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The field is not the lab, and the lab is not the field: Experimental linguistics and endangered language communities

Abstract: The scientific ideals of experimental/laboratory linguistics which uses large scale subject pools, statistics, carefully constructed controls and expensive equipment can run into conflict when working with an endangered language community. The questions raised by experimental linguistics are not necessarily those of most interest to the community and endangered language communities are not necessarily well-suited to support the requirements of experimental linguistics methodologies. In this chapter, we report on our experience working with speakers of Scottish Gaelic on the Isle of Skye in Scotland. We address questions of study design and how we had to modify our research methodologies for working in partnership with this community and we consider how our work was received by the community. We finally present feedback we received from study participants and sketch what we think are best practices for using experimental methodologies in collaboration with an endangered language community.

Keywords: Gaelic, Celtic, Laboratory, Phonetics, Psycholinguistics

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1 Introduction

As experimental equipment becomes more compact, accessible and portable, incorporating experiments into field research becomes increasingly plausible for linguists everywhere (see for example, Whalen and McDonough 2015). Experiments constitute a subset of the tools available to the linguist, and within almost every subfield of linguistics, the use of such methods has been established. However, when working with an endangered language community, adopting such methods entails adapting to a unique set of concerns. Working with an endangered language requires that not only are the experiments going to produce fruitful results, but they also must have clear benefits for the community (see Rice 2010, 2011, and this volume for discussion of the relationship between research and community service, and Czaykowska-Higgens, this volume, for an elaboration on how one might measure outcomes in such partnerships).

This paper is a reflection on the authors' experience using experimental techniques[1] with speakers of Scottish Gaelic on the Isle of Skye in Scotland. In what follows, we describe our experiences working with Scottish Gaelic, and come to outline specific considerations we feel are required on the part of the linguist in approaching an endeavor similar to ours. In order to do so, we describe the nature of our research group, the aims that we hoped to achieve regarding our research questions, and the ways in which our group was connected to the endangered-language community. We discuss the challenges of transferring to

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1 A reviewer rightly points out that by definition all scientific linguistic work is experimental in the sense that it includes hypothesis testing. That includes of course traditional pen and paper elicitation or in more modern techniques of documentary linguistics (see for example many of the other chapters in this volume, e.g. Fitzgerald's paper). We do not mean to diminish the importance of the scientific method in traditional field methodologies. We are using the term "experimental" here as a shorthand, commonly found in the discipline, to refer to instrumental methodologies, psycholinguistic methodologies, and other techniques that require statistical analysis of speakers who participate in a controlled study. These are the techniques traditionally viewed as "lab" based linguistics and have largely been restricted to more widely spoken languages like English or Spanish. A similar observation can be made about our use of the term "theoretical linguistics" later in this paper. We do not intend to suggest that traditional field methodologies do not involve theories (nor, for that matter, do we mean that experimental methodologies do not use theories). We are using the term as it is commonly used among practitioners to refer to formal structural approaches (including but not limited to Generative Grammar). Rightly or wrongly, the terms "experimental" and "theoretical" are commonly used in these ways in the discipline and we adopt that usage while recognizing that they could be confusing and probably misleading.

the field the experimental techniques that would answer our research questions. We also describe the particular challenges of working with the Scottish Gaelic speaking community. Finally, we describe the feedback we received from the experiment participants and outline where we can improve our approach in the future.

2 Research agenda, methodologies and community connections

At the University of Arizona, we have a research team that has collaborated on four National Science Foundation Grants researching Scottish Gaelic syntax, phonetics, phonology, and morphology and has recently begun a new research grant into the phonology of Welsh.[2] The Scottish Gaelic part of the team consists of five faculty (Archangeli, Carnie, Hammond, Ussishkin, Warner), a native speaker (Fisher), a post-doctoral fellow (Clayton, now faculty at the University of Nevada), 16 graduate students and graduate alumni, including the two first authors of this paper, and a number of undergraduate research assistants. Our research has used elicitation, computational techniques from corpus linguistics, and experimental methodologies – the latter being the focus of the present work.

We selected experimental methodologies to focus on some of the typologically rare phonological properties of the Scottish Gaelic language[3] such as apparent nasal fricatives, a unique palatalization pattern, morphologically triggered initial consonant mutation, epenthesis, hiatus, and preaspiration, among others. The wide variety of tools allowed us to investigate each phenomenon from different perspectives. Our questions were of three types: the phonetic realizations of the phenomena in question, the psycho-phonological representation of alternations, and native speaker perception of these phenomena. We elicited three classes of responses from native speakers:

(a) Physiological articulation (tongue movement or nasal airflow), using ultrasound machine and an oral/nasal airflow measurement system.

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2 NSF Grants numbered: BCS11443818, BCS0921685, BCS0639059, BCS1453724

3 We also did one experiment on the production of Gaelic-influenced English.

(b) Reaction times and response choices (from button presses) to an auditory or visual stimulus, testing materials involving gated and other modified speech as well as masked-priming.

(c) Written or spoken responses to a prompt.

A list of the published research emerging from this group is found in Appendix A.

3 Ethical principles for experimental work with endangered-language communities

We would like to start this paper with an observation that also has important practical implications: Experimental work on an endangered language is not appropriate in all situations. For many languages, doing experimental field work would be a waste of time and would squander limited resources (see Dixon 1997 for more on this observation). Languages that either lack sufficient basic documentation (such as a grammatical description or dictionary) or do not have sufficient speakers to do a statistically valid experiment should be investigated through other means. If the community needs help with construction of pedagogical tools or in language planning then an experimental approach to language description may well be a poor use of resources.

In our research on Scottish Gaelic we have been lucky. Despite being endangered, the language has a long descriptive tradition with numerous dictionaries and grammars and has a significant literary tradition. The language also has many pedagogical resources and has both political and media support systems in place. Thus for us, while we continue to do traditional elicitation, documentation, and description, we are able to do experimental work as well. This might not be possible in other communities.

With this in mind, there are a number of prerequisites to beginning an experimental research program with an endangered language. (1) The researcher must have access to a sufficient amount of descriptive work on the language, and (2) a sufficient amount of language documentation materials to provide a basis for experimental stimuli. (3) There must also be sufficient community interest for the proposed experimental research, and ideally the community should have (4) a pre-existing revitalization infrastructure. In our experience, having a revitalization infrastructure, is needed for fostering collaboration with the speaker community. It may be the case that the experimental research is purely academic (i.e. theory-driven) and researcher-focused in nature. As such, if there is no revitalization infrastructure, even with the interest of the community it is unclear how the

linguist will be of benefit to the community, cf. however Perez Báez, this volume. The first two requirements (description and documentation) are necessary for constructing valid experiments, whereas the last two (interest and infrastructure) ensure that the linguist is working in accordance with the community goals.

4 Developing community relationships and the importance of the community linguist

Linguistic research done with communities that speak endangered languages has implications outside the scope of the research itself. Research often brings along with it funding and resources for equipment, research assistants, and—in both direct and indirect ways—the community of speakers. Along with these funds may come such issues as who benefits from the funds and who does not. As such, the broader context of research cannot be ignored if the linguist hopes to conduct ethical research.

In addition to taking precautions to minimize broader negative effects of research on a community, linguistic research should only be conducted when the community is open to the research taking place. This may seem obvious, but there exist many levels of interest that can be characterized by involvement and collaboration. The experimental research on which this chapter is based is researcher-focused in nature, but developed as a fully collaborative documentation project. In short, researcher-focused projects need not always be dispreferred. This type of work is one way to meet the needs of all involved parties (Czaykowska-Higgins 2009, this volume; Bowern and Warner 2015; Fitzgerald, this volume; but cf. Crippen and Robinson 2013). For linguists and communities of endangered languages, it may be impossible to design a study that reflects the interests and needs of both parties.

In the case of our research on the Isle of Skye, Scotland, our affiliation with Sabhal Mòr Ostaig (SMO), the Gaelic-medium College, was crucial when it came to providing space to run experiments, participant recruitment, and credibility to the community. The authors' experimental and theoretical research subsequently spawned a documentation project in collaboration with the Media Studies unit at SMO. Without our existing affiliation with SMO, such a project would not be possible. The primary goal of this new project is to develop an audio-video corpus of vernacular Scottish Gaelic. The corpus consists of high quality digital audio and video recordings of interviews with native Gaelic speakers. The interviews address a variety of topics, but are focused on traditional occupations, oral history, folklore, and personal narratives. The collected material will be provided

with time-aligned transcriptions in the original Gaelic, morpheme-by-morpheme glosses, and English translations. No such corpus has been previously available, and as such the audio-video corpus will be a major boon to both the research and local communities. This project has also received financial support from the National Science Foundation [#BCS 1500620 and BCS 1500220].

The success of our research in the community is largely to due to the fact that we are collaborating with a native speaker with deep community ties. Muriel Fisher, who won the 2014 Community Linguist award from the Linguistic Society of America, is a native speaker of Gaelic from the village of Glendale on Skye. While she currently resides in Tucson and teaches Gaelic at the University of Arizona, she has maintained strong connections with her home. She returns each summer to Skye to teach summer courses at SMO. She has a wide network, not only of native speaking friends and relatives, but also of language experts who work at SMO. This has allowed us to have unique access not only to speakers who can serve as consultants in our experiments but also access to expertise in the grammar and dialectology of the language, which was invaluable in constructing the stimuli for our experiments.

Fisher's own work in pedagogy is an important bridge between our more theoretically-oriented work and the needs of the community. As a teacher she has created a four-level textbook with audio material in the language. She also has developed some unique and popular courses at the Gaelic college, including a refresher course for native and heritage speakers who would like to brush up their Gaelic. Since she started collaborating with us, she has learned a lot of linguistics —she is a natural at language description and scientific observation—and now incorporates many of the insights of linguistics and our research into her own teaching. For example, our work on vowel epenthesis and stress has helped her explain to students one of the more baffling aspects of the Scottish Gaelic orthography.[4]

While Scottish Highland culture is similar in many ways to American culture, there are many surprising and challenging differences. These come in every way from the norms of politeness to negotiating complex agreements. Take, for example, helping elderly native speakers to be comfortable with a potentially scary instrumental set up like our ultrasound machine. While the speakers are familiar with ultrasound technology from their doctor's offices, it brings to some the special anxiety associated with a medical procedure. Another source of anxiety relates to

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4 In particular, epenthetic vowels are not written, yet are predictable based on the orthographic consonants. A sonorant followed by a non-homorganic obstruent (excluding voiceless stops) following a stressed vowel, is consistently followed by an epenthetic vowel even though it is not written.

language attitudes: whether they are "doing the task right" or "misrepresenting their language." This is particularly acute in a community like Skye, where Gaelic has long been viewed as a second-class language and until recently all schooling was done in English. Speakers often express concern that they "don't really know Gaelic properly" because they didn't go to school in the language, or they don't know all the words that their grandparents did, etc. As such they are often reluctant to participate in studies where it appears the stakes are high (because we are either using fancy equipment, or they are surrounded by a group of people that includes university professors). Fisher has been critical in mitigating these issues. For instance, when consultants first arrive at our study sites, they are greeted by Fisher, who sets them at ease by greeting them in Gaelic, offering them tea and biscuits, and gently talking them through the demographic questionnaire, consent documents and the experimental procedure. As a community insider, she was acutely aware of the anxieties study participation can bring out in speakers. She was able to joke with the consultants and relax them. She also sat with the participants if they were nervous and talked to them in Gaelic to help them feel more relaxed.

The novelty of an experimental setting can potentially put community members in an uneasy state. Uneasiness compounded with a seemingly endless barrage of experimental items could easily end badly. Fisher was able to tell us when the experiment was too long and which pieces of equipment would be too uncomfortable or intimidating. American undergraduate participants are accustomed to sitting in front of a computer screen for hours, whereas for many speakers of endangered languages this is not the case. Under Fisher's supervision, all of our experiments were developed in a way to be as comfortable as possible for participants. For example, one of our tasks called for participants to listen to real and nonsense words in Gaelic and then judge which words were real and which were fake. After we had compiled a list of candidate words, she worked with us to discard any words that were archaic or had negative connotations. Without a native speaker community member as part of our design team, we may have inadvertently asked participants to listen to words that were taboo or vulgar. After the stimuli had been approved and our experiments were in a testable state, Fisher performed the task as if she were a participant. Based on her feedback, we made adjustments to ensure that the experience would not be stressful or awkward. This included adding extra pauses into the experiments and rewriting our briefing scripts to better explain procedures. Another example has to do with the production of the stimuli for one of our speech perception experiments. Most gating experiments gate to white noise or a square wave to avoid adding perceptual artifacts. Fisher found this too irritating in pilot testing, so we gated to silence instead, which avoids irritating beeps. The cost in potential perceptual artifacts has turned out to be not a problem.

Fisher also helped mitigate one of the biggest challenges we had in recruiting consultants to participate in our experiments. The University of Arizona institutional review board (IRB) has a template for a very comprehensive and lengthy subject consent form that we were required to have each consultant complete. The consent form is of course for the protection of the speaker, but it is a challenge for many Gaels, who remember that complex legal documents were once used as tools to evict Gaelic speakers from their ancestral lands. Speakers are very concerned about signing such documents, but are happy to offer their consent once given an equivalent oral description of the experimental procedure and their rights as participants. Fisher's sensitivity to this issue led to fruitful discussions with our IRB over whether such a detailed form was necessary with this speaker community, and subsequently we were able to bypass the written consent form while still ensuring that our native speakers were appropriately informed about what the experiments entail and what their rights were.

Another potentially awkward and difficult part of conducting experiments in the field is the question of compensation. On one hand, we want to recognize the expertise and linguistic prowess of the participant. This means paying more than we might to an undergraduate doing a 20 minute experiment in a typical linguistics lab, but it also means doing it in a way in which the speaker will not feel compelled to participate if they don't want to or if they are embarrassed about taking money, especially if this might cause upset elsewhere in the community. Best practices in compensation will vary by the community a researcher is working with. In our case, under the advice of Fisher, we did not cast our compensation as a "payment", but instead as a "thank you gift", which was given to the consultant in a sealed thank you card signed by all the field team. This exchange was done in private by Fisher as part of the intake. In our case, taking cash out of a pocket and directly handing it to the participant would have been seen as very offensive. Otherwise it would have been likely that speakers would refuse the money and may have taken offense that we would try to "pay" them.

Dropping twelve excited foreign researchers down in the middle of a relatively quiet rural island environment brings with it the challenge of ensuring the community will accept our work and invite us back. Fisher was critical to our success in this as well. Knowing us all personally, but also knowing her community, she was able to coach us in basic social niceties that would ensure we were viewed as welcome partners of the community rather than scientific interlopers who were looking to examine the natives under microscopes. This coaching was in everything from the dress of our research group, which was too informal and in some cases too revealing for the community standards, to the personal conduct of the research group from the minute a speaker-consultant walked into the space

where we were performing the research. Fisher had us repeatedly rehearse and practice our patter and our manners as we conducted the experiments so that it helped the native speakers feel comfortable and made us a more accepted part of the local community.

Most importantly, Fisher has been critical to helping us explain our sometimes esoteric research questions to native speakers and help them understand what kind of impact our work would have on the language community. She also helped us shape our questions in ways that would better serve the community. As an example of the former, we are interested in the mental representation of the morphologically triggered phenomenon of initial consonant mutation (lenition). Traditional Gaelic pedagogy requires the student to learn a set of rules for the alternations[5] and memorize a heterogeneous set of morphological environments in which it occurs and the exceptions to those environments. The mutation phenomenon is a challenge for classroom learners. Our research has exposed one or two facts that might be relevant to how mutation is taught. First, our research shows that even taking into account dialect and age, there is actually widespread variation among speakers in where they apply the rules and when they apply the exceptions – apparently with little effect on comprehension. This means that with the exception of a couple of cases where the mutation is the unique marker of a morphological contrast (such as in the past tense of verbs), instructors may instead want to model the mutation in their own speech and writing rather than spending a great deal of time on prescriptive instruction, allowing learners and lapsed native speakers to acquire the contrasts through exposure. Second, although the results are still not fully clear, some of our data may be consistent with the idea that native speakers simply store both allomorphs of a word (lenited and unlenited) rather than applying an online phonological rule (Green 2006; Warner et. al 2013). As such teachers of the language may simply want to have students learn both forms from the beginning rather than teaching one "underlying" form and a set of principles for deriving the lenited form. Here our research can inform instructional practice, while the perspective of community language teachers helps us shape our research question.

It is in no way an exaggeration to say that without Fisher, this project would not have been feasible. At least one community member should be in close consultation during the planning of any such experimental work, to help the researchers to avoid any cultural or practical pitfalls

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5 In Gaelic lenition, the following changes occur, leaving aside details about palatalization: /p/ → [f], /f/ → Ø, /m/ → [v], /b/ → [v], /t/ → [h], /d/ → [ɣ], /s/ → [h], /k/ → [x], /g/ → [ɣ].

5 The Challenges of Experimental Design

The construction and administration of experiments when working with an endangered language community brings its own unique challenges (Clemens et al. 2012; Norcliffe et al. 2015). For example, the resources for building the experiments are more limited and the population we study is both smaller and more diverse. This creates situations unfamiliar to many experimental linguists who expect greater statistical and instrumental power than may be available in the field context.

5.1 Stimuli

Building experimental stimuli relies on having access to resources such as dictionaries, word lists, corpora and grammars. Even though Scottish Gaelic has a number of different dictionaries (Dwelly 1902–1912; MacFarlane 1912; Mark 2003), these reference materials bring with them their own special challenges. As inherently conservative tools, dictionaries for languages like Gaelic, which have a long literary tradition, often contain many words that are archaic, dialect specific, or generally unfamiliar to native speakers. This is exacerbated in cases like that of Scottish Gaelic, where there is universal bilingualism (with English) and there is a tendency to only use Gaelic for basic day-to-day communication. Many Gaelic speakers don't have technically specialized vocabularies and tend to switch to English when discussing more technical matters. So we found that many of the words and forms we selected from the dictionary were of no use in our experiments, as speakers simply didn't know them. Here again, Muriel Fisher was a critical factor in our success, since only she could identify which words speakers were likely to know and which they were not. We were also able to directly draw on her native-speaker knowledge of the language to find the right items (e.g. "Can you think of a one syllable word that begins with an f that rhymes with bat?" or "we need a word that sounds like X", etc.)

For example, in one of our studies, we asked participants to read aloud words off a screen while ultrasonic images of their tongue's movement were recorded. The goal was to compare tongue movement in words with lenition versus words without lenition. The two categories of words needed to be as similar as possible in all respects besides the lenition. That is, all words should be equally common, equally long, have similar syllable structures, etc. To hold these various aspects constant, we needed a large and representative corpus of Scottish Gaelic. If our corpus were a collection of 18th century literature, we may have presented words that were unknown to the participants, even if all the relevant aspects were

controlled. Similarly, if we had too small a corpus of modern Gaelic, we would not have enough data to reliably control all stimuli, even if the participants knew all the words. For these reasons, the documentation from which stimuli are drawn should be both *large* and *representative* of the speaker's knowledge. For our corpus, we combined three smaller corpora into one. The first two corpora were pre-existing (MacBain 1911; Pike and Maolalaigh 2013) whereas we created the third by compiling online publications from the Scottish Gaelic language BBC (BBC Alba). With this combination of resources, we were able to develop stimuli for our experiments.

5.2 Participants

In a university setting, experimental linguistics often involves large numbers of undergraduate participants. Such participants are relatively easy to come by. An announcement to a university's psychology or linguistics department will usually suffice to bring in enough students to fill out an entire study. Moreover, there is such access to participants that some may be excluded from the analyses based on non-standard experimental performance. We can legitimately discard an undergraduate participant's results, for instance, because she has been studying German since she was 5 years old, her vowel perception does not pattern with other participants, or she has an under 80% accuracy rate on some task. Researchers often expect to exclude participants based on such exceptions or technical problems, and so recruit more students than are needed for a study. This is not the case with endangered languages. This kind of participant is not who we get when we go into the field. When working on an endangered language, every drop of data is precious. This cannot be changed, and so other aspects of an experiment might have to be altered to work successfully in the field. For instance, to increase statistical power, more items per community member may be appropriate. However, too many experimental items may lead to boredom, stress, or fatigue. In our case, we had to redesign a typical lexical decision experiment by adding in extra resting periods. Lexical decision is a task in which real words and non-words are presented to the participant, and the participant must decide which words are real and which words are invented. In a university, such studies have been conducted with up to 480 words (Bentin et al. 1985). We wanted to present as many words as possible to each participant, but the more we added, the more stressful the task would become. A compromise was made— extra breaks (a total of four, where just one is normal) were inserted during the task, and a total of 160 words were used. Fewer words and more breaks resulted in a less stressful task.

However, there are some aspects of the population that cannot be controlled in the field setting. In university settings, the fact that we are drawing from the student body means that we are already controlling numerous aspects of our sample population. But in the field, it may be much harder to control or balance a participant pool for age, dialect, socio-economic status, frequency of target language use, or education. All of these add variation into the sample and potentially experimental error into the data. Community members of differing ages will have varying levels of hearing, vision, and exposure to computers. In a language like Gaelic, different speakers have different levels of competency with the language. Some speak it all the time. Others learned it as children. Some use it in their work or school. Others only use it to talk to their grandparents. Some have university-level education in the language. Others are only literate in English. Some were monolingual in Gaelic until school age; others have been functionally bilingual since starting to speak. All of these factors will influence their performance. When working with a small community of speakers, whose time and resources are limited and whose members live at considerable geographic distances, these differences simply cannot be avoided. The more variation between participants, the harder it will be to find a statistically significant effect. For these reasons, even when using sophisticated statistical techniques such as linear mixed regression, researchers may encounter resistance in the peer review process because of potential confounds and small subject pools. While we expect that such complaints mostly come from researchers who work on larger more widely spoken languages where such factors can be easily controlled for, we also recognize the scientific concern of such researchers as clearer more definitive conclusions are always better than more tentative ones. It is important to recognize that there is more value in conducting this work with a less clear set of results than not conducting it at all, which is the only other alternative. If one wants a broader view of language beyond that available from more widely spoken languages, then one has to make accommodations in this regard. The results and conclusions may not be as clear-cut as those in more traditional experimental work, but it is better to have some results than nothing, especially when the language may not be spoken at all in the future. The broader impacts of this kind of research may well make up for any minor deficiencies of experimental power.

The actual conduct of experiments with this diverse body of participants is also different from that in traditional linguistics labs. With community-based experimental work it is important to pay special attention to each person's needs, comfort, and background. For example, many of our native speaker consultants were elderly and had hearing or vision problems. When we conducted experiments that entailed listening to modified gated speech, these speakers often had trouble hearing the stimuli. Similarly, we conducted a nasal airflow study in

which speakers were asked to read from a printed list of words. Unfortunately the shape and position of the nasal mask prevented speakers from wearing glasses (or forced them to wear them at odd angles). This is not only uncomfortable for the participant, but it means that they may not be correctly seeing the prompts. Accommodating these kinds of obstacles requires careful forethought and attention and may require some on-the-fly improvisation on the part of the experimenter (e.g. writing out the stimuli in a larger print size). Careful attention on intake can also help. When we discovered that one of our extremely fluent speakers never learned to read or write in the language (although she was literate in English), we were able to save the consultant a great deal of embarrassment by not having her do experiments that relied on reading or writing in Gaelic orthography. Instead we redirected her to recording some stories and histories with our native speaking collaborator. Even though she did not participate in the experiments we were able to gain some valuable data for our other documentary projects, while also recognizing the consultant's knowledge and understanding of the culture and history of the island and respecting her language knowledge.

Other non-trivial differences distinguish speakers of an endangered language from undergraduate students. These two groups have different expectations of the researcher, different attitudes towards the languages they speak, and different levels of familiarity with experimental settings. For these reasons and others, it is misguided to expect that research in experimental linguistics can be directly transplanted from a university laboratory into the field, wherever that may be. One major difference between typical experimental participants and community members relates to their expectations of the researcher. Speakers of an endangered language who are willing to participate in such research are often proponents of revitalization efforts themselves, and so have a vested interest in the outcomes of the research. As such, it is possible that participants feel under pressure to perform well on the experimental tasks because they want to aid the researcher. Monolingual undergraduate participants probably do not have these attitudes towards experimental research and are less likely to be upset by certain experimental tasks. For example, if a task contains a training phase in which the participant is given feedback on their mistakes, this may not be stressful at all for the undergraduate. However, for a speaker of an endangered language this may very well feel like intense judgment on their linguistic abilities. The structure of almost any experimental task can be reinterpreted as a test, and tests can be stressful as well as shaming if one is insecure about one's ability in the target language. It is of utmost importance that community members are very clearly briefed before all experiments that these tasks are in no way a measure or judgment of their language abilities. This is especially true in the context of an endangered language community, where speakers are often not confident about their linguistic ability.

For example, after finishing a task we frequently heard speakers say things like "Oh dear, I didn't do very well on that. I wish you could have tested my mother. She was a much better speaker of the language than I am. I hope I didn't ruin your experiment." After a few instances of this kind of response, we quickly adjusted our explanations of the tasks and tried to make it clear that we weren't testing their competence in the language and that we expected variation (as well as some errors since everyone makes errors in speaking); indeed, variation and errors were in some ways more interesting to us than what they learned in school.

5.3 Summary

It should be obvious from all the considerations discussed in this section that experimental work done in collaboration with an endangered language community is very different from experimental work done in a lab. There are unique challenges in constructing the experiments and in building a participant pool. Resources for constructing balanced and controlled experiments are less available and the selection of materials may require much more work than that required when working with a majority language. The participant pool is more heterogeneous than that normally found in the lab and is likely much smaller. There are different expectations of the participants, which shift the way experiments are conducted. These considerations are all critical to successful conduct of experimental work with an endangered language community. We also note that the scientific community must also be prepared to have different expectations for the outcomes of such research.

6 Community evaluation of our research

During our 2014 and 2015 visits to Scotland, we invited participants to respond to a questionnaire about what they thought about our work. The questionnaire posed various questions about participants' (1) opinions on the research (such as its usefulness and impact on their language), (2) comfort during the experiments, and (3) understanding of the research. The main use of these surveys was to try to understand where we had room for improvement and which of our design decisions played out well. Since we ourselves conducted the survey, we can expect that the results are likely to be biased in our favor. Even though we made the questionnaires anonymous, consultants are unlikely to give us critical feedback since they knew we would be reading them. This is especially true since we made an effort to engage with them and participate in their community. Because we were their guests, they were highly unlikely to give us serious critiques. Quite

expectedly then, the responses to our survey were overwhelmingly positive. For example, we learned that our preparation was largely successful with respect to participant comfort. While pleased by this, we focus here on those areas where the consultants gave us specific critical responses.

Many participants replied that they did not fully understand the research. This result was not terribly surprising given that some of our experiments were investigating very technical topics. One artifact of this is that some of the native speakers felt that we did not take advantage of their unique knowledge of the structure, history and culture in the language. This is not a satisfactory result for us. In response, working closely with Muriel Fisher, we have developed one-page handouts written in lay language to be distributed at SMO and to future participants. These handouts concisely review the methods and theories with which we are working and use language that is not laden with terminology. We hope that these pamphlets will help community members better understand the research we are conducting. We also attempted to provide an explanation of why the questions we were addressing might be relevant to not only our understanding of the Gaelic language, but also to their community efforts.

Participants' overall opinions on the merit of the research fell into two major categories. Either people said that the research is important in that it (1) adds to the status of the language or (2) may hopefully be used in pedagogy. The former group expressed sentiments such as "[...] more understanding of the language will hopefully lead to more respect/appreciation of it", and that the research helps the community "[...] realize that we do have a worthwhile culture/language."

For the participants who hoped that our research results can be incorporated into pedagogy, we had responses such as "I would hope that this would help being able to teach Gaelic in an easier way for learners", and "The research findings could be helpful in informing future teaching and learning". The main goal of our research was linguistic rather than pedagogical, and as such these opinions are worth noting as they reflect our intuition that our work must have clear broader impacts.

7 Conclusions

For both the experimentalist hoping to work in the field and the community linguist hoping to incorporate new techniques, experimental work on endangered languages is a new and challenging task. Special attention has to be paid to experimental design and the relationship with the community. A running theme in this chapter is the importance of having a community member involved in the project from the beginning. Without this kind of invaluable assistance, experimental work

within endangered language communities is highly likely to encounter serious problems. With active community engagement, we could feel much more confident that our research led to a net positive effect for all parties involved. Our initial theoretical work opened up doors for collaboration on a documentation project, and the participants found the overall experience interesting and enjoyable.

Appendix A

Papers and presentations based on the research described here

Archangeli, Diana, Jeff Berry, Andrew Carnie, N. Hunt, Sunjing Ji, and Keisha Josephs. 2011. ATR in Scottish Gaelic Tense Sonorants: A preliminary report. In Andrew Carnie (ed.), *Formal Approaches to Celtic Linguistics*, 283–306. Newcastle upon Tyne: Cambridge Scholar's Press.

Archangeli, Diana, Samuel Johnston, Jae-Hyun Sung, Muriel Fisher, Michael Hammond, and Andrew Carnie. 2014. Articulation and neutralization: a preliminary study of lenition in Scottish Gaelic. *INTERSPEECH*. 1683–1687.

Archangeli, Diana, S. Johnston, Jae-Hyun Sung, Muriel Fisher, Michael Hammond, Andrew Carnie. 2014. Svarabhakti vowel articulation in Scots Gaelic. Paper presented at the 14th Confrerence on Laboratory Phonology, Tokyo Japan, 25–27 July.

Brenner, Daniel, Andrea Davis, Natasha Warner, Andrew Carnie, Muriel Fisher, Jessamyn Schertz, Michael Hammond and Diana Archangeli. 2011. Can you say [ṽ] or [x̃]. aerodynamics of nasalized fricatives in Scottish Gaelic. *Journal of the Acoustical Society of America*, 130 (4). 2550.

Brenner, Daniel, Andrea Davis, Natasha Warner, Andrew Carnie, Muriel Fisher, Jessamyn Schertz, Michael Hammond and Diana Archangeli. 2011. Can you say [ṽ] or [x̃]. aerodynamics of nasalized fricatives in Scottish Gaelic. Paper presented at the Acoustical Society of America annual conference, San Diego, 30 October–4 November.

Chen, Yan, Elise Bell, Michael Hammond, Andrew Carnie, Adam Ussishkin. in prep. A modern corpus of Scottish Gaelic constructed from on-line BBC Alba website. University of Arizona manuscript.

Clayton, Ian. Forthcoming. Revisiting Hebrides English. To appear in *English World-Wide*.

Clayton, Ian. 2017. Preaspiration in Hebrides English. *Journal of the International Phonetic Association* 47 (2). 155–181.

Davis, Andrea, Michael Hammond, Diana Archangeli, Andrew Carnie, Muriel Fisher, Natasha Warner, Collin Gorrie, Lionel Mathieu, Jessamyn Schertz. 2011. Perceptual and judgment-based experiments on Scottish Gaelic Svarabhakti. Paper presented at the 14th International Congress of Celtic Studies, Maynooth Ireland, 2–5 August.

Hammond, Michael, Andrea Davis, Natasha Warner, Andrew Carnie, Diana Archangeli, Muriel Fisher. 2014. Vowel insertion in Scottish Gaelic. *Phonology* 31. 123–153.

Hammond, Michael, Yan Chen, Elise Bell, Andrew Carnie, Diana Archangeli, Adam Ussishkin, Muriel Fisher (2017) Phonological restrictions on lenition in Scottish Gaelic. *Language* 93.2: 446–472. DOI: https://doi.org/10.1353/lan.2017.0020

Schertz, Jessamyn, Diana Archangeli, Andrew Carnie, Jae-Hyun Sung, Lionel Mathieu, Michael Hammond, Natasha Warner, Brenna Ward, Chelsea Milburn, Peter A. Brown, Daniel Brenner, Collin Gorrie and Andrea Davis. 2011. The articulation of epenthetic vowels in

Scottish Gaelic. Paper presented at the 14th International Congress of Celtic Studies, Maynooth Ireland, 2–5 August.

Sung, Jae-Hyun, Diana Archangeli, Ian Clayton, Daniel Brenner, Samuel Johnston, Michael Hammond, and Andrew Carnie. 2014. The articulation of lexical palatalization in Scottish Gaelic. Poster presented at the 167th Meeting of the Acoustical Society of America, Providence, RI, 5–9 May.

Sung, Jae-Hyun, Diana Archangeli, Daniel Brenner, Ian Clayton, Samuel Johnston, Michael Hammond, and Andrew Carnie. 2013. The articulation of Scottish Gaelic plain and palatalized consonants. Paper presented at Utrafest VI, Queen Margaret University, 6–8 November.

Warner, Natasha, Andrew Carnie, Daniel Brenner, Micaya Clymer, Lionel Mathieu, Jae-Hyun Sung, Jessamyn Schertz, Michael Hammond, Diana Archangeli, Muriel Fisher, and Collin Gorrie. 2011. Nasalization and frication in Scottish Gaelic. Paper presented at the14th International Congress of Celtic Studies, Maynooth Ireland, 2–5 August.

Warner, Natasha, Andrew Carnie, Muriel Fisher, Jessamyn Schertz, Lionel Mathieu, Collin Gorrie, Michael Hammond, and Diana Archangeli. 2011. The timing of perceptual cues in Scots Gaelic. Paper presented at the annual meeting of the Acoustical Society of America, San Diego, 30 October–4 November.

Warner, Natasha, Daniel Brenner, Jessamyn Schertz, Andrew Carnie, Muriel Fisher, and Michael Hammond. 2015. The aerodynamic puzzle of nasalized fricatives: Aerodynamic and perceptual evidence from Scottish Gaelic. *Laboratory Phonology* 6 (2). 1–44.

Warner, Natasha, Daniel Brenner, Jessamyn Schertz, Andrew Carnie, Muriel Fisher, and Hammond, Michael. 2014. The aerodynamic puzzle of Scottish Gaelic nasalized fricatives. Paper presented at Dag van de Fonetiek, Utrecht, the Netherlands, 17 December.

Warner, Natasha, Daniel Brenner and Andrew Carnie. 2012. Nasalized fricatives vs. approximants in Scottish Gaelic. Paper presented at the Celtic Linguistics Conference 7, University of Rennes II, 23 June.

Warner, Natasha, Ian Clayton, Andrew Carnie, Muriel Fisher, Daniel Brenner, Michael Hammond, Diana Archangeli, and Adam Ussishkin. 2013. Perception of Scottish Gaelic alternating (leniting) consonants. Paper presented at the annual meeting of the Acoustical Society of America, San Francisco, 2–6 December.

Warner, Natasha, Ian Clayton, Daniel Brenner, Andrew Carnie, Michael Hammond, Muriel Fisher. 2014. The effect of Gaelic initial consonant mutation on spoken word recognition. Paper presented at the Celtic Linguistics Conference 8, Edinburgh, 6–7 June.

Warner, Natasha, Ian Clayton, Daniel Brenner, Andrew Carnie, Michael Hammond, Muriel Fisher. 2014. The effect of Gaelic initial consonant mutation on spoken word recognition. Paper presented at the annual meeting of the Linguistic Society of America, Minneapolis, MN, 2–5 January.

Warner, Natasha, Jessamyn Schertz, Andrew Carnie, Muriel Fisher, Lionel Mathieu, Collin Gorrie, Michael Hammond and Diana Archangeli. 2011. Timing of perceptual cues in Scots Gaelic. *Journal of the Acoustical Society of America*. 130 (4). 2573.

Warner, Natasha, Jessamyn Schertz, Andrew Carnie, Muriel Fisher, Diana Archangeli, Michael Hammond, Lionel Mathieu and Collin Gorrie. 2012. Timing of perceptual cues in Scots Gaelic sound distinctions. Paper presented at the Celtic Linguistics Conference 7, University of Rennes II, 23 June.

Ussishkin, Adam, Natasha Warner, Ian Clayton, Daniel Brenner, Andrew Carnie, Michael Hammond, and Muriel Fisher. 2017. Lexical representation and processing of word-initial

morphological alternations: Scottish Gaelic mutation. *Laboratory Phonology: Journal of the Association for Laboratory Phonology*, 8 (1). http://www.journal-labphon.org/article/10.5334/labphon.22/ (accessed 25 May 2017).

References

Bentin, Sholomo, Gregory McCarthy, and Charles C. Wood. 1985. Event-related potentials, lexical decision and semantic priming. *Electroencephalography and clinical Neurophysiology*, 60 (4). 343–355.

Bowern, Clare, and Natasha Warner. 2015. Lone wolves and wollaboration: A reply to Crippen and Robinson (2013). *Language Documentation & Conservation* 9. 59–85. https://scholarspace.manoa.hawaii.edu/bitstream/handle/10125/24634/bowern_warner.pdf (accessed 25 May 2007).

Clemens, Lauren E., Jessica Coon, Peter Graff, Niclás A. López, Adan Morgan, Pedro M. Pedro, and Narua Polinsky. 2012. Experimental design for field linguists. Paper presented at the annual meeting of the Linguistic Society of America, Portland OR, 5–8 January.

Crippen, James A., and Laura C. Robinson. 2013. In defense of the lone wolf: Collaboration in language documentation. *Language Documentation & Conservation*. 7. 123–135. https://scholarspace.manoa.hawaii.edu/bitstream/10125/4577/1/crippenrobinson.pdf (accessed 25 May 2017).

Czaykowska-Higgins, Ewa. 2009. Research models, community engagement, and linguistic fieldwork: Reflections on working within Canadian indigenous communities. *Language Documentation & Conservation* 3 (1). 15–50. https://scholarspace.manoa.hawaii.edu/bitstream/10125/4423/1/czaykowskahiggins.pdf (accessed 25 May 2017).

Dixon, Robert M. W. 1997. *The rise and fall of languages*. Cambridge University Press.

Dwelly, Edward. 2001. [1902–1912]. *Illustrated Gaelic-English dictionary*. Edinburgh: Birlinn.

Green, Anthony D. 2006. The independence of phonology and morphology: The Celtic mutations. *Lingua* 116 (11). 1946–1985.

MacBain, Alexander. 1911. *An etymological dictionary of the Gaelic language.* University of Stirling dissertation. http://www.ceantar.org/Dicts/MB2/index.html (accessed 25 May 2017).

MacFarlane, M. 1912. *The School Gaelic dictionary.* Stirling: Eneas Mackay. https://archive.org/details/cu31924026841043 (accessed 25 May 2017).

Mark, Colin. 2003. *The Gaelic-English dictionary*. London: Routledge.

Norcliffe, Elisabeth Alice C. Harris, T. Florian Jaeger. 2015. Cross-linguistic psycholinguistics and its critical role in theory development: Early beginnings and recent developments. *Language Cognition and Neuroscience* 30. 1009–1031

Pike, L., and Maolalaigh, R. Ó. 2013. Faclair na Gàidhlig and Corpas na Gàidhlig: New Approaches Make Sense. E-prints. http://eprints.gla.ac.uk/119406/7/119406.pdf (accessed 25 May 2017).

Rice, Keren. 2010. The linguist's responsibilities to the community of speakers: Community-based research. In Lenore A. Grenoble and N. Louanna Furbee (eds.) *Language documentation: Practice and values*, 25–36. Amsterdam: John Benjamins.

Rice, Keren. 2011. Documentary linguistics and community relations. *Language Documentation & Conservation* 5. 187–207.

Whalen, Doug and Joyce M. McDonough. 2015. Taking the laboratory into the field. *Annual Review of Linguistics* 1 (1). 395–415.