DE AND SEEK

# CHANGING THE WORLD THROUGH SCIENCE

NO. 17 // WINTER 2014

This winter, snowstorm after snowstorm has rolled down from Canada, blanketing DC in drifts of white. But this was no winter for hibernation at VL2! Our Center has its own yearly cycle, punctuated by PI meetings in February, our annual Scientific Advisory Board meetings in March and our NSF Site Visits in June. These gatherings define us, leading us to continually reshape who we are and how we present ourselves to both internal and external audiences; they also help us improve our science and our training, imagine and create new visual learning tools to transform the world, develop powerful new resources to aid future researchers. and chart our future.

On February 1, 2014, our PI meeting had, as its singular focus, elucidating the scientific and educational implications of one of VL2's central discoveries: that Visual Sign Phonology plays a critical role in the development of literacy in young deaf children (see the article in this issue of *Visualize*). Each of our seven science networks is engaged in ground-breaking research that will contribute to "breaking the code" of how a phonology based on

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the segmentation of visual linguistic units leads to the mastery of an orthographic system in a second language derived to represent the sound-based phonological units of a spoken language. Our focus has been sharpened around the study of young children learning to read, and our questions have coalesced around understanding how early sensory experience and the age of exposure to a visual language during a critical period of development change the developing brain in ways that afford higher cognitive processing advantages in young visual learners. It has been very exciting for us to experience the maturing of our Center and the refining of our research efforts around very important discoveries that will have a huge impact on the education and lives of children.

As we write this (and, yes it is snowing again today!), we are deeply engaged in preparing for both the Scientific Advisory Board meeting and the NSF Site Visit. We are always thrilled to welcome our Board and our Site Visitors to campus. We show them where we have come and where we want to go, and ask them to help us take

VISUAL LANGUAGE

AND VISUAL LEARNING

our next steps. In turn, they challenge us to defend our claims, justify our funding and expand our thinking in ways that propel our discoveries. Their extraordinary expertise, collectively oriented toward improving the work of VL2, feeds the passion for discovery that resonates throughout our international network of scientists, students, translation teams, parents, teachers, and policy-makers. It is this resonating impact of our work beyond the laboratory that demonstrates the value of our Center-based structure. VL2 remains, in our minds, a model for how science and society should partner to improve the world.

> Laura-Ann Pettito and Thomas Allen, Co-Pls, VL2

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# visualize

VISUAL LANGUAGE & VISUAL LEARNING OFFICIAL NEWSLETTER

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# **Accessing Important ASL Tools:** VL2 ASL Assessment Portal

# Currently there are few resources available that provide easy access to signed language assessments used in research and education. The VL2 ASL Assessment Portal is helping to change that.

The Portal, which gathers multiple ASL assessment tools in a central web-based interface, will roll out this spring. The Portal has been in planning and development since the early years of the Center, and was designed to respond to the need among researchers, educators and parents of deaf children to have easy Internet access to a variety of tools for assessing ASL skills.

VL2 has supported the development of a number of tools for ASL Assessment, as well as several neurocognitive assessments that use ASL as a means for delivering the test content to the test taker. Our ultimate goal is to load many of these assessments into the central portal, which will initially contain the *Visual Communication and Sign Language Checklist (VCSL)* developed by **Laurene Simms, Sharon Baker and Diane Clark**. The VCSL provides information on children from birth to age five regarding their achievement of norm-based milestones in early language development. The Checklist was "normed" using a national sample of deaf children from deaf families and will be useful for determining whether deaf infants and toddlers (from all families) are developing signing skills along a trajectory that is similar to that of native signers. VCSL is an open-access tool and does not require assessment credentials or a licensing fee to use.

The Portal provides the capability for capturing assessment data for research purposes, and is an excellent platform for the development of new tests. The product's software was developed in the Minerva Deaf Research Lab at the University of Alberta under the direction of **Dr. Lynn McQuarrie** (*pictured above*). **Thomas Baron** was the Lead Software Developer. A short video explaining the many capabilities of the Portal is viewable at http://youtube.com/TheAssessmentPortal.



# Creating Their Own Stories: the VL2 Storybook App Authoring System

Translation, or converting what researchers discover in our VL2 studies into products that directly benefit society, is a vital part of Center activities. The VL2 team is continually looking for new ideas to engage a wider community and provide ways for them to benefit from our research-based knowledge, products and services.

One of our most highly successful, innovative translational products is our ASL/English bilingual Storybook Apps for tablets. Developed by Melissa Malzkuhn, founder and Director of the Motion Lab and part of VL2's Translation Team headed by Dr. Melissa Herzig, the Apps allow young children to read stories in ASL and English at the touch of a finger. These stories feature talented deaf storytellers and art by deaf illustrators, and include fingerspelled words and phrases so young children are given early exposure to bilingual literacy and reading strategies that promote later success in reading English.

Now, to expand the Storybook bilingual reading experience and make it more accessible and widespread, we are establishing the **Storybook Apps Authoring System (SAAS)**, a program and a website portal that allows people to create their own bilingual and interactive apps using our existing code. Code used in *The Baobob* and other upcoming VL2 storybooks will be available for a small fee, along with tutorials and documentation educators and developers can employ to create their own apps. Users will also be able to access fee-based support, training and other resources.

"There are so many great storytellers,

artists and ideas out there," Malzkuhn says. "Helping more people get involved in app development means more children will benefit. And people can use their creativity and decide how they want to use storytelling in teaching."

Engaging others to develop additional bilingual Storybook apps provides multiple benefits. More people creating stories means that children have a larger "library" to choose from. Parents, teachers and children can work together to bring their stories to life. And for VL2, the SAAS contributes revenue to support a valuable product and promote Center sustainability.

Malzkuhn notes that the code framework supports videos, texts and images.

"People can take science lessons, for example, and expand them into visualizations," she explains. "They can use ASL's natural iconicity to describe complicated concepts that can be cross-referenced to English vocabulary." Developers and educators will also have the option to decide which platform they prefer, iPad or Android.

Currently Malzkuhn and her team are working on expanding the Authoring System technology to allow people to import their own content to the platform "There are so many great storytellers, artists and ideas out there. Helping more people get involved in app development means more children will benefit. And people can use their creativity and decide how they want to use storytelling in teaching."

- Melissa Malzkuhn

and choose the level of assistance they need to create their Storybooks. Plans are underway to offer workshops and training, strands on App development, and possibly Apps in different languages (printed and signed). The team will continually update and modify the SAAS as needed to ensure the most outstanding product and user-friendly experience.

VL2 continues to be committed to evaluating the experiences of children and users with the Apps, and providing creative classroom activities that incorporate extended learning in ASL and English literacy.

"I believe we have created a valuable educational tool," says Malzkuhn."Now we need to reach out to teachers to let them know how they can use the program for their students."

The SAAS is another example of the innovation and creativity our product development team displays as they work to create meaningful translational tools for young visual learners.

#### The new website is scheduled to launch in June 2014 and workshops are planned for later in the year.

## Where Science Meets Technology and Design: VL2's Motion Lab

VL2's Motion Lab, established in 2011, creates new knowledge through research and

development of creative literature and digital technology. The Lab's projects include the development of ASL/English bilingual Storybook Apps, explorations of digital narratives on a bilingual interface, and studies of gesture literacy and visual typography in fingerspelling.

"Through my work in translational science, I came to

#### identify a need for investigations on new and upcoming technology to develop ASL/English resources for young deaf children," said **Melissa Malzkuhn**, Director of Motion Lab and VL2's Digital Innovation and Media Strategies Manager. "We are

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cultivating a lab culture where science meets technology and design, from a creative standpoint."

Motion Lab has recently been awarded a seed grant from the Provost Office for a new project, "An Investigation on Gesture-Based and Interactive Technology for Learning" with Melissa Malzkuhn and **Dr. Ben Bahan** of ASL and Deaf Studies as Co-Principal Investigators. The project seeks to investigate gesture-based technology (such as LEAP Motion and Kinect) and gaming platforms to map foundations for translational science work. VL2 research serves as the foundation of this resource development for young deaf children and visual learners.

"Storytelling is at our core, and we are always exploring new technology to best deliver stories so we can continue to learn, thrive, and be constantly curious about new things," Malzkuhn said.

With the seed grant, Motion Lab is thrilled to welcome **Lauren Benedict**, who joins the team as Lab Projects Coordinator to plan several upcoming events. They include a storytelling symposium and workshop sessions introducing gaming, augmented reality and gesture technology.

### **Tracking Growth Trajectories in Literacy:** The Early Education Literacy Studies (EELS) Lab

With a mountain of data collected over the past three years as part of the Early Education Longitudinal Study (SFA3, Network 7), the EELS team has turned to the analysis phase, and is engaged in a number of statistical projects that examine the growth



trajectories in literacy for preschool-aged deaf children over a

three-year period. In its Network 7 project, the team is specifically examining the interactions among cochlear implant usage variables and early sign communication variables on the rates of acquisition of literacy. Thinking also

about future research projects, the EELS team has evolved into a sustainable and interdisciplinary Gallaudet lab (The Early Education Literacy Studies Lab) to leverage its current strong research record into the design of future collaborative research efforts. Naturalistic studies in home and school environments on the acquisition of literacy and language skills that are primarily quantitative in nature will continue to be the hallmark of the EELS team. They will also work to continue to improve the quality of language assessments for deaf children and take the lead in further development of the ASL Assessment Portal.

In early January, the EELS team submitted a proposal to NSF to extend the longitudinal study through participants' elementary school years, and to focus its data collection and analyses on aspects of cognition and literacy that contribute to the development of STEM capabilities among deaf students. EELS researchers have also begun interactions among faculty at Gallaudet not formerly associated with VL2 to consider possible areas for collaboration and grant-writing.

#### Co-PI and Director of the Early Education Literacy Studies Lab, Tom Allen, leads the EELS team in a discussion of analysis strategies for tracking longitudinal literacy growth.



### The Biology Behind Language Acquisition: BL2 Lab



VL2's state-of-the-art Brain and Language Laboratory (BL2) is led by **Dr. Laura-Ann Petitto**. The Laboratory features one of the world's most advanced brain imaging systems, called functional Near Infrared Spectroscopy (fNIRS), as well as an Infant Habituation Lab, Video-Recording and Editing studios, Video-Conferencing facilities, Experimental and Observation Chambers and more.

BL2's research team conducts neuroimaging and behavioral studies that provide knowledge about the biological mechanisms and environmental factors, which, together, make possible the human capacity to learn and convey language, achieve reading mastery, and become a skilled bilingual. We are investigating questions such as: What is the impact of learning two languages on the developing brain? When is the optimal time to expose a young child to two languages and two reading systems? What are the most optimal programs for teaching a young bilingual child to read? What are the normal developmental stages of bilingual language and reading acquisition, and how can we ensure that bilingual children are achieving the greatest academic success?

For more information about BL2's innovative science research program, visit our team at petitto.gallaudet.edu.



# Follow Up: Signing Creatures Workshop

Imagine toddlers watching mobiles that engage them in ASL rhyming, or children listening to stories signed by avatars. Sound like something out of a movie? Actually, much of the scientific and engineering knowledge to create such products already exists. But it is spread out among distinct research communities who rarely have the opportunity to gather and collaborate.

That's why almost fifty avatar, robotics and visual language scientists were so excited to explore the many possibilities for innovation at the November 15 and 16, 2013 **Avatar and Robotics Signing Creatures Workshop**. Funded by NSF and held at Gallaudet, the workshop brought together experts from multiple disciplines with the goals of advancing science and sharing ideas for creating avatar and robotics learning tools for young children, including young deaf visual learners.

Participants' areas of expertise included sign language linguistics, language acquisition and child pedagogy, signing avatars and human-figure animation, eyetracking and non-verbal behavior (e.g., sign) recognition, dialogue interaction and social robotics, advanced avatar behavior generation and relational agents. Together they attempted to develop a fuller picture of the linguistics of signed language communication, the most effective teaching methods for optimal neural development, and the capabilities of robot and virtual human technologies in sign language production, recognition and interaction.

The greater Gallaudet and DC communities were included in the standing-room-only **Knowledge Explosion** that opened the event. Over forty presenters took a few minutes to discuss their research questions, discoveries and visions for their fields. Then in Breakout sessions, teams made up of experts from different disciplines answered prepared questions for sharing with the group and NSF. Later in the workshop participants also identified challenges and "hot new scientific directions" needed to advance science and facilitate creation of learning tools for children.

This NSF workshop was highly successful. Scientists expressed that they saw issues in a new way, gained new research ideas and developed new networks. Both robotics and avatar experts envisioned collaborative efforts involving both technologies along with visual learning science. And all said they were enriched by learning more about visual language and the people who study it.

VL2 is now seen as a critical leader in driving new research pathways. Follow up will be needed to solidify the potential collaboration teams and match them with specific funding venues at NSF. Using the knowledge garnered in this Workshop, the VL2 Center is designing new learning tools and planning new grant writing in Years 8, 9 and beyond to federal and foundational granting agencies.





# **New Directions in Neuroscience:** PEN Program Update

Our PhD in Educational Neurosciences (PEN) program reflects the interdisciplinary nature of the field, incorporating multiple departments on campus including Psychology, Linguistics, Interpretation, Education, and Hearing Speech and Language Sciences. This cross-field fertilization produces discoveries about how the mind acquires knowledge in different domains (e.g., language, reading, math and numeracy, science and social-emotional) and directs these discoveries towards core challenges in education.

PEN graduate students are well situated to conduct state-of-the-art neuroimaging and behavioral research, producing new knowledge that benefits both science and society. **Adam Stone** (*left*) and **Geo Kartheiser**, (*right*) our two first-year pioneers in the PEN program, are enthusiastically navigating the seas of graduate school. In addition to their classes, they have been thinking to the future, refining their research interests, and preparing for the exciting years to come.

Late in 2013, Adam and Geo submitted F31 Pre-doctoral Fellowship Applications to NIH/National Institute for Deafness and Other Communication Disorders. During the current semester, they are beginning to prepare for their first summer lab rotations. Adam is headed to Rain Bosworth's lab at the University of California at San Diego to further his interest in reading research using eye-tracking methods. Geo will work in Karen Emmorey's lab at San Diego State, participating in Dr. Emmorey's ongoing research in working memory.

We are also delighted to announce our first PEN hire, Assistant Professor Clifton Langdon. Dr. Langdon is dedicated to creating new research discoveries that broaden and deepen our understanding of human cognition (particularly language processing) and is enjoying his work with the next generation of Educational Neuroscience researchers.

With its new curriculum, PEN has enriched Gallaudet's course offerings with some innovative and important courses that are open to students both inside and outside the program. Our PEN 705 (Neuroethics) course, taught this fall by Dr. James Giordano, Chief, Neuroethics Studies Program at the Edmund D. Pellegrino Center for Clinical Bioethics at Georgetown University, challenges students to see that the potential benefits of science (and neuroscience in particular) are often accompanied by potential ethical conundrums that require continual vigilance by individuals engaged in research. The PEN Educational Neuroscience Pro-Seminar (PEN701), led this past semester by Dr. Diane Clark, brings internationally recognized scholars to campus to share their research and engage in discussions with Gallaudet students. This fall, we welcomed **Dr. Matt** Traxler from the University of California at Davis, who discussed his research into individual differences in reading acquisition (and its cognitive correlates) among deaf individuals: Dr. Bruce McCandliss. who

discussed how the emerging field of educational neuroscience can contribute to our growing understanding of the neural basis of reading development; and **Dr. Laurene Simms** and **Ms. Suzanne Scott**, who presented jointly on bilingual and bimodal instruction focusing on innovative instructional practices for students with cochlear implants. This semester, we will welcome Drs. Elisa Newport and Ted Supalla from Georgetown University and Dr. Tom Humphries from the University of California at San Diego.

The PEN Steering Committee (VL2 Co-Pls Thomas Allen and Laura-Ann Petitto, Dr. Melissa Herzig and Dr. Langdon), meets weekly to guide and advance this new program. Already a new course in neuroimaging methods has been designed and presented to the Council on Graduate Education at Gallaudet. Newly proposed Memoranda of Understanding are being discussed with leading neuroimaging labs for future summer placements for PEN students. And most exciting of all, we are looking forward to our second admissions process that will lead to the matriculation of our second cohort of Educational Neuroscience students next fall.

One of the most vital missions of VL2 is to help train the scientists of the future. We are fortunate to work with a cadre of excellent VL2 students who make significant contributions to all aspects of student life in the Center.

Our Student Leadership Team, mentored by Dr. Peter Hauser (NTID/RIT) plays an important role in keeping students at our various sites connected. Here are some updates from the Team.

#### **SRC Reviews**

The Student Review Committee (Benjamin Anible, University of New Mexico, Chair) is busy reviewing student-written applications for research, training, and travel support. Students wishing to apply for financial support for their research or for attending a conference to present their findings can submit an SRC application to Ben at banible@unm.edu.

#### **Visual Sign Phonology Workshop**

The SLT sponsored three students to attend the Visual Sign Phonology Workshop at Gallaudet on February 1: Jessica Contreras (RIT), Gina DeNaples (RIT), and Paul Twitchell (UNM). UCDavis students Liv Hoversten and Trevor Brothers and UNM students Benjamin Anible, Corrine Occhino-Kehoe and Helen Arenholz, as well as Dr. Jill P. Morford, participated via video conferencing. Thanks to all who were able to be part of this event!

#### **Tweet Program**

Gallaudet Graduate Assistant Andrea Sonnier (PhD Program in Education) is coordinating the newly-launched VL2 Student Tweet program. Each VL2 student will write a tweet summarizing a published VL2 research article. About 1-2 tweets will be posted per week via VL2's Twitter account (@VL2Science) throughout the spring, leading up to the NSF Site Visit in mid-June. This is a great way to practice sharing VL2 findings, especially in bite-sized chunks.

# SCIENTISTS OF THE FUTURE: Student Updates

#### Website Update

VL2 is redesigning its website. Gallaudet student Erica Wilkins is spearheading this project with **Digital and Media Innovation Manager Melissa** Malzkuhn, working with our Web designers to update content and give the site a fresh look and feel. The SLT is providing input on what the "Students" section will look like. The website will include bios of all current and former VL2 students and alumni, announcements of upcoming VL2 events including the Friday "The" VL2 Meetings, and also guidelines and procedures for submitting SRC applications. The SLT is looking for input about what else should be featured on this part of the VL2 website. Students are encouraged to email Shane Blau at srblau@ucdavis.edu with their ideas.

# SL2 HUB Conference, March 27-29 at Gallaudet

SL2 Hub-DC is an interdisciplinary student-led conference that centers around sign language research. This conference is run by students and all session presenters are student researchers. The conference brings together students from all disciplines, including Linguistics, Deaf Studies, Education, and Interpreting. The conference has three main goals (1) to share how each discipline approaches and contributes to the field of sign language research, (2) to build interdisciplinary connections, and (3) to support emerging researchers' journeys through the early stages of their academic and research careers.

Along with student presenters, there will be a Keynote panel moderated by Dr. Peter Hauser that will include experienced researchers in the field who will discuss their own research journeys. For more information about the conference, access the website at https://sites. google.com/site/sl2hubdc/home, the Facebook page at https://facebook.com/SL2HubDC or the YouTube Channel http://www.youtube. com/user/SL2HubDC.

*We will continue to send updates about future conferences.* 

#### **NSF Site Visit**

The Annual NSF Site Visit is in mid-June. As always, we strive to have a large student presence at these meetings, especially for the special half-hour students-only meeting that occurs during the visit. To prepare for this meeting, the SLT will be sending out an endof-year survey shortly, as well as information about how students can request support for attending this meeting.

#### New SLT Member Elections for 2014-2015

It's almost time to pick the next SLT for Year 9 (2014-2015). Elections will be held in April and all positions are open (5 SLT members, one representing each Strategic Focus Area, and 1 SRC Chair). We encourage students to consider serving. Details about nominations will be emailed soon.

#### "The" VL2 Meeting Updates

"The" VL2 Meeting, our weekly student-run videoconference meeting open to all VL2 students, allows students from throughout the VL2 network to meet current researchers and learn about their work, as well as discuss student issues that arise. We have an exciting list of presenters scheduled over the next few months, and a debate scheduled on April 25 from 3:00 to 4:30 p.m. The debate will be moderated by Dr. Carol Padden and will feature Dr. Adam Schembri and Dr. Gaurav Mathur. Additional updates will be sent out soon.

On March 14, Student Practice Day, students will have the opportunity to practice presenting their research and receiving constructive feedback in a safe environment. To learn more about how to sign up for Student Practice Day or to attend the VL2 Meeting, students can contact Jessica Contreras at JMC8191@rit.edu.

# A VL2 Journey: Profile of Dr. Clifton Langdon

# Clifton Langdon's favorite hobby is, he says, "fiddling with things."

"Taking apart and putting back together computers and mechanical devices is relaxing for me," he explains. "I enjoy seeing pieces come together to create a whole entity with a function." Figuring out how parts come together to create something greater is a theme that's also evident in Dr. Langdon's research and career. As an educational neuroscientist, he and his colleagues address "difficult, yet thrilling questions, trying to understand the brain and how it learns," he says. He was a pioneer as one of the first VL2 Pre-Doctoral Fellows, helping to define the many ways students contribute to the Center in addition to his studies and research. And he now serves as the first Assistant Professor in the new PhD in Educational Neurosciences (PEN) program. (Langdon is also an affiliated faculty member in the Hearing, Speech and Language Sciences Department).

#### Langdon's current research addresses critical topics in language learning.

"I have branched out into developing and conducting research projects that address core questions about the stability and plasticity of neural tissue and the systems underlying language processing," he says.

Langdon grew up in San Diego, where he spent much of his free time outdoors hiking, mountain biking and at the beach. His family members were trade workers (mother in drafting and cabinetry, and father and brothers in masonry) and were very supportive of his scientific interests.

"I remember as a child reading

through National Geographic and astronomy magazines and playing around with mixing different colored liquids, watching how color spread through still liquids, swirling liquids, and so on," he recalls.

#### When he reached college, Langdon pursued the broadest track possible: Liberal Studies.

"The idea of studying linguistics had not occurred to me until I started working in a student lab at Palomar Community College for learning American Sign Language," he recalls. "I encountered people who, despite traumatic brain injuries, became successful signers. Then there were others who, with every possible resource for learning, didn't do as well. I was curious about why some people failed and some succeeded."

Langdon says these experiences caused him to wonder about the structure of language and how the learning of languages occurs. "This was the beginning of not only my interest in linguistics, but also the science of learning," he says.

Langdon transferred to California State University of San Marcos and took all of the linguistics courses available. CSUSM did not offer a bachelor's degree in linguistics; fortunately, one of Langdon's mentors, linguistics professor Dr. Jule Gómez de García, encouraged him to design his own.

"I came to see my education in a different light," he explains. "It was not something to follow in a prescribed sequence. Instead it was something dynamic, more of a tool for me to answer questions in novel ways."

Langdon received his BA in 2005, and then worked for a year and half in the renowned research laboratory directed by **Dr. Karen Emmorey** at San Diego State University.

"Being in Dr. Emmorey's laboratory was a fantastic experience," he recalls. "She had a strong group of PhD students and post-doctoral researchers who taught me the questions that the field seeks to answer, the methodologies that they use to address them, and critically, the way a scientist thinks."

Langdon says that coming to Gallaudet in 2007 for his post-graduate studies was an obvious next step. "Gallaudet was the logical conclusion to the question: Where should I go to study the linguistics of ASL in order to answer my questions about how people learn ASL?"

His new academic advisor, **Dr. Paul Dudis**, was also a Research Strand Director in VL2. The Center, in the early stages of



Dr. Clifton Langdon, the first Assistant Professor in the new PhD in Educational Neurosciences (PEN) program. infrastructure development, had just established a merit-based pre-doctoral fellowship, which was awarded to Langdon. As the inaugural VL2 Fellow, he co-founded and helped lead two organizations, the Student Leadership Team, which represents students and coordinates mentorship and training; and the Student Review Committee which administers a permanent research grant fund for VL2 students.

When **Dr. Laura-Ann Petitto** arrived as the new VL2 Science Director, she hired Langdon as a research assistant in the Brain and Language Laboratory (BL2).

"In BL2, we work on addressing fundamental questions about the nature of the developing brain in terms of reading and bilingualism," Langdon explains. "Dr. Petitto and I, along with our wonderful BL2 team, are addressing the essential question: What are the normal developmental stages of bilingual language and reading acquisition, and how can we ensure that bilingual children are achieving the greatest academic success?"

Langdon successfully defended his thesis in December 2013. "**Dr. Deborah Chen Pichler**, my dissertation chair, is an expert in language acquisition of ASL. My dissertation used learning to answer questions about the structure of language, and I am continuing this research strand to further elucidate the basis of how these linguistic constructions are processed."

And along with his new PhD, after a competitive search Langdon was hired as the first professor in the PEN program. "In this program, we are training students to become cognitive neuroscientists who are committed to bridging their discoveries on the developing and learning brain to the pressing needs of education," he explains. "Our research agenda enables the students in PEN to jump to the forefront of the field and ask profoundly illuminating questions about the nature of human language."

Langdon's current research "sets the stage for the next series of exhilarating questions about age of language exposure and its impacts on how linguistic structures are processed," he explains.

"My research is woven together with three strands," he continues. "The first investigates the linguistic structure of classifier constructions as a testing ground for the biological (dis)similarities of spoken and signed languages. The second studies the effects of delayed language acquisition in relation to structuring language differently (i.e., the neuroplasticity of language). And the third strand unites the behavioral studies of atypical acquisition with neurolinguistics by studying the boundaries of neuroplasticity of the auditory cortex. This research agenda could profoundly impact educational policies for language instruction in young children."

The intense curiosity Langdon displays in his research seems appropriate for someone whom, in his spare time, enjoys taking things apart and putting them back together. He likes to discover how devices function, "using an elegant process or a myriad of components hobbled together." This need to explore, he says, "connects with my personality. And that drives me as a scientist." •



## **Sharing Center Resources:** VL2 Data Sharing Portal Project

In the seven and a half years that VL2 has been in operation, datasets spanning many studies from many labs have been created and analyzed. Recent Federal requirements from NSF and other Federal funding agencies mandate the creation of data sharing and data management plans for all proposals submitted for funding. Fulfilling this mandate is complex enough for single studies emanating from a single lab. For a Center such as VL2 that is made up of multiple studies from multiple labs over a period of years, the requirement poses considerable challenges.

In the past year, VL2 has been developing an infrastructure for sharing Center data. The design involves the creation of a website with links to a variety of data resources that include project abstracts; project metadata (dates of the study, PIs involved, participant descriptions, etc.); project tools, such as questionnaires and data collection protocols; codebooks; and links to publications based on the data.

The site also contains a link to an online procedure for requesting access to VL2 study data. The procedure includes an automated data "picker" for selecting variables for secondary analysis of reduced data sets and a data sharing agreement form that outlines the conditions for granting access to VL2 data. These conditions follow protocols advanced by NSF and NIH to protect the confidentiality of study participants, ensure appropriate and non-redundant analyses of study data, and clarify issues of intellectual property.

A working version of the VL2 Data Sharing Portal will debut soon using the Wave 1 database from the Early Education Longitudinal Study (EELS) as the prototype. The EELS dataset is complex, containing over 900 variables, four survey forms, and a battery of cognitive assessment protocols. It will serve as a model for sharing a variety of VL2 datasets. n of Centers to have A n of Centeredness n of Scientific Synergy





# Converging Findings for Breakthrough Learning: Visual Sign Phonology Workshop

As our Year 8 science converges, reflecting core findings, emerging scientific themes and discoveries from years 1-7, we at VL2 are focused on how our Center can contribute breakthrough knowledge that changes the assumptions of science and society regarding visual learning.

Our **Visual Sign Phonology Workshop**, held at the Center on February 1, brought together an expert team of scientists, linguistics specialists and educators from across the nation to examine crucial questions about the relationship between the underlying organizational systems of signed languages and the vital role they play as children learn to read in English.

Through our studies, we have increasing evidence that young visual learners are utilizing visuallybased knowledge accessed through fingerspelling and other pathways. Scientists have traditionally examined the ways the ears and auditory processes contribute to language learning and reading. Our workshop team aspired to contribute new knowledge about the eyes and visual processing in building these essential skills.

The workshop's goals included determining a consistent rubric/name for what we are now calling Visual Sign Phonology. Then the team moved on to further define aspects of this concept, which is comprised of multiple cues and encompasses a level of language organization that is comparable to sound phonology in spoken language.

Another important area of discussion involved considering how to further advance our knowledge of visual sign phonology and exactly how it works. Our research into this topic spans the disciplines of cognitive neuroscience, language learning, reading and linguistics. Considering VL2's looming translational priorities, what studies will be most effective? Where should we be Far left: VL2 Science Director and Co-PI Laura-Ann Pettito conducting the VSP Workshop.

Center: VL2 Study PI Rain Bosworth with student attendees.

Bottom: A dynamic group of PIs and other experts participated in the VSP workshop.

focusing the majority of our research and attention?

Our final workshop goal was to determine the best methods and tools to study visual sign phonology. What behavioral and brain imaging methods are best suited to studying its multiple cues? And when we consider what we can learn from the young visual learners we study, at what age is it most important to monitor them to learn about the role that visual sign phonology has in their acquisition of reading?

The workshop was a great success, and illustrates the significant impact that our VL2 Center studies can have on language and reading for the benefit of all children, especially the young deaf visual learner. Additional insights from this important workshop will be featured in future issues of *Visualize*.

# Science In Action: VL2 Study Updates

Here is a sampling of some of the exciting updates we receive from our VL2 researchers, who are continually making new discoveries that benefit children, parents, educators and the scientific community. These updates are from Year 6-7 study leaders. We'll be featuring highlights from our Year 8 research and additional ongoing studies in the June issue of *Visualize*.

### From Dr. Matthew Dye, University of Illinois at Urbana-Champaign.

#### "Optical Imaging of Visual Selective Attention In Deaf Adults."

Dr. Dye presented work from his VL2-supported project in a symposium at the Society for Neuroscience in San Diego, CA in November 2013. He reported that using advanced optical imaging technology, his lab was able to demonstrate that visual inputs activate heteromodal brain areas in the right hemisphere more strongly in deaf than in hearing individuals. Importantly, the optical data showed that this increase in activation of the right temporal lobe had a "biphasic" time course, with an initial activation (after 25-50 ms) followed by a broader later activation (300-450 ms). Over the coming months, Dr. Dye's group will be applying novel statistical analyses to the data in order to examine in more detail the exact temporal lobe structures implicated in this deafness-induced brain plasticity.

#### From Dr. David Corina, University of California, Davis.

#### "Electrophysiological Indices of Visual Language Experience on Auditory and Visual Function."

At the Cognitive Neurolinguistics Laboratory at UC Davis, we are looking at children with cochlear implants and the effect of using sign language on their auditory and visual response. This research addresses the claim that experience with sign might negatively affect childrens' ability to process sound in the auditory cortex. By comparing deaf children with cochlear implants who have ASL experience to those deaf children with cochlear implants who have not been exposed to ASL, we can objectively assess the impact of visual language on auditory cortical function. Our preliminary results show that the experimental paradigm is successfully evoking auditory and visual responses in the children who use sign language and in hearing controls, and we look forward to comparing these responses with our non-signing group, which is currently underway. We believe that these empirical data will lead to objective and evidence-based policies and recommendations that promote optimal attainment of linguistic competencies in deaf children.

#### From Dr. Charlotte Enns, University of Manitoba.

#### "Parent & Child Visual Language Training." Her Co-PI is Dr. Lynn McQuarrie, University of Alberta.

Knowledge creation is composed of three phases: first-generation knowledge (knowledge inquiry), secondgeneration knowledge (knowledge synthesis) and third-generation knowledge (creation of knowledge products and tools). Based on our previous work in Phase 1 (knowledge inquiry – ASL acquisition research) and phase 2 (knowledge synthesis – ASL developmental milestones) we are now wrapping up the third phase in our knowledge creation process with the creation of knowledge tools and products. Our goal in this phase of the research is to develop creative and engaging materials to help parents facilitate signed language acquisition. To that end, a parent toolkit website has been developed and we are in the final stages of filming and editing our video tutorials. All materials will be uploaded to the VL2 Parent Toolkit website by March 2014.

#### *From Dr. Peter Hauser*, *RIT National Technical Institute for the Deaf.* "Executive Function in Deaf Bilingual School-Aged Signers."

Dr. Hauser's VL2 study on the impact of language on executive function development had two key findings. Executive functions involve metacognitive skills and behavioral regulation which are important for learning and social behavior. Dr. Hauser's team found that deaf children who were exposed to ASL at birth have better executive function skills than those who learned ASL after their first few years of life. The difference between early and late signers continues to be evident in deaf young adults—they do not catch up. The study also grouped participants based on their language skills:

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(a) those with strong ASL and reading skills; (b) those with strong ASL skills but weak reading skills; and (c) those with weak ASL skills and strong reading skills. Among deaf children, those with strong ASL skills, regardless of their reading skills, performed better on a EF task than those with just strong reading skills. Among young adults, those with strong ASL and English skills performed best suggesting a positive bilingual effect on executive functions emerges as the deaf individual becomes a more fluent reader. Deaf adults with strong ASL skills but weak English skills still performed better than those with just strong English skills. The results of this study supports the line of VL2 research showing that age of ASL acquisition is very important for deaf children.

#### From Dr. Keith Rayner, University of California, San Diego.

#### "Orthographic Processing Effects on Eye Movements in Deaf Readers."

We submitted a project to explore the Orthographic Processing Effects on Eye Movements in Deaf Readers, but also conducted a second parallel project on ASL activation during English reading in collaboration with Dr. Jill Morford at University of New Mexico.

The first project is already published: Bélanger, N. N., Mayberry, R. I., & Rayner, K. (2013). Orthographic and phonological preview benefits: Parafoveal processing in skilled and less-skilled deaf readers. The Quarterly Journal of Experimental Psychology, 66(11), 2237-2252.

For the second project, "Automatic American Sign Language (ASL) activation during reading in ASL-English deaf bilinguals," we have presented preliminary results at two conferences. This work was a collaboration between Dr. Rayner, Dr. Nathalie Bélanger, and Dr. Morford: Much evidence suggests that bilinguals activate words in both languages when reading either in their L1 or in their L2. The present experiment extended prior research and embedded pairs of unrelated English words for which translation equivalents in ASL were either related (signs that share several phonological/structural parameters in ASL) or unrelated (no overlap at all between the two sign equivalents in ASL) within sentences. In a preliminary analysis of our data, eye movement measures on the target words suggest that while reading English sentences, ASL was activated extremely early in deaf ASL-English bilinguals. Now that we have finished data collection, we are currently performing the full and final analysis for this experiment.

#### From Drs. Matthew Traxler and David Corina, University of California, Davis. "Individual Differences in Deaf Readers."

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We are in the midst of modeling individual differences in comprehension outcomes for our VL2 literacy project. The highlights thus far include: Cochlear implant status and digital hearing aid status do not correlate with comprehension outcomes; and neither does degree of (self-reported) hearing loss.

Factors that do relate to comprehension outcomes include phonological processing accuracy (Deaf readers who perform at higher levels on judgments of the phonological qualities of letter-strings also perform better on comprehension tests), and vocabulary knowledge (our study goes beyond existing reports by showing that reading experience and executive function/working memory both contribute to vocabulary knowledge in deaf readers).

Upcoming Center Events VL2 Scientific Advisory Board Meeting.....March 16 & 17

VL2 Translation Innovation "Quality Assurance" Evaluation committee of learning tools spearheaded by Dr. Melissa Herzig.....Spring 2014

VL2 NSF Site Visit...June 12 & 13

In addition, we have been looking at the ways in which deaf readers capitalize on their first-language knowledge of ASL when they read English texts. Our findings indicate that deaf readers do activate ASL knowledge while interpreting English texts.

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