



Expanding our Reach and Theirs: When Linguists go to High School

Jeffrey Lidz^{†*} and Yakov Kronrod[†]
University of Maryland

Abstract

In 2007, we began an outreach program in Linguistics with psychology students in a local majority–minority high school. In the years since, the initial collaboration has grown to include other schools and nurtured a culture of community engagement in the language sciences at the University of Maryland. The program has led to a number of benefits for both the public school students and the University researchers involved. Over the years, our efforts have developed into a multi-faceted outreach program targeting primary and secondary school as well as the public more broadly. Through our outreach, we attempt to take a modest step toward increasing public awareness and appreciation of the importance of language science, toward the integration of research into the school curriculum, and giving potential first-generation college students a taste of what they are capable of. In this article, we describe in detail our motivations and goals, the details of the activities, and where we can go from here.

1. Introduction

In the fall of 2007, the University of Maryland, Department of Linguistics began a collaboration with the psychology program at a local majority–minority high school. This collaboration has since expanded to include language scientists from several departments across the university and to include an additional two high schools. This program served as a catalyst for several related outreach activities and for the cultivation of an outreach culture in the language sciences at Maryland. In this report, we describe our goals and motivations, the activities that we have conducted, and our assessment of the challenges and successes of the program.

2. Motivation and History

Our high school collaboration was motivated by two issues: the relative lack of minorities pursuing PhDs in linguistics and a general ignorance in the population at large about language structure and language science.

It has been widely observed that there is an acute under-representation of scientists from minority groups in linguistics and cognitive science. Based on our experiences at several universities, it was clear that increasing participation at the PhD level would not be an effective strategy for overcoming this under-representation. The problem lay not in the attitudes of graduate admissions committees but in a shortage of qualified minority applicants for PhD programs. Even with the most inclusive of intentions, graduate admissions committees could have little impact because the number of people from under-represented groups applying to do a PhD in linguistics is vanishingly small. As we looked at our own undergraduate majors, we saw low participation from minorities, despite being at a university with an undergraduate minority population approaching 40 percent. Increasing the diversity of people interested in studying linguistics would therefore require efforts with children in primary and secondary schools.

A related problem, also widely noted, is that the general populace seems to have no idea what linguistics is. People in the USA fear grammar almost to the same degree as they fear mathematics. This fear is fueled in part by their exposure to grammar as a patchwork of incoherent prescriptive rules that, when followed correctly, somehow leads to good writing (see Pullum 2009, or the hundreds of Language Log¹ posts under the category 'peeving'). Moreover, the idea that there could be a science of language seems not to have permeated the culture, despite the fact that linguistics is a thriving discipline steadily increasing in both descriptive and explanatory coverage (Pesetsky 2013). The possibility that insights coming from linguistics might help to demystify language structure and be brought to bear in the service of teaching good writing has also escaped consideration from mainstream American educational culture.

While obviously we could not be responsible for changing the distribution of minorities pursuing PhDs in linguistics and related disciplines, we thought that we could create a program that could shift the scales ever so slightly and to create a model that others might be able to build on. While we could not single-handedly change the world's attitudes about linguistic structure, we could present interesting ideas about language science to young people in a way that might resonate with them.

Language, we thought, could also serve as an antidote to the fractionation found in American high school education. Language could be used to help students learn physics, through the study of sound, and to learn anatomy and biology, through the study of the vocal tract and the brain. Historical linguistics could be used as a vehicle for learning about what happens when people from different cultures and languages come into contact. And through linguistic theory and psycholinguistics, language could provide a window into human psychology. In the long run, we envisioned a language curriculum that would cross-cut all traditional disciplines, from English and Social Studies to Biology and Physics. Indeed, Hudson (2007) showed how linguistics positively affected secondary school curricula in England. In related work, Mallinson, Hudley, Strickling, and Figa (2011) emphasize the value of building partnerships with educators and helping to address educational issues specific to culturally and linguistically diverse populations of students while bringing linguistics into the education system.

In 2007, the University of Maryland had an ongoing collaboration with Northwood High School in Silver Spring, MD. Northwood has a minority population of around 70%, with a large proportion of students whose parents do not have college degrees. We discussed the possibility of adding some linguistics to their AP psychology class.

The Northwood psychology teachers had three additional goals beyond injecting some linguistics into their classes. They wanted their students simply to set foot on a university campus, making the idea of college more concrete to them. They wanted them to get a taste of what it was like to sit in a university lecture hall. And, they wanted them to see that people not much older than them were involved in creating new knowledge.

In light of these interests, we created a program by which a representative from the linguistics department (initially J. Lidz, though we since have included 1 or 2 graduate students) would give a lecture at Northwood on the relation between language and psychology. The psychology classes would also take a field trip to UMD. During their field trip, they would attend a lecture, followed by a breakout session. We organized 10 topic areas, and each student could sign up for 2. These small groups are centered around a question in language science, including topics as diverse as sound structure, infant language acquisition, bilingualism, eye-tracking, machine translation, and the electrophysiology of language. Each group had a maximum of 10 students paired with 2–4 graduate students. Some groups also had undergraduate researchers assisting. The goals of the breakout sessions were to present active research areas and discoveries while also trying to explain the complex relation between data and theory in linguistics and the cognitive sciences.

3. Content Goals

Linguistics and the language sciences provide a gateway into many disciplines because language plays so central a role in human society and human psychology. Language resides at the center of what it means to be human, providing the primary vehicle through which we communicate and a clear window into the nature of human cognition. The scientific rigor required for linguistic analysis or experimentation promotes logical argumentation skills that serve students in many capacities. And the accessible nature of language provides a wedge for studying the mind, allowing us to probe the nature of learning and mental representation (Fodor 1975; Chomsky 1980), in addition to the interactions between linguistic structure and memory (Frazier and Fodor 1978; McElree, Foraker, and Dyer 2003), reasoning (Johnson-Laird 1983; Geurts 2003; Noveck 2001), mathematics (Carey 2009), and other aspects of extralinguistic cognition (Landau 2000; Perner et al. 2003; Gleitman and Papafragou 2005). Exposure to linguistics can help to dispel common language myths that permeate our society (Napoli and Lee-Schoenfeld 2010) and can help to remove bigotry in the form of social, legal, and educational discrimination against people who speak a non-mainstream language or dialect (Labov 1982; Wolfram 1993; Baugh 2007; Charity 2008; Charity et al. 2008). Others have tried to bring this focus to secondary school students in the past. For example, Stewart and Cárdenes (2010) describe a course that uses Lippi-Green (1997) to dispel language myths through exposure to language science.

3.1. LANGUAGE IN PSYCHOLOGY

A primary goal of our program, because it was to be tailored for psychology students, was to use language to illuminate human psychology. Human language provides a model system for studying the complex character of mental representations because it is so easy to observe the outputs of the system. In contrast to visual percepts, mathematical representations or emotional content, sounds, words, and sentences are easy to come by. Consequently, a large portion of the data we use to construct theories of linguistic cognition is readily accessible. Several topic areas readily presented themselves and were straightforward to integrate with the AP Psychology curriculum.

AP Psychology classes do not have individual specific state standards or official curricula to follow and instead use the College Board course descriptions² to guide content. In addition to the College Board, the American Psychological Association (APA) also publishes standards for the teaching of psychology³ that provide additional guidance for teachers. For this reason, it was easy to introduce our program without worrying about fulfilling specific state requirements. However, our activities did fit with many APA recommendations, particularly with units on the biological basis of behavior, cognition, and developmental psychology.

Perhaps the most basic observation in linguistics is that we can produce and understand novel sentences freely. Nonetheless, not every novel combination of words is a grammatical sentence, and it is straightforward to separate notions of meaningfulness from notions of grammaticality (Chomsky 1957). These basic observations open several domains of psychological inquiry. What are the mental structures that underlie language productivity? How does a child, exposed only to sentences, acquire a system capable of representing an infinite set of sentences? Through what mechanisms is knowledge of language deployed in real-time understanding and production? What role does memory play in rapid sentence understanding? Do listeners build linguistic structure prior to encountering unambiguous evidence for it? How is grammatical knowledge represented in the brain? How can we characterize language disorders, and are they independent of other cognitive disorders? What similarities in structure can be found across

diverse languages? How do people learn multiple languages at the same time? Does bilingualism slow down language acquisition and does it confer any cognitive advantages? Do differences in linguistic structure correlate with differences in corresponding cognitive domains? Why do humans understand language so effortlessly when state of the art speech recognition systems stumble over the simplest questions? How are signed languages like and unlike spoken languages?

Questions like these formed the basis for our working groups. Graduate students were charged with finding ways to engage these questions in a way that would be both fun and informative. We encouraged group leaders to find demonstrations that involved experimental techniques and to center the discussion around data collection and how that data can lead to answers for the questions above. And, as much as possible, we encouraged group leaders to use insights from their own research in developing their materials.

3.2. ON DATA

A second content goal of our program was to emphasize the inherent difficulty of accurately measuring the contents of the mind, using language as an example. Appreciating this difficulty is valuable for helping students to understand and evaluate scientific theories of language and cognition. Moreover, it provides a stepping stone to becoming effective interpreters of data in the public sphere, whether that data are about school performance, nutrition, political attitudes, or subatomic particles. The complexity inherent in drawing inferences from patterns of behavior or brain signals to the systems responsible for generating those patterns highlights this complexity in all kinds of data analysis. Awareness of this issue may ultimately lead to a healthy skepticism in evaluating claims made in the news and to the development of a generally inquisitive scientific mindset.

The distributional analyses that form the methodological basis for traditional linguistics make the scientific method transparent (Honda and O'Neil 1993). Once students shake off their notions of prescriptive grammar, they become ready participants in the development of hypotheses and generating data to test those hypotheses. And because the data can be generated so quickly, the entire process can be repeated live, giving a clear sense of how satisfying and effective science can be. One group had students develop a theory of expletive-infixation in English, capitalizing on student interest in parts of language that are not discussed in school. Emphasizing that the scientific method applies even to things as mundane as words and sentences opens students to the idea that many aspects of the world can be investigated in this fashion.

A unique aspect of our environment at Maryland, however, is that our language scientists bring more than the traditional arsenal of tools to bear on the study of linguistic structure, its acquisition, and use. Consequently, we developed groups that highlight the diversity of data types that bear on the questions outlined above. One group examined what infants and children know about syntax prior to being able to produce full sentences. While for adults and even older children, we can ask questions about grammaticality, meaning, or inference, infants are limited in their capacity to make their understanding explicit and even in their capacity to answer questions or carry out commands. But, starting within the first few months of life, infants develop the ability to control their eye-movements to direct their attention. This capacity provides a potential tool for investigating language understanding, when utilized in an experimental context. From this jumping off point, the students saw demonstrations of how we develop techniques to use eye-movements as an indicator of understanding; how the experiments are designed, how the data are collected, and how it is analyzed. When they see the full complexity involved in moving from a question about children's syntactic representations to a data point like '19-month-olds looked longer at this image than that

one', students come to appreciate the ingenuity that goes into setting up an experiment and the wide range of pitfalls in drawing inferences from patterns of behavior to knowledge.

It has been effective to create pairs of sessions that are related thematically as a way of focusing student interest and highlight issues surrounding the interpretation of data. For example, pairing the 'Baby Talk' session just described with our syntax session, 'Knowledge of Language: Figuring out what you already know', allows us to explore different avenues into the same type of knowledge. In the syntax group, students first think about whether they learned their language in school, whether their linguistic knowledge is a form of memory, and whether the rules of prescriptive grammar govern their speech. To prepare for the syntax group, rather than providing a reading, we ask students to make some acceptability judgments of a series of sentences and to tell us about their language pet peeves. This simple assignment primes them to think about the descriptive adequacy of prescriptive rules and about the implicit nature of linguistic knowledge. Having explored these issues, students move to the Baby Talk group to think about how learners come to have knowledge of linguistic structure and how we can get evidence for it. To prepare for this session, we ask students to identify the behavioral repertoire of infants younger than 2 years, asking them to watch YouTube videos of children eating, climbing stairs, and talking. The notion of implicit knowledge and the tools we use to uncover this knowledge provides a unifying framework across the sessions.

Similar issues about the distance between data and theory were highlighted in groups focusing on electrophysiological measures in syntactic processing, magnetoencephalography as a probe into phonological representation and processing, eye-tracking with adults to make inferences about the moment-by-moment computations involved in reading comprehension, and myriad other behavioral measures. While students were initially excited by the technology used to collect data, they ultimately came to appreciate more about the relation between the graphical images of data in their textbooks (such as fMRI studies showing certain areas of the brain 'lighting up') and the analytic tools required to interpret these images.

An effective pairing for the thinking about language and the brain puts our electrophysiology session together with a group called 'Name that vegetable!' This group focuses on data from two patients with brain injuries that, when combined, display a double dissociation of linguistic capacity. One patient exhibits a difficulty naming animals and vegetables while retaining the ability to name other objects such as clothes and furniture. The other patient can name animals but lost the ability to name inanimate objects. This setup allows for a discussion of cognitive organization and processing and shows us how we can learn about normal language processing by studying aphasias. This session sets up a discussion of the methods beyond behavioral observation that yield insight into language and the brain. We then move the students to our electrophysiology labs. Here, students learn about EEG and MEG as measurement techniques. We show people in an EEG cap, put somebody in the MEG scanner, and directly observe the brainwaves being measured while talking about how the equipment works and what it can tell us about the neurophysiological activity of the brain. Seeing the equipment engages the students and puts them in good position to discuss complex phenomena like semantic N400s, mismatch effects in perception, and syntactic P600s. When designing the preparation materials for these sessions, we have found that it is important to avoid low-level technical issues or deep theoretical questions. Students open up to the session more easily when reading a story of a person with an unusual brain condition and are then better prepared to think about the science and methods that allow us to move beyond simple behavioral observations.

Because a large proportion of our participants come from families where English is not the primary language, groups examining bilingualism have been especially popular. Here again, we take the inherent interest of the students and use it to emphasize scientific questions. One group, for example, examined the categorization abilities of monolingual and bilingual speakers

of English and Korean, exploring some of the issues associated with heritage language learners raised in Lee-Ellis (2012). Here, students were able to witness differences in phonological categorization, by seeing that most of them were unable to distinguish certain sounds that are phonemically distinct in Korean but not English, but that the 1 or 2 Korean–English bilinguals among them had no trouble. This enabled them to better understand how we test for categorization and to understand differences between auditory and linguistic processing. We have similarly been able to capitalize on student interest in bilingualism in groups examining executive function, working memory, and the bilingual advantage (Bialystok, Craik, and Luk 2012).

By viewing problems through the inherent interest of the students in technology, the brain, or specific populations like infants, bilinguals, or deaf-signers, we have been able to channel their curiosity toward the investigation of significant issues in linguistics, cognitive science, and science more generally.

4. Evolution of the Program

In the first year of this program, the campus visit had three components: a 60-minute lecture by linguistics faculty members, the working groups and a visit to the student union food court for lunch. For the first hour, half of the students attended the lecture while the other half went to 2 working groups of 30-minutes each. For the second hour, they switched. In this initial year, we overestimated high school students' willingness to sit in a lecture hall. While the teachers had asked us to provide this experience, our first attempt was to give an hour-long lecture and did little to connect the content of the lecture with the content of the working groups. In addition, we had not gained a clear enough sense of what they had already learned about language and the mind in their class and so did not effectively connect the visit to the course content. Many of the students reported being bored in the lecture and found it to be redundant with what they had already learned in class and from our earlier visit to their school.

In the second year, the lecture was cut to 20 minutes and focused on setting up the problem of measurement in psychology and linguistics. This gave students the experience of hearing a lecture in a university lecture hall but with an emphasis on aspects of psychology and linguistics that they would not have been exposed to in their class. The lecture set up a general theme that was shared across the working groups, where the students got to interact with both professors and graduate students. The students still went to lunch at the student union, which remains the highlight of the trip for many.

In subsequent years, the program has evolved in its offerings as we have cultivated an interconnected interdisciplinary language science community at the University of Maryland. Our efforts in building this community were institutionalized when we were awarded an Interdisciplinary Graduate Education, Research, and Training (IGERT) grant from the National Science Foundation (NSF) in 2008. The Northwood High School outreach program has been part of this program from its inception, and as our interdisciplinary community has grown to include students and faculty from 12 departments and programs from 5 different colleges on campus, in addition to collaborators at Gallaudet University, so too has the range of topics and expertise in our outreach efforts. The graduate students who participate now come from Biology, Computer Science, Education, Electrical Engineering, Human-Computer Interaction, Human Development, Linguistics, Philosophy, Psychology, and Second Language Acquisition. This diversity allows for a more varied menu of working groups.

Once the program was stable, we expanded it so that more students could benefit from the experience of visiting the University and engaging with researchers. One part of the expansion was to another area high school. We now reach twice as many students, bringing over 200 students to campus annually.

The other expansion of our High School outreach was to an area math–science Magnet High School (Montgomery–Blair High School). Our goal of providing a ‘college experience’ for a majority–minority population was inappropriate for this population. These students are on a fast track to college, some already with research internship experience. This group had formed their own linguistics club in 2011 and contacted us to help them to gain a better handle on what they were trying to learn on their own. To accomplish this goal, we had individual researchers visit their linguistics club every other week after school to talk about problems in linguistics and language science. These discussions have ranged from psycholinguistics and real-time sentence processing to the philosophy of language and semantic composition. We have also developed a campus visit with this group, capitalizing on what we had learned from our previous years of outreach.

5. *Benefits to High School Students*

There are many benefits that high school students gain by participating in these activities. Our program provides general exposure to and promotes appreciation of what it means to be a college student. The students experience the diversity of people involved in research, see the physical layout of the campus, and get their first taste of academic discourse. Many students appreciate that some of the people conducting original research on campus are not much older than they are. Consequently, they may more readily see a path from high school into a life of research and inquiry. In addition, our program provides direct access to scientific findings in the area of language science that both fulfills the students’ curiosity and gives them an idea of how research on very small problems relates to bigger questions.

According to Jon D’Souza (personal communication), a teacher at Northwood High School: ‘Participating in the home–away field trip to UMD extends the students’ learning by connecting what we are doing in the classroom to authentic experiences outside our school walls’. These same interactions allow our researchers to step outside of our walls as well, as we discuss below. D’Souza further adds that

The partnership between UMD and Northwood is a valuable experience for our students. Not only does it provide students with hands on activities, but it exposes students to the college atmosphere and gets many students hooked on Psych. (Jon D’Souza, Personal Communication, 2013)

Carlos Montalvan, the teacher who helped launch this outreach collaboration and also helped us expand into the new school upon his transfer there, listed three benefits for his students. First, he notes that students may be inspired to look for research opportunities when they get to college. He says

taking students to visit the research laboratories... is a unique opportunity for students to see research in action. Students see how graduate students use eye-tracking devices and brain imaging techniques to study cognition. It is my hope that students are inspired to major in psychology and consider becoming undergraduate research assistants. (Carlos Montalvan, Personal Communication, 2013)

Along the same lines, he notes that ‘some students get to visit the school they will attend, but all students leave with an appreciation for what they want to look for in a college’.

Second, he notes that the class lecture provides a context for the field of psycholinguistics, helping students to see the relevance of language science. He says, ‘in particular, students enjoy learning about KoKo the gorilla and the fact that jargon [sic] used by adolescents is of interest to linguists too’.

Third, he notes that the interdisciplinary nature of language science crosscuts several areas of the AP Psychology curriculum, allowing students to build connections linking various aspects of the study of mind together:

In addition to illustrating research methods, students see research in units of study that we have covered, from biological basis of behavior, cognition, learning, and their relevance to language acquisition and animal cognition. (Carlos Montalvan, Personal Communication, 2013)

This sentiment echoes the past work on incorporating linguistic knowledge directly into the secondary education curriculum in Australia (Mulder 2007, 2011) and elsewhere (Denham 2007).

Each year, we collect direct feedback, in the form of surveys, from students who participate. Students perceive two main benefits of our program. First, students regularly report that they had previously been unaware of linguistics and language science, and the connection between language and psychology, and report being very interested in this content. Second, they report gaining an awareness of the university research community, an introduction to institutions of higher education, and a chance to feel like a peer with a scientist. For many students from the public schools we interact with, our program provides their first visit to a college campus. Many do not come from families where going to college is an expectation. By engaging in these activities, many students felt opened to the possibility of applying to a big state university and pursuing a serious college education. For other students, particularly at the Magnet School, going to college is presupposed. Hence, informal interactions with researchers were reported to be eye-opening for many of the visiting students, many of them finding these interactions to be of more interest and benefit than the topic-based discussion groups. One student commented that

One of the best parts was during lunch, when several professors and graduate students visited. Since we're in high school, it was nice that we could talk about college and things to consider about the universities we apply to. (High School Student feedback, 2013)

For these students, access to current science and ongoing research provides a valuable preview of what may lie ahead. They wanted to go even deeper into the material, suggesting that we should 'extend the time for each activity...extending the lectures to 45 minutes would have...made a lot of the lectures more informative'.

5.1. FEEDBACK FROM HIGH SCHOOL STUDENTS

The individual comments from the AP Psychology students were instructive for assessing parts of the program that work and those that need improvement. First, we considered their view of the opening lecture. With the shortened version of the lecture at their visit to UMD, students reported that the lecture was too brief and did not cover enough novel ground, commenting that it was 'repetitive', 'just scratched the surface, not detailed enough', and 'could be more interactive'. This was reflected in their quantitative responses of 3.8 out of 5 and 3.3 out of 5 when asked whether they learned something new from the lecture and were excited by the lecture, respectively. At the same time, many reported that it was 'fun and informative, knowledgeable and interesting', that the presentation style was 'funny and down to earth', and that the lecturer was 'relatable and funny' and 'broke down the concepts he was trying to explain'. This was reflected by their average response of 4.3 out of 5 when asked whether the lecture was easy to follow along with and understand. Several students commented on the experience itself, stating that they liked 'getting to see like what it would be like in the future when [they] go to lectures in college'.

We got more in-depth responses when it came to the specific small discussion groups that the students attended. Some commented on the way the sessions were run, telling us that ‘the small groups were nice because you could interact more’ and ‘I like how they asked questions about the topic and how they made the activities interactive’. Overall, the students ranked their sessions 4 out of 5 in accessibility. Others commented on the material presented, telling us that they ‘liked learning about things that most people never take the time to think about’ and that the ‘the lectures were very informative and conducive to what we were learning about in AP Psychology’. Students ranked how informative the sessions were an average of 3.7 out of 5. Others told us about their overall impressions of the whole experience. One student told us that

it was a very interesting experience. It gave me an overall feel of what it’s like to be a college student, having work on campus, and sitting in the lecture hall.

Some were both more impressed and left wanting more, saying ‘I was left in awe from both the labs and campus social life. I only wish I had more time to visit other areas of the psychology buildings’.

We also got feedback on things we could improve on. Students were eager for an experience that gave them access to novel material that was professionally presented, and these expectations were not always met. One student felt that

half of the material they discussed with us was stuff we already knew from class, and the rest they had to dumb down because they were grad students and we’re high schoolers.

This type of response led to a lower rating of how excited the students were by the material, averaging 3.5 out of 5. Another student commented that ‘the students who taught us know what they’re teaching, but did not know how to teach’. We welcome such feedback, as one of the aims of our interdisciplinary program is to train researchers to present their research to a broad array of audiences. Indeed, graduate students report that communication skills represent a major benefit from participating in outreach.

5.2. BENEFIT TO LANGUAGE SCIENTISTS

Outreach activities benefit not only the field but also promote the idea of a public university. They help the public and the key players in our communities see the relevance and importance of our work. Closer to home, this outreach highlights to local administrators the breadth and impact of our work (Fitzgerald 2010). Outreach activities also provide specific training benefits to graduate students who participate.

Graduate students have vast demands on their time, ranging from coursework and teaching, to research and writing. Adding outreach to the mix provides at least five specific benefits that make the extra time commitment worthwhile. First, outreach activities force students to frame their work in a way that resonates with the interests of people who are not deeply connected to a body of theoretical literature, helping them maintain a clear vision of why their work is both important and relevant.

Second, outreach activities help graduate students develop communication skills by forcing them to engage a broad, diverse audience lacking the theoretical background that motivates their research. Many graduate students discover by failing to engage the high school students on their first attempt just how hard it can be to communicate subtle ideas in an engaging way. This initial failure often translates into improved communication not only with the high school students but also within the field and in adjacent disciplines.

Third, because many of our working groups involved students from different disciplines working together, students come to appreciate the challenges of cross-disciplinary communication. By preparing working groups with people who may not share all of their assumptions, students are forced to find the right grain size at which to present their ideas. The cross-disciplinary communication involved in preparing for this event may be as challenging as working with the high school students, and many of our graduate students report that building their cross-disciplinary communication skills is a direct benefit of participating in this program.

Fourth, engaging with high school students forces graduate students to find or create accessible and engaging materials that provide a hook into their research questions. Sometimes, these materials may come in the form of scientific videos, for example, in the case of discussing language disorders and deficits. Sometimes a simple YouTube video can be enlightening, for example, when seeing what an infant can and cannot do behaviorally, as preparation for thinking about how to explore infants' knowledge of language. Sometimes video games that engage certain psychological mechanisms are useful in exploring how language connects with extralinguistic cognition. Scenes from movies or TV shows can often open discussion into subtle issues, for example, in thinking about the similarities and differences between Siri, the Terminator and Commander Data as a jumping off point into computational linguistics.

Finally, participating in outreach promotes a sense of civic engagement, preparing students for a career that bridges academic research and real world problems. As American culture seems to grow increasingly skeptical of the necessity of basic science and its role in informing policy, preparing graduate students with the tools to both justify themselves and to engage the public becomes critical.

We collected feedback on the benefits of the outreach program from 18 graduate students and 7 professors. First, we wanted to get an idea of general satisfaction with the outreach program. When asked 'How happy are you with existing outreach activities', students who had been involved with at least one outreach event averaged 4.15 out of 5 on a scale of general satisfaction. When asked 'Do you find the time to benefit ratio for doing outreach is good?', the same students averaged 3.85 out of 5. Clearly, graduate students do not view these activities as a burden.

We then asked about specific benefits that are derived from these activities. Most reported that the biggest benefit was learning how to present their research to an audience outside their area of specialty. A typical response was

getting a chance to communicate details of my own research and the field as a whole to such a new audience really made me think about how to communicate about what we do. (Graduate Student Feedback, 2013)

Students found that participating in these events helped them develop 'the ability to convey complex topics to lay audiences and generate interest in scientific research'. This idea of making research interesting surfaced repeatedly, and another student reported learning 'how to communicate my work to a broad audience and how to address the challenge of making my work relevant and interesting to the non-scientific community'.

Benefits in communicating, in turn, led many to a better understanding of their own research and its relationship to science more broadly and to the community. We were told that 'these visits helped me organize my thoughts about my research, and to figure out how to discuss the topics that I care about in an approachable and relatable way'. The outreach was not just about high school students learning about language science but gave us an opportunity to develop our own understanding. One student mentioned that 'since teaching is the best way of learning, I also benefited from developing a better foundational understanding of the issues myself'.

Some responders considered the broader implications of language science outreach and what it means for the future of our field. One response particularly captured this sentiment:

Linguistics is a subject that doesn't have a lot of pull in general public perception and which is generally not taught until after high school (Philosophy has similar problems). So even though students do a lot of language study before college, they don't connect that activity with Linguistics. So showing them that connection before they've finalized their college choices is important if we want to expand beyond the traditional sources of Linguistics students and to function as a viable alternative to STEM majors. (Language Science Researcher at UMD, 2013)

In the end, it turned out to be a challenge but not as difficult as some thought going into it. One student reported that

In fact, this turned out to be easier than I had anticipated. I found that, when the issues are laid out in a clear and engaging fashion, students without a background in the literature can get excited about and develop insights into the material. (Graduate Student feedback, 2013)

And there were other benefits, including seeing what questions arise for non-experts, and even finding future collaborators. One researcher said:

It was energizing to talk with the MBHS linguistics group. I always find it interesting to talk with non-specialist audiences, and to see how their questions differ from those of specialists. It also increased my faith in the intellectual curiosity of teenagers. Another benefit was that the visit helped me to find a summer intern for our research group, who went on to do very good work with us. (Language Science Researcher, 2013)

Many people also found personal satisfaction in contributing a little bit to others' educations. One researcher summarized the sentiment nicely: 'most of all, though, I just relish the opportunity to give back and educate a batch of eager young learners about problems that I think really matter!'

6. *Broader Outreach Efforts in Language Science at UMD*

Developing the basic framework for engaging the community and emphasizing it as an important aspect of our interdisciplinary language science program has allowed us to expand our program opportunistically. Some opportunities came to us from the community itself, and some came from our joining existing programs; but, their success came from the culture of community mindedness established through our IGERT program. Here, we highlight some other outreach activities we have integrated into our program.

We have recently begun partnering with a local high school (85% minority), Eleanor Roosevelt High School (ERHS), to bring students in a competitive science and technology internship program into UMD language science labs. The program is organized by ERHS, which places approximately 200 high school seniors into labs at local universities and research agencies. In the past, these students had been placed into labs essentially by word of mouth. Recently, we have begun coordinating intern placement into language science labs through a centralized web resource for faculty to locate candidate interns. Students in this program gain research experience in a field they know little about before entering college. Faculty mentors gain talented and committed research assistants. One ERHS Language Science intern won a blue ribbon in the behavioral sciences category in a regional science fair. Some students continued to work in their internship labs as undergraduates. In our first year of coordinated efforts, we were able to place 7 students in UMD language science labs.

We have also developed partnerships with area middle and elementary schools. In one program, we have partnered with the Philosophy Outreach Group to include more language scientists in meetings with a middle school philosophy club. This program sends scholars to meet with a group of gifted students for a weekly discussion on topics ranging from morality to philosophy of language. Several biweekly Friday lectures have also been developed and include such topics as 'Language' and 'The Brain'. These lectures provide material that middle schoolers otherwise would not have access to, while giving the visiting researchers a chance to engage a novel audience. We have also been involved in various capacities with elementary schools in the area. Language scientists have worked as science fair judges at two area schools from 2010 to 2013, covering 3rd through 5th grade. Additionally, we sent representatives to participate in an elementary school career day to talk about careers as scientists. At this level, we cannot present detailed research, but we bring a unique perspective usually missing from science fairs, ensuring that Language Science is presented alongside other STEM fields.

Outside of a school setting, we recently participated in a large regional STEM fair as one of only two behavioral science groups and the only one centered on language science. We interacted with both children and their families, engaging them in fun activities while discussing language science and how it relates to both personal and career development.

We have also added a large community-facing outreach event. Our Language Science community has participated in the flagship community involvement day at the University of Maryland called 'Maryland Day'. Between 75,000 and 100,000 people (depending on weather) come to campus to learn about the research and scholarship that their tax dollars are funding. For our part, we have engaged hundreds of people at our family friendly event with 13 diverse educational activities and lab tours. These events give us a chance to educate the broader public about the relevance of language science.

These outreach activities give us a broad base of events to bring scientists and community members together, striving to increase awareness and improve our own communication skills. And through these programs, we are able to carry through on the linguist's responsibility for community engagement (Hale 1965; Wilkins 1992; Hale et al. 1992; Wolfram 1993; Rice 2006; Fitzgerald 2007). The 'principle of debt incurred' (Wolfram 1993) and the 'principle of linguistic gratuity' (Labov 1982) both state that language information must be made available to the public in order to benefit society and particularly populations of sociolinguistic importance. Many scholars have also noted the need to educate the greater public about topics such as language ideologies and the negative consequences of common misconceptions about proper language and misunderstandings of natural language variation (Lippi-Green 1997; Fairclough 2001). Of course, we are not the first to put this philosophy into practice. While there are many antecedents to our outreach efforts (Reaser and Adger 2007; Eyster et al. 2001, *inter alia*), and even other university linguistics outreach programs such as Concordia University's CLOUT program, we hope that our activities can provide a novel model for community engagement in the language sciences.

7. *Lessons Learned*

We have learned quite a bit about what makes for a successful outreach program. We share three lessons here that we think are critical and will apply to a wide variety of outreach activities across the language sciences and beyond.

First, developing an effective outreach program requires connecting with people who are already involved in the community rather than trying to impose new structures or to reinvent existing ones. We have partnered with psychology teachers, school administrators, counselors, self-run student groups, and University officials. These partnerships help to integrate our work

with the needs of community stakeholders and with existing organizational structures. In schools, it is important to have a champion for the activities, as this ensures continuity through the years and also that simple tasks such as getting a school bus or distributing pre-reading assignments get completed on time.

Second, developing an outreach program requires understanding not just your own goals but also the goals of those you hope to serve. Outreach programs should be developed *with* your planned constituencies rather than *for* them. Finding the right level at which to talk about basic and applied science requires understanding both what your constituency already knows, what they hope to learn, and what access your program can add. What the students want out of the interaction may be different from what you at first imagine. When we first conceived our outreach program, it did not occur to us that sitting in a university lecture hall would be a useful goal, and yet, this was one of the top priorities of our high school collaborators. Learning to ask has proven useful in collaborating with administrators, high school teachers, and secondary school students, allowing all parties to have a more meaningful experience.

Third, the benefits of an outreach program are as much internal as they are external. An outreach program is most likely to be successful if you are as open to learning from it as you are to providing opportunities. Specifying what you hope members of your team will learn and the skills they will gain ensures that learning flows both from you to the people you hope to reach and back. In addition, being clear about the benefits of participating in outreach helps those who are not yet committed to see why it is useful to do so.

8. Next Steps

It is hard to quantify whether we have had any impact on the future of the high school students we worked with and harder yet to tell whether we will have any impact on the diversity of students studying linguistics. Nonetheless, we believe these activities have been worthwhile and can provide a model for others to build their own programs. We have exposed a broader population to the scientific study of language, and we have done so in a way that provides specific training benefits to graduate students.

In the future, we hope to expand these training benefits to undergraduate students. Many language science laboratories on campus, including those working in psycholinguistics, first and second language acquisition, education, biology, and computer science, provide research opportunities for undergraduate students. In these laboratories, undergraduates get their first hands-on exposure to basic and applied research activities. We believe that expanding this undergraduate training to include participation in outreach activities will both improve the undergraduate experience and also improve our outreach efforts. Outside of the research labs, this experience can be combined directly with their coursework. Fitzgerald (2010) showed how incorporating service oriented learning in undergraduate classes enhanced the students' education experience. Bringle and Hatcher (1995) also discussed how to integrate a service-learning pedagogy into university coursework, highlighting the importance of having students engage with the community to see how what they are learning can be of use to society. As we noted above, our program makes the path from high school into a life of research real.

In addition, we hope to make some of the materials we use publicly available for several reasons. By codifying our method and the contents of our workgroup modules, it will be easier for us to expand our program to more schools while only adding a small amount of work for the faculty and graduate students who participate. Second, by making this information publicly available, we hope to encourage others to either use it directly or as a model for developing their own programs.

Acknowledgements

We would like to thank the members of the University of Maryland Language Science community for their support during the development of these efforts, especially Colin Phillips and Norbert Hornstein. We would also like to thank the dedicated teachers from Northwood and Paint Branch High Schools, Carlos Montalvan, Asewe Onyango, and Jon D'Souza for the contribution of their time and students. Thanks also to Daniela Ganelin and Alan Du, the leaders of the Montgomery–Blair linguistics club. This work was supported in part by NSF grant IGERT-DGE-0801465.

Notes

* Correspondence address: Jeffrey Lidz, Department of Linguistics, University of Maryland, 1401 Marie Mount Hall, College Park, MD 20742, USA. E-mail: jlidz@umd.edu

† Joint first authors. Both authors contributed equally to the work reported here.

¹ <http://languagelog.ldc.upenn.edu>

² <http://apcentral.collegeboard.com/apc/public/repository/ap-psychology-course-description.pdf>

³ <http://www.apa.org/monitor/2012/01/school-psychology.aspx>

Works Cited

- Baugh, John. 2007. Linguistic contributions to the advancement of racial justice within and beyond the African Diaspora. *Language and Linguistics Compass* 1(4) 331–4.
- Bialystok, Ellen, Fergus I. M. Craik, and Gigi Luk. 2012. Bilingualism: consequences for mind and brain. *Trends in Cognitive Sciences* 16. 240–50.
- Bingle, R. G., and J. A. Hatcher. 1995. A service-learning curriculum for faculty. *Michigan Journal of Community Service Learning* 2. 112–22.
- Carey, S. 2009. Where our number concepts come from. *Journal of Philosophy* 106(4) 220–54.
- Charity, Anne H. 2008. Linguists as agents for social change. *Language and Linguistics Compass* 2(5) 923–39.
- Charity, Anne H., Jeree Harris, Joe Hayes, Katie Ikeler, and Andrew Squires. 2008. Service learning as an introduction to sociolinguistics and linguistic equality. *American Speech* 83(2) 237–51.
- Chomsky, Noam. 1957. *Syntactic structures*. The Hague: Mouton.
- . 1980. Rules and representations. New York: Columbia University Press.
- Denham, Kristin. 2007. Linguistics in a primary school. *Language and Linguistics Compass* 1(4) 243–59.
- Eyler, Janet, Dwight E. Giles, Jr., Christine M. Stenson, and Charlene J. Gray. 2001. *At a glance: what we know about the effects of service-learning on college students, faculty, institutions and communities, 1993–2000*, 3rd edition. Vanderbilt University: Learn and Serve America National Service Learning Clearinghouse. Nashville, TN.
- Fairclough, Norman. 2001. *Language and power*, 2nd edition. Harlow: Pearson Education.
- Fitzgerald, Colleen M. 2007. Indigenous languages and Spanish in the U.S.: how can/do linguists serve communities? *Southwest Journal of Linguistics* 26(1) 1–14.
- . 2010. Developing a service-learning curriculum for linguistics. *Language and Linguistics Compass* 4(4) 204–18.
- Fodor, Jerry A. 1975. *The language of thought*. Cambridge, Massachusetts: Harvard University Press.
- Frazier, Lynn, and Janet D. Fodor. 1978. The sausage machine: a new two-stage parsing model. *Cognition* 6. 291–325.
- Geurts, Bart. 2003. Reasoning with quantifiers. *Cognition* 86. 223–51.
- Gleitman, Lila R., and Anna Papafragou. 2005. Language and thought. *Cambridge handbook of thinking and reasoning*, ed. by R. Morrison and K. Holyoak. NY: Cambridge University Press. Cambridge.
- Hale, Kenneth. 1965. On the use of informants in field-work. *Canadian Journal of Linguistics* 10(2–3) 108–19.
- Hale, Kenneth, Colette Craig, Nora England, Laverne Masayeva Jeanne, Michael Krauss, Lucille Watahomigie, and Akira Yamamoto. 1992. Endangered languages. *Language* 68(1) 1–42.
- Honda, Maya, and Wayne O'Neil. 1993. Triggering science-forming capacity through linguistic inquiry. *The view from building 20*, ed. by K. Hale and S. J. Keyser, 229–56. Cambridge: The MIT Press.
- Hudson, Richard A. 2007. How linguistics has influenced schools in England. *Language and Linguistics Compass* 1(4) 227–42.
- Johnson-Laird, Philip N. 1983. *Mental models: towards a cognitive science of language, inference, and consciousness*. Cambridge, MA: Harvard University Press.

- Labov, William. 1982. Objectivity and commitment in linguistic science: the case of the Black English trial in Ann Arbor. *Language in Society* 11. 165–201.
- Landau, Barbara. 2000. Language and space. *Perception, cognition, and language: essays in honor of Henry and Lila Gleitman*, ed. by B. Landau, J. Sabini, J. Jonides and E. Newport. Cambridge, Mass: MIT Press.
- Lee-Ellis, Sunyoung. 2012. Looking into Bilingualism through the heritage speaker's mind. PhD Dissertation. University of Maryland.
- Lippi-Green, Rosina. 1997. *English with an accent: language, ideology, and discrimination in the United States*. London and New York: Routledge.
- Mallinson, Christine, Anne H. Charity Hudley, Laura Strickling, and Morgan Figa. 2011. A conceptual framework for promoting linguistic and educational change. *Language and Linguistics Compass, Education and Pedagogy* 5. 441–53.
- McElree, Brian, Stephani Foraker, and Lisbeth Dyer. 2003. Memory structures that subserve sentence comprehension. *Journal of Memory and Language* 48. 67–91.
- Mulder, Jean. 2007. Establishing linguistics in secondary education in Victoria, Australia. *Language and Linguistics Compass* 1. 133–54.
- . 2011. Grammar in English curricula: why should linguists care? *Language and Linguistics Compass* 5. 835–47.
- Napoli, Dona Jo, and Vera Lee-Schoenfeld. 2010. *Language matters: a guide to everyday questions about language*, 2nd edition. New York: Oxford University Press.
- Noveck, Ira A. 2001. When children are more logical than adults: experimental investigations of scalar implicature. *Cognition* 78(2) 165–88.
- Perner, J., M. Sprung, P. Zauner, and H. Haider. 2003. Want—that is understood well before think—that, say—that, and false belief: a test of de Villiers' linguistic determinism on German speaking children. *Child Development* 74. 179–88.
- Pesetsky, David. 2013. Что дѣлать? What is to be done? Plenary talk. Linguistics Society of America annual meeting, January 4, 2013.
- Pullum, Geoffrey K. 2009. 50 years of stupid grammar advice. *The Chronicle of Higher Education* 55(32) April 17, 2009. Chronicle Review section, B15.
- Reaser, Jeffrey, and Carolyn Adger. 2007. Developing language awareness materials for nonlinguists: lessons learned from the 'Do You Speak American?' curriculum development project. *Language and Linguistics Compass* 1(3) 155–67.
- Rice, Keren. 2006. Ethical issues in linguistic fieldwork: an overview. *Journal of Academic Ethics* 4(1) 123–55.
- Stewart, Thomas W., Jr., and Alma B. Kuhlemann Cárdenes. 2010. Discovering 'Language Myths and Truths': a summer enrichment course in linguistics for high-school students. *Language and Linguistics Compass* 4(2) 80–95.
- Wilkins, David P. 1992. Linguistic research under Aboriginal control: a personal account of fieldwork in central Australia. *Australian Journal of Linguistics* 12. 171–200.
- Wolfram, Walt. 1993. Ethical considerations in language awareness programs. *Issues in Applied Linguistics* 4. 225–55.