2008 Research Highlights

Language Research in Service to the Nation

The Scope of Work that University of Maryland Center for Advanced Study of Language (CASL) scientists produce is broad. Currently, research scientists at CASL are actively working on 21 research projects, ranging from the evaluation of government language testing to the development of dialect identification tools to increasing language analysts’ productivity on the job. No other center in the country brings together such a range of experts in different disciplines to look at the government’s language challenges in new ways.

CASL enables its scientists to act as independent advisors who provide sound, research-based solutions. This year CASL research continued to inform government decisions on critical language training programs and investments across the intelligence and defense communities. Upcoming studies hold promise for breakthrough research in areas such as cognitive neuroscience and computational linguistics.

The signing of a new five-year contract has given CASL the opportunity to refocus its research to adapt to new domestic and international realities. CASL now participates in Independent Technical Reviews (ITRs) that include peers from across academia, industry, and government, including institutions such as the Intelligence Science Board and the National Academy of Sciences. These sessions produce rich dialogue on both the details of the science and the overarching CASL research agenda.

“I felt that the research design showed a great deal of thoughtful effort by the research team, and that the technical review was very positive and productive.”

—Peer Reviewer at a CASL ITR

CASL’s scientific experts, state-of-the-art laboratories, and independent peer-review process lay the groundwork for high-quality applied research—research that is helping the government answer tough operational questions as they emerge.
How do we identify individuals who are most likely to learn languages more effectively and efficiently?

By studying successful professionals and improved language aptitude testing.

In the past five years, CASL conducted extensive studies of adult language learners’ cognitive functions, collected comprehensive descriptions of successful language learners across three agencies, and engaged with experts in test development and psychometrics to evaluate language aptitude test design. As a result, CASL is working to help agencies identify individuals who have an aptitude for language and is working hand-in-hand with the government to modify its aptitude testing and evaluation processes and tools.

Does reducing class size and introducing technology pay dividends for learning in the foreign language classroom?

These modifications improved the learning environment, better preparing our troops for the language battlefield.

CASL delivered a comprehensive report and recommendations to the Defense Language Institute Foreign Language Center (DLIFLC) on its new initiative that reduced class size and introduced technology such as iPods, SmartBoards, and PCs to the classroom. DLIFLC is continuing to use CASL research and advice to optimize their learning environment.

Are online foreign language training programs a good investment?

CASL research found that some are not. CASL examined the effectiveness of Rosetta Stone™ Version 2 in Arabic, Chinese, and Spanish. Results of that study and a previous CASL evaluation describing the program’s potential effectiveness revealed shortcomings with the software, both with respect to the claims made by the company and in the usefulness of Rosetta Stone for self-study by beginning language learners. This evaluation is aiding the government in making future decisions on software investments.

Researcher Highlight

Senior Research Scientist Michael Maxwell was a runner up for the Best Paper Award at the First International Conference on Global Interoperability for Language Resources in Hong Kong on January 10, 2008. The paper, titled “Interoperable Grammars,” discusses CASL work on writing grammatical analyses in XML so that they can be targeted for multiple uses.
Giving language practitioners the products, services, and training they need to improve their job performance.

» How can government linguists quickly recognize many different Arabic dialects?

With an expert-inspired online tool, CASL brought together top language experts to provide the content for AVIA—an online dialect identification and familiarization tool. AVIA continues to grow. Now with 17 dialects, AVIA helps linguists who have mastered expressions in Modern Standard Arabic or other forms of Arabic find equivalent expressions, as well as information about verb conjugations and pronunciation in these dialects.

» How do you extend the usefulness of traditional language dictionaries?

By building a robust technology tool that helps users find forms of words that usually don’t appear in the dictionary. That’s what CASL is building for two languages—Bengali and Urdu. CASL’s tool breaks any variant of a word into its meaningful parts and relates this form of the word to its simpler dictionary form. Because electronic dictionaries often have to be recreated when the technology that drives them becomes obsolete, CASL is building a tool that can be easily migrated to new computer environments, giving the government a dictionary that will last for decades.

» How can language analysts maximize the efficiency and effectiveness of their translations?

Through a research-based tool for improving the government’s translation quality control programs. Short translation times are essential to government agencies, for example in situations where time and accuracy are critical. CASL has developed and is now validating and refining a tool for assessing the quality of translations. This research focuses on gisting—that is, quickly summarizing in English—key information from foreign language voice and text translations.

» How can analysts quickly identify critical content in large audio archives?

By improving existing human language translation tools. CASL delivered recommendations to users of the Nexidia® Iraqi Language Pack so that they could make more effective phonetic search queries. CASL identified and implemented support for language mechanics (spelling, short vowels, morphology, and pronunciation variation) in the query formats specific to the tool.

» How can we decrease the effect of stress and fatigue on the productivity of government language analysts?

Through real-time online measurement, noise mitigation, and sound workplace design. CASL is developing real-time online measures to signal when an analyst’s language performance has declined. These measures stem from extensive CASL research on noise mitigation, workplace design, and stress alleviation techniques for language analysts who are exposed to large volumes of information and can be susceptible to unnoticed declines in performance.

» How can we increase an analyst’s ability to engage in innovative problem solving?

By enhancing their cognitive performance in divergent thinking. CASL offered guidelines for improving the cognitive processes of intelligence analysts and language professionals. Possible solutions include using EEG neurobiofeedback training as a technique for training analysts to change their brainwaves to achieve desirable neurophysiological states that enhance cognitive performance, especially divergent thinking. CASL’s extensive laboratories facilitate development of these techniques.
CASL at a Glance: FY 2008

134 FULL- AND PART-TIME STAFF
61 RESEARCH SCIENTISTS AND ASSISTANTS
90 PERCENT OF PRINCIPAL INVESTIGATORS WITH A PhD
56 PERCENT OF RESEARCH ASSISTANTS WITH A MASTER’S DEGREE
101 CLEARED TS//SCI STAFF
25 CURRENT TECHNICAL TASK ORDERS
6 HIGH-TECH LABORATORIES, WHICH INCLUDE EEG AND EYE-TRACKING DEVICES
6 SUBCONTRACTS WITH OTHER UNIVERSITIES

ORGANIZATIONS SERVED
- Central Intelligence Agency (CIA)
- Defense Intelligence Agency (DIA)
- Defense Language Institute Foreign Language Center (DLIFLC)
- Defense Language Office (DLO)
- Federal Bureau of Investigation (FBI)
- Foreign Service Institute (FSI)
- National Geospatial-Intelligence Agency (NGA)
- National Security Agency/Central Security Service (NSA/CSS)
- Office of the Director of National Intelligence (ODNI)
- United States Secret Service

Degrees held by CASL research scientists and assistants

MAs 34%
BAs 20%
PhDs 46%

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Proficiency Enhancement Program (PEP)—an innovative program, phased in over several years, that reduces class sizes, raises higher basic course entrance requirements, provides intensive training for new language teachers, revises curricula, and enhances the technology in the foreign language classroom.

While these innovations were being phased in, DLIFLC asked CASL to examine the impact of two aspects of the PEP initiative in particular: class size reduction and technology use for language learning and teaching.

• What is the impact of class size reduction (e.g., from ten to six learners) on foreign language learning and teaching in Arabic and Chinese classrooms at DLIFLC?

• What is the impact of technology use (e.g., iPods, SMART Boards, Tablet PCs) on foreign language learning and teaching in Arabic and Chinese classrooms at DLIFLC?

The trends that have emerged from this research indicate that class size reduction and technology use have significantly improved the learning environment at DLIFLC.

• Train learners and teachers to take advantage of small class sizes
• Teach learners how to use technology for foreign language learning
• Supply appropriate target-language-specific technology
• Enable the wireless capability of the Tablet PCs
Language analysts at a large government agency

The Arabic Variant Identification Aid (AVIA)

To help intelligence analysts who understand one dialect of Arabic recognize dialects that they have not studied.

• Can we develop a tool that analysts can use at their desks to quickly identify where an Arabic speaker is from?
• How can we quickly assign a speech sample to a translator who is an expert in the correct Arabic dialect?

A dynamic online tool that helps identify Arabic dialects.

• 24 dialects ranging from Bahraini to Yemeni
• “Clickable” sound files with samples of each dialect
• A transcription guide

CASE STUDY: Tool Development

Client
Language analysts at a large government agency

Initiative
The Arabic Variant Identification Aid (AVIA)

Task
To help intelligence analysts who understand one dialect of Arabic recognize dialects that they have not studied.

Client’s questions
• Can we develop a tool that analysts can use at their desks to quickly identify where an Arabic speaker is from?
• How can we quickly assign a speech sample to a translator who is an expert in the correct Arabic dialect?

Results
A dynamic online tool that helps identify Arabic dialects.

Recommendations
• 24 dialects ranging from Bahraini to Yemeni
• “Clickable” sound files with samples of each dialect
• A transcription guide
Recalling his first trip to Germany, Gregory Iverson, the Area Director for Less Commonly Taught Languages and Cultures, says, “I had my undergraduate honors major in German, and I couldn’t understand anything for the first few months! And then I became very good.” He tells this anecdote to emphasize the difference between the formal study of a language and the daily use of it. Exploring and understanding that distinction have been fundamental to Iverson’s academic work and are central to the projects he now oversees at CASL.

One such project is Arabic Dialect Identification and Recognition. Iverson explains that people study Modern Standard Arabic, also called Classical Arabic, and “The problem is that nobody speaks that language. The actual vernaculars are quite different.” One popular tool to come out of the project is the Arabic Variant Identification Aid (AVIA), a resource that covers 17 varieties of Arabic. “A person listening to a conversation can use it to look up a word and determine that it’s probably Palestinian and not Moroccan,” Iverson says. “It’s quite a challenge to understand real conversations, as people in our government are being asked to do.”

Iverson notes that his work at CASL falls somewhere between pure applied and pure basic research, adding “We do basic research in order to apply it to some real-world problems, and that’s exciting.” The basic, or academic, research is necessary in order to understand “just what you’re dealing with and what you then need to teach people.” Iverson points to research involving East Asian tonal languages to illustrate his point: “American professionals have a hard time reaching a reasonable level of performance, so we try to study the basics of how tone systems work, to understand their phonetics, and how their properties are encoded. Then we can better help people learn them.”

Then we can better help people learn them.”

As he makes the adjustment from the University of Wisconsin, Milwaukee, Iverson is invigorated by the intellectual stimulation of his work and colleagues at CASL. “For me the really exciting part is to learn a lot. To get to work with neuroscientists, sociologists, and anthropologists is fascinating, and I think we can do some good here.”
Researcher SPOTLIGHT

C. ANTON RYTTING

What does it mean to be human? For thousands of years philosophers and scientists have puzzled over the unique nature of humans and our species-specific ability to communicate through spoken language. These questions, while philosophically interesting, have direct and practical import in today’s world. CASL researcher C. Anton Rytting seeks to understand how humans learn language in order to help people both acquire a second language and decipher foreign language texts.

“The American public needs to be more multilingual,” says Rytting, a computational linguist. Rytting uses computer modeling of language to understand how beginning language learners (such as infants) find words in a continuous stream of sound. These techniques, it is hoped, can also be used to make predictions about who can acquire a second language and which language a person has the greatest aptitude to learn.

Two projects that Rytting is involved with investigate tonal languages, such as Chinese and Vietnamese. One project aims to uncover which speech mistakes made by nonnative speakers prevent listeners from understanding what’s being said. For example, a slight change in pitch can change the entire meaning of a word. Such subtleties make tonal languages particularly difficult for native English speakers. The other project seeks to find factors that help researchers predict who can more easily reach a given level of proficiency in a tonal language.

Rytting spends most of his research time, however, on a third project that helps users make better use of Arabic speech technology. Rytting likens the project to search engines like Google, but for Arabic: If you type in the keyword speak, a linguistically aware search engine would search for other forms of the word, such as speaks and spoke. In English text, this type of search is relatively easy; however, Arabic speech includes dozens of forms of the same word, and several possible variant pronunciations for each form, making the speech search more difficult.

“If we can develop tools to be made available to institutions, there will be a larger pool of foreign language speakers.”

—C. Anton Rytting, CASL research scientist

“If we can develop tools to be made available to institutions [government, educational, and academic], there will be a larger pool of foreign language speakers, and they can use these tools to use their foreign language expertise more effectively.” Because these projects benefit second language learners and help us better understand the process of language learning, they are both “scientifically important and have practical import,” Rytting says. He investigates “what it means to be human while helping people. Few people get to do both in one lifetime; it’s ideal.”
JARED NOVICK

As a graduate student at the University of Pennsylvania, Jared Novick was drawn to questions about the role of general cognitive functions—attention, memory, inhibition—in language processing. How do we make sense in real time of the flood of linguistic input that hits our eyes and ears so fast? How do we recover correct interpretations of sentence meaning when our first analysis is wrong? How do memory and cognitive control help achieve this?

During his postdoctorate at the Massachusetts Institute of Technology, Novick began to examine these questions using brain imaging techniques. His work has contributed to a reinterpretation of the role that Broca’s area—a region in the brain’s left hemisphere—plays in language processing. Many now believe that this area supports cognitive control—the ability to adapt behavior to current task demands especially in the face of competition or interference. This, Novick and colleagues have argued, can have widespread implications for language processing and comprehension.

At CASL, Novick builds on his previous research—in particular, the role cognitive control and working memory play in language processes. He likes CASL’s approach and how it gives him the “flexibility to take my prior research interests and my training in basic science and continue shaping them within an applied setting and toward important, practical goals.”

According to Novick, “To see hypotheses borne out that not only have contributions to the academic community but also have a concrete and practical impact realized within the intelligence community” is a rewarding part of working with CASL.

Novick’s current research at CASL aims to improve foreign language and intelligence analysis by studying the underlying processes that guide and control cognitive behavior. One project seeks to improve these functions by using EEG neurobiofeedback training to enable people to change their brainwaves and achieve a desirable neurophysiological state that may enhance cognitive performance.

For Novick, these projects have the possibility for creating intervention techniques that could improve performance for foreign language professionals or intelligence analysts—whether it is problem solving or language processing, via faster processing, greater accuracy, or more controlled attention to tasks.

Novick sees CASL’s success in part as a result of the ability to continue to build on prior research and having practical implications for the future. Further, CASL has the rarity of an academic environment where everyone is interested in the same thing—language.

“The University of Maryland Center for Advanced Study of Language (CASL) transcends boundaries to conduct academically rigorous research in foreign language that supports national security. Our research is interdisciplinary and collaborative, bringing together people from the government, academia, and the public. Our research is both strategic and tactical, so that it not only advances areas of knowledge, but also directly serves the critical needs of the nation.
Before learning about CASL through a colleague, researcher Erica Michael was considering an academic teaching job at a small liberal arts college. With a PhD in cognitive psychology from Penn State and substantial postdoctoral research experience at Carnegie Mellon, including two years at the Center for Cognitive Brain Imaging and three years as a National Research Service Award fellow, Dr. Michael believed her next step would be a traditional academic position. But she found CASL “different in every respect” from her other job options—from the amount and type of research being conducted to the applied focus of the work. Intrigued by CASL’s multidisciplinary approach and being surrounded by “so many people with similar interests,” Dr. Michael joined CASL’s research staff in 2005.

“The chances were high I’d be interested in almost every CASL project,” Dr. Michael says, noting her own multifaceted research background in developmental psychology, cognitive psychology, psycholinguistics, and cognitive neuroscience. Having started out her graduate work studying cross-linguistic differences in children’s use of gender-specific language, Dr. Michael became increasingly interested in language and cognition in adults. Her doctoral and postdoctoral work examined the cognitive aspects of bilingual language processing and second language acquisition.

At CASL Dr. Michael continues to pursue her interests in the cognitive factors involved in language tasks. One of her current CASL projects focuses on gisting—that is, summarizing in English key information from a foreign language text. The goal of the research is to help language professionals maximize the efficiency and effectiveness of their translation work. Dr. Michael’s team is also working with clients to create and evaluate a tool for assessing gists, which they hope will ultimately lead to more standardized quality control practices.

In addition, Dr. Michael is working with CASL research scientist Petra Bradley on a project investigating some of the contextual factors that affect language work, including fatigue, noise, and physical features of the workspace. Future research will examine the potential trade-offs between distraction and collaboration in an open workspace environment. Dr. Michael notes that working at CASL “offers a unique opportunity to do research that is intellectually stimulating but also goes beyond the ivory tower to have a real impact on people’s lives.”

“\textit{A common thread throughout my career has been the integration of multiple perspectives, methods, and disciplines in the study of second language processing. This integrative approach has been a real asset in the multidisciplinary research environment at CASL.}”

—Erica B. Michael, CASL research scientist
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Professor Gregory R. Hancock was named chair of the College of Education’s Department of Measurement, Statistics, and Evaluation effective July 1, 2008. The University of Maryland has one of the best psychometric programs in the world.