

1                   **Expanding our reach and theirs: When linguists go to high school**

2

3   **Abstract:**

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5   In 2007, we began an outreach program in Linguistics with Psychology students in a local

6   majority-minority high school. In the years since, the initial collaboration has grown to include

7   other schools and nurtured a culture of community engagement in the language sciences at the

8   University of Maryland. The program has lead to a number of benefits for both the public school

9   students and the University researchers involved. Over the years our efforts have developed

10   into a multi-faceted outreach program targeting primary and secondary school as well as the

11   public more broadly. Through our outreach we attempt to take a modest step toward increasing

12   public awareness and appreciation of the importance of language science, toward the

13   integration of research into the school curriculum, and giving potential first-generation college

14   students a taste of what they are capable of. In this article we describe in detail our motivation

15   and goals, the details of the activities, and where we can go from here.

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19   *1. Introduction*

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21   In the fall of 2007, the University of Maryland Department of Linguistics began a collaboration

22   with the psychology program at a local majority-minority high school. This collaboration has

23   since expanded to include language-scientists from several departments across the university

24   and to include an additional two high schools. This program served as a catalyst for several

25   related outreach activities and for the cultivation of an outreach culture in the language sciences

26 at Maryland. In this report, we describe our goals and motivations, the activities that we have  
27 conducted, and our assessment of the challenges and successes of the program.

28

## 29 *2. Motivation & History*

30

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

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

45 A related problem, also widely noted, is that the general populace seems to have no  
46 idea what linguistics is. People in the US fear grammar almost to the same degree as they fear  
47 mathematics. This fear is fueled in part by their exposure to grammar as a patchwork of  
48 incoherent prescriptive rules that, when followed correctly, somehow leads to good writing (see  
49 Pullum 2009, or the hundreds of Language Log posts under the category “peeving”). Moreover,  
50 the idea that there could be a science of language seems not to have permeated the culture,  
51 despite the fact that linguistics is a thriving discipline steadily increasing both descriptive and

52 explanatory coverage (Pesetsky 2013). And the possibility that insights coming from linguistics  
53 might help to demystify language structure and be brought to bear in the service of teaching  
54 good writing seems not to be under consideration in mainstream American educational culture.

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

61         Language, we thought, could also serve as an excellent antidote to the fractionation  
62 found in American HS education. Language could be used to help students learn physics,  
63 through the study of sound, and to learn anatomy and biology, through the study of the vocal  
64 tract and the brain. Historical linguistics could be used as a vehicle for learning about what  
65 happens when people from different cultures and languages come into contact. And through  
66 linguistic theory and psycholinguistics, language could provide a window into human  
67 psychology. In the long run, we envisioned a language curriculum that would cross-cut all  
68 traditional disciplines, from English and Social Studies to Biology and Physics. Indeed, Hudson  
69 (2007) showed how linguistics positively affected secondary school curricula in England. In  
70 related work, Mallison, Hudley, Strickling, and Figa (2007) emphasize the value of building  
71 partnerships with educators and helping to address educational issues specific to culturally and  
72 linguistically diverse populations of students while bringing linguistics into the education system.

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

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

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

94

### 95 *3. Content Goals*

96

97 Linguistics and the Language Sciences provide a gateway into many disciplines because  
98 language plays so central a role in human society and human psychology. Language resides at  
99 the center of what it means to be human, providing the primary vehicle through which we  
100 communicate and a clear window into the nature of human cognition. The scientific rigor  
101 required to do linguistic analysis or experimentation promotes logical argumentation skills that  
102 serve students in many capacities. And the accessible nature of language provides a wedge for

103 studying the mind, allowing us to probe the nature of learning and mental representation (Fodor  
104 1975; Chomsky 1980), in addition to the interactions between linguistic structure and memory  
105 (Frazier and Fodor 1978; McElree, Foraker, and Dyer 2003), reasoning (Johnson-Laird 1983;  
106 Geurts 2003; Noveck 2001), mathematics (Carey 2009) and other aspects of extralinguistic  
107 cognition (Landau 2000; Perner et al 2003; Gleitman and Papafragou 2005). Exposure to  
108 linguistics can help to dispel common language myths that permeate our society (Napoli and  
109 Lee-Schoenfeld 2010), and can help to remove bigotry in the form of social, legal, and  
110 educational discrimination against people who speak a non-mainstream language or dialect  
111 (Labov 1982; Wolfram 1993; Baugh 2007; Charity 2008; Charity et al. 2008). Others have tried  
112 to bring this focus to secondary school students in the past. For example, Steward and  
113 Cardenez (2010) describe a course that uses Lippi-Green (1997) to dispel language myths  
114 through exposure to language science.

115

### 116 3.1 LANGUAGE IN PSYCHOLOGY

117

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

126         Perhaps the most basic observation in linguistics that we can produce and understand  
127 novel sentences freely. Nonetheless, not every novel combination of words is a grammatical  
128 sentence and it is straightforward to separate notions of meaningfulness from notions of

129 grammaticality (Chomsky 1957). These basic observations open several domains of  
130 psychological inquiry. What are the mental structures that underlie language productivity? How  
131 does a child, exposed only to sentences, acquire a system capable of representing an infinite  
132 set of sentences? Through what mechanisms is knowledge of language deployed in real-time  
133 understanding and production? What role does memory play in rapid sentence understanding?  
134 Do listeners build linguistic structure prior to encountering unambiguous evidence for it? How is  
135 grammatical knowledge represented in the brain? How can we characterize language disorders,  
136 and are they independent of other cognitive disorders? What similarities in structure can be  
137 found across diverse languages? How do people learn multiple languages at the same time?  
138 Does bilingualism slow down language acquisition and does it confer any cognitive advantages?  
139 Do differences in linguistic structure correlate with differences in corresponding cognitive  
140 domains? Why do humans understand language so effortlessly when state of the art speech  
141 recognition systems stumble over the simplest questions? How are signed languages like and  
142 unlike spoken languages?

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

149

### 150 3.2 ON DATA

151

152 A second content goal of our program was to emphasize the inherent difficulty of accurately  
153 measuring the contents of the mind, using language as an example. Understanding this difficulty  
154 is valuable for helping students to understand and evaluate scientific theories of language and

155 cognition. Moreover, it provides a stepping stone to becoming effective interpreters of data in  
156 the public sphere, whether that data is about school performance, nutrition, political attitudes, or  
157 subatomic particles. The complexity inherent in drawing inferences from patterns of behavior or  
158 brain signals to the systems responsible for generating those patterns highlights this complexity  
159 in all kinds of data analysis. Awareness of this issue may ultimately lead to a healthy skepticism  
160 in evaluating claims made in the news and to the development of a generally inquisitive  
161 scientific mindset.

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

172         A unique aspect of our environment at Maryland, however, is that our language  
173 scientists bring more than the traditional arsenal of tools to bear on the study of linguistic  
174 structure, its acquisition and use. Consequently, we developed groups that highlight the  
175 diversity of data types that bear on the questions outlined above. One group examined what  
176 infants and children know about syntax prior to being able to produce full sentences. While for  
177 adults and even older children, we can ask questions about grammaticality, meaning or  
178 inference, infants are limited in their capacity to make their understanding explicit and even in  
179 their capacity to answer questions or carry out commands. But, starting within the first few  
180 months of life, infants develop the ability to control their eye-movements to direct their attention.

181 This capacity provides a potential tool for investigating language understanding, when utilized in  
182 an experimental context. From this jumping off point, the students saw demonstrations of how  
183 we develop techniques to use eye-movements as an indicator of understanding; how the  
184 experiments are designed, how the data is collected and how it is analyzed. When they see the  
185 full complexity involved in moving from a question about children’s syntactic representations to a  
186 data point like “19-month-olds looked longer at this image than that one”, students come to  
187 appreciate the ingenuity that goes into setting up an experiment and the wide range of pitfalls in  
188 drawing inferences from patterns of behavior to knowledge.

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

197         Because a large proportion of our participants come from families where English is not  
198 the primary language, groups examining bilingualism have been especially popular. Here again,  
199 we have been able to take the inherent interest of the students and use it to emphasize  
200 scientific questions. One group, for example, examined the categorization abilities of  
201 monolingual and bilingual speakers of English and Korean, exploring some of the issues  
202 associated with Heritage language learners raised in Lee-Ellis (2012). Here students were able  
203 to witness differences in phonological categorization, by seeing that most of them were unable  
204 to distinguish certain sounds that are phonemically distinct in Korean but not English, but that  
205 the 1 or 2 Korean-English bilinguals among them had no trouble. This enabled them to better  
206 understand how we test for categorization and to understand differences between auditory and



207 linguistic processing. We have similarly been able to capitalize on student interest in  
208 bilingualism in groups examining executive function, working memory and the bilingual  
209 advantage (Bialystok, Craik, and Luk 2012).

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

214

#### 215 *4. Evolution of the Program*

216

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

228 In the second year, the lecture was cut to 20 minutes and focused on setting up the  
229 problem of measurement in psychology and linguistics. This gave students the experience of  
230 hearing a lecture in a university lecture hall, but with an emphasis on aspects of psychology and  
231 linguistics that they would not have been exposed to in their class. The lecture set up a general  
232 theme that was shared across the working groups, where the students got to interact with both

233 professors and graduate students. The students still went to lunch at the student union, which  
234 remains the highlight of the trip for many.

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

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

251           The other expansion of our High School outreach was to an area math-science Magnet  
252 High School (Montgomery-Blair HS). Our goal of providing a “college experience” for a majority-  
253 minority population was inappropriate for this population. These students are on a fast track to  
254 college, some already with research internship experience. This group had formed their own  
255 linguistic club in 2011 and contacted us to help them to gain a better handle on what they were  
256 trying to learn on their own. To accomplish this goal, we had individual researchers visit their  
257 linguistics club every other week after school to talk about problems in linguistics and language  
258 science. These discussions have ranged from psycholinguistics and real time sentence

259 processing to the philosophy of language and semantic composition. We have also developed a  
260 campus visit with this group, capitalizing on what we had learned from our previous years of  
261 outreach.

262

### 263 *5. Benefits to High School Students*

264

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

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

279 The partnership between UMD and Northwood is a valuable experience for our students. Not only  
280 does it provide students with hands on activities, but it exposes students to the college  
281 atmosphere and gets many students hooked on Psych. (Jon D'Souza, Personal Communication,  
282 2013)

283 Carlos Montalvan, the teacher who helped launch this outreach collaboration and also helped  
284 us expand into the new school upon his transfer there, listed three benefits for his students.

285 First, he notes that students may be inspired to look for research opportunities when they get to  
286 college. He says:

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

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

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

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

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

304 This sentiment echoes the past work on incorporating linguistic knowledge directly into the  
305 secondary education curriculum in Australia (Mulder 2007, 2011) and elsewhere (Denham  
306 2007).

307 Each year we collect direct feedback, in the form of surveys, from students who  
308 participate. Students perceive two main benefits of our program. First, students regularly report  
309 that they had previously been unaware of linguistics and language science, and the connection  
310 between language and psychology, and report being very interested in this content. Second,

311 they report gaining an awareness of the university research community, an introduction to  
312 institutions of higher education, and a chance to feel like a peer with a scientist. For many  
313 students from the public schools we interact with, our program provides their first visit to a  
314 college campus. Many do not come from families where going to college is an expectation. By  
315 engaging in these activities, many students felt opened to the possibility of applying to a big  
316 state school and pursuing a serious college education. For other students, particularly at the  
317 Magnet School, going to college is presupposed. Hence, informal interactions with researchers  
318 were reported to be eye-opening for many of the visiting students, many of them finding these  
319 interactions to be of more interest and benefit than the topic-based discussion groups. One  
320 student commented that:

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

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

328

## 329 5. 1 FEEDBACK FROM HIGH SCHOOL STUDENTS

330

331 The individual comments from the AP Psychology students were instructive for assessing parts  
332 of the program that work and those that need improvement. First, we considered their view of  
333 the opening lecture. With the shortened version of the lecture at their visit to UMD, students  
334 reported that the lecture was too brief and did not cover enough novel ground, commenting that  
335 it was “repetitive”, “just scratched the surface, not detailed enough”, and “could be more  
336 interactive”. This was reflected in their quantitative responses of 3.8 out of 5 and 3.3 out of 5

337 when asked whether they learned something new from the lecture and were excited by the  
338 lecture, respectively. At the same time, many reported that it was “fun and informative,  
339 knowledgeable and interesting,” that the presentation style was “funny and down to earth,” and  
340 that the lecturer was “relatable and funny” and “broke down the concepts he was trying to  
341 explain.” This was reflected by their average response of 4.3 out of 5 when asked whether the  
342 lecture was easy to follow along with and understand. Several students commented on the  
343 experience itself, stating that they liked “getting to see like what it would be like in the future  
344 when [they] go to lectures in college”.

345 We got more in-depth responses when it came to the specific small discussion groups  
346 that the students attended. Some commented on the way the sessions were run, telling us that  
347 “the small groups were nice because you could interact more” and, “I like how they asked  
348 questions about the topic and how they made the activities interactive”. Overall, the students  
349 ranked their sessions 4 out of 5 in accessibility. Others commented on the material presented,  
350 telling us that they “liked learning about things that most people never take the time to think  
351 about” and that the “the lectures were very informative and conducive to what we were learning  
352 about in AP Psychology.” Students ranked how informative the sessions were an average of 3.7  
353 out of 5. Others told us about their overall impressions of the whole experience. One student  
354 told us that “it was a very interesting experience. It gave me an overall feel of what it's like to be  
355 a college student, having work on campus, and sitting in the lecture hall”. Some were both more  
356 impressed and left wanting more, saying “I was left in awe from both the labs and campus social  
357 life. I only wish I had more time to visit other areas of the psychology buildings.”

358 We also got feedback on things we could improve on. Students were eager for an  
359 experience that gave them access to novel material that was professionally presented, and  
360 these expectations were not always met. One students felt that “half of the material they  
361 discussed with us was stuff we already knew from class, and the rest they had to dumb down  
362 because they were grad students and we're high schoolers.” This type of response led to a

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

369

## 370 5.2 BENEFIT TO LANGUAGE SCIENTISTS

371

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

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

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

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

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

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

412           We collected feedback on the benefits of the outreach program from 18 graduate  
413 students and 7 professors. First, we wanted to get an idea of general satisfaction with the  
414 outreach program. When asked "How happy are you with existing outreach activities", students



415 who had been involved with at least one outreach event averaged 4.15 out of 5 on a scale of  
416 general satisfaction. When asked “Do you find the time to benefit ratio for doing outreach is  
417 good?”, the same students averaged 3.85 out of 5. Clearly, graduate students do not view these  
418 activities as a burden.

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

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

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

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

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

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

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

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

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

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

458 Many people also found personal satisfaction in contributing a little bit to others' educations.

459 One researcher summed up the sentiment nicely: "most of all, though, I just relish the  
460 opportunity to give back and educate a batch of eager young learners about problems that I  
461 think really matter!"

462

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

464

465 Developing the basic framework for engaging the community and emphasizing it as an  
466 important aspect of our interdisciplinary language science program has allowed us to expand

467 our program opportunistically. Some opportunities came to us from the community itself, and  
468 some came from our joining existing programs; but, their success came from the culture of  
469 community mindedness established through our IGERT program. Here we highlight some other  
470 outreach activities we have integrated into our program.

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

483         We have also developed partnerships with area middle and elementary schools. In one  
484 program, we have partnered with the Philosophy Outreach Group to include more language  
485 scientists in meetings with a middle school philosophy club. This program sends scholars to  
486 meet with a group of gifted students for a weekly discussion on topics ranging from morality to  
487 philosophy of language. Several biweekly Friday lectures have also been developed and include  
488 such topics as "Language" and "The Brain". These lectures provide material that middle  
489 schoolers otherwise would not have access to, while giving the visiting researchers a chance to  
490 engage a novel audience. We have also been involved in various capacities with elementary  
491 schools in the area. Language scientists have worked as science fair judges at two area schools  
492 from 2010 to 2013, covering 3rd through 5th grade. Additionally, we sent representatives to

493 participate in an elementary school career day to talk about careers as scientists. At this level,  
494 we cannot present detailed research, but we bring a unique perspective usually missing from  
495 science fairs, ensuring that Language Science is presented alongside other STEM fields.

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

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

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

519 Eyler et al. 2001, inter alia), and even other university linguistics outreach programs such as  
520 Concordia University's CLOUT program, we hope that our activities can provide a novel model  
521 for community engagement in the language sciences.

522

### 523 *7. Lessons Learned*

524

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

528         First, developing an effective outreach program requires connecting with people who are  
529 already involved in the community rather than trying to impose new structures or to reinvent  
530 existing ones. We have partnered with psychology teachers, school administrators, counselors,  
531 self-run student groups, and University officials. These partnerships help to integrate our work  
532 with the needs of community stakeholders and with existing organizational structures. In  
533 schools, it is important to have a champion for the activities, as this ensures continuity through  
534 the years and also that simple tasks such as getting a school bus or distributing pre-reading  
535 assignments get completed on time.

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

544 Learning to ask has proven useful in collaborating with administrators, high school teachers,  
545 and secondary school students, allowing all parties to have a more meaningful experience.

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

552

### 553 *8. Next Steps:*

554

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

561 In the future, we hope to expand these training benefits to undergraduate students.  
562 Many language science laboratories on campus, including those working in psycholinguistics,  
563 first and second language acquisition, education, biology and computer science, provide  
564 research opportunities for undergraduate students. In these laboratories, undergraduates get  
565 their first hands-on exposure to basic and applied research activities. We believe that expanding  
566 this undergraduate training to include participation in outreach activities will both improve the  
567 undergraduate experience and also improve our outreach efforts. Outside of the research labs,  
568 this experience can be combined directly with their coursework. Fitzgerald (2010) showed how  
569 incorporating service oriented learning in undergraduate classes enhanced the students'

570 education experience. Bringle and Hatcher (1995) also discussed how to integrate a service-  
571 learning pedagogy into university coursework, highlighting the importance of having students  
572 engage with the community to see how what they are learning can be of use to society. As we  
573 noted above, our program makes the path from high school into a life of research real.

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

580

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