, VL2. As a core part of the PEN PhD program, VL2 links Gallaudet with a network of world leading scholars in cognitive neuroscience, neuroimaging, visual cognition, language cognition and bilingualism, reading and literacy, deafness, and American Sign Language.

Gallaudet’s PhD Program in Educational Neuroscience (commencing fall 2013) pioneers new interdisciplinary approaches to how humans learn, spanning early childhood development and adults, with a special interest in the neuroplasticity of visually-guided learning processes sub-serving higher cognition. The PEN PhD program at Gallaudet further provides a unique opportunity to study the learning and education of the young deaf visual learner. Candidates whose research programs involve both cognitive neuroscience and strong credible connections to education are particularly encouraged to apply. For example, research programs in language, bilingualism, reading and literacy, math and numeracy, science, and/or social-emotional learning will be seriously considered.

Gallaudet’s PEN PhD program is also propelled by the goal of achieving great excellence in teaching, and to provide its students with the most cutting-edge knowledge, healthy and lively critical analysis and discussion, strong mentorship, and a great richness and diversity of career paths.

More details can be found on VL2’s website.

VL2 & Affiliates at EHDI Annual Meeting, Apr. 14-16, Glendale, AZ

VL2, VL2 affiliates, and Gallaudet University partners and colleagues are heavily represented at the annual meeting of the Early Hearing Detection and Intervention association. Prof. Laura-Ann Petitto, VL2’s Science Director and Co-PI, will be presenting one of the plenaries, “How the Human Child Discovers Language: New Insights from the Neural Foundations of Language, the Bilingual Brain, and the Visual Phonological Mind.” VL2 Scientific Advisory Board member Dr. Ronald Stern will be presenting as part of a panel on “Child First: Moving Beyond Screening and Intervention in Pursuit of Better Education for Deaf and Hard of Hearing Children.”

GU professors Beth Benedict and Marilyn Sass-Lehrer will be presenting three times between the two of them. Benedict will run a plenary panel, “Lessons to Learn from Deaf College Students,” featuring several Gallaudet University students from a variety of language and education backgrounds. Benedict and Sass-Lehrer will present “Early Language Acquisition and Development: Visualize This.” Sass-Lehrer will also be presenting as part of two panels, one on “Promoting Family Social-Emotional Well Being: an Interdisciplinary Approach” and a separate panel on “family-centered early intervention.”

VL2 research brief writers Debra Nussbaum and Julie Mitchiner will be presenting separate talks on “Identifying Effective Practices to Support Early Linguistic Competence: Project Update” (Nussbaum) and “The Implications of Bimodal Bilingual Approaches” (Mitchiner).

Registration is still open for this important conference:

iPad App Workshop at Columbia School for the Deaf
Feb. 28, Melissa Malzkuhn and Melissa Herzig (pictured left) were invited by Quest Visual Theatre (with Tim McCarty) to
present at the Columbia School for the Deaf as part of their teacher-training program. In hands-on one and a half hour workshop, Malzkuhn and Herzig introduced The Baobab, explained the research principles behind the design, and offered suggestions for how to use the app in the classroom.

**VL2 at the ASL/English ECE Summit IV, March 21-23**

The National ASL/English Bilingual Consortium for Early Childhood Education will be hosting their fourth annual summit at the Texas School for the Deaf in Austin, Texas, March 21-23, 2013. VL2 researcher and strategic focus area team leader Peter Hauser will be giving one of the keynote addresses March 21. Melissa Malzkuhn, VL2’s Digital Innovations and Media Strategies Manager, and Melissa Herzig, VL2’s Translational Manager, will be talking about VL2’s storybook apps, and Jenny Singleton, VL2 researcher and strategic focus area team leader, will be sharing information about VL2 with attendees. VL2 research assistant Adam Stone will be discussing the potential of iPad technology for bilingual teaching. For more information about the schedule: [http://www.bilingualece.org](http://www.bilingualece.org)

**“Sign Language Trending in Hollywood”**

Following the ASL-only episode of the popular television show, “Switched at Birth,” there’s been a resurgence of interest in sign language in movies and television. The media and event service companies, Deaf Night Out and Deaf Night Out’s Red Carpet recently sent out a press release on the increased interest in ASL in Hollywood. VL2 Science Director Laura-Ann Petitto’s work is cited [in an article on this topic](http://www.bilingualece.org).

**Promoting Science & Research on the California Highways**

As an effort to promote the sciences at San Diego State University, the university is using billboards to promote researchers and research topics. VL2 researcher and strategic focus area team leader Karen Emmorey was spotted recently, larger than life, on a California highway!

**ASDC 2012–Save the Date!**

June 26–30, 2013, the American Society for Deaf Children will host the 2012 conference in Tucson at the Arizona School for the Deaf and Blind. The ASDC Biennial Conference provides families with five days of information and fun. Daytime workshops captivate parents while children participate in educational and recreational activities. Evening events bring families together, providing the opportunity to form new friendships and peer support.

Alliances built and information gathered make this conference a once in a lifetime experience for families across the nation. For more information contact the conference planning committee atASDC2013AZ@asdb.az.gov or visit the facebook page at [Http://www.facebook.com/ASDC2013AZ](http://www.facebook.com/ASDC2013AZ)

**Susan Goldin-Meadow presents “Insight Into Core Knowledge from Gesture”**

Last year, affiliated researcher Susan Goldin-Meadow presented her work on gesture for the Lorentz Center workshop on Core Knowledge, Language and Culture” held May 29-June 1, 2012, in Leiden, the Netherlands. The Lorentz Center is an international center for the sciences, and it’s purpose is to encourage more collaborative work and interaction. A video (with some automatic captioning) was just made available of Dr. Goldin-Meadow’s [presentation](http://www.bilingualece.org). Power point slides are clearly visible in this presentation.