Incorporating sign language phonetics & phonology exercises into the linguistics classroom*

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1 Introduction

In many introductory linguistics courses, instructors make a point of including at least a brief section on sign languages, trying to help students understand that languages exist in multiple modalities[1] and have analyzable linguistic structures. Often, though, after that first mention, sign languages essentially disappear from the standard linguistics curriculum, potentially leaving students with an impression that linguistic research on sign languages is not possible or not active, and/or that such research is somehow secondary to 'main-stream' research on spoken languages. We

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The author order is alphabetical.

[1] Our discussion in this paper focuses only on visual sign languages, but we acknowledge the existence of tactile sign language(s) as well; see e.g. granda and Nuccio (nd) and Edwards and Brentari (2020) for discussion of protactile sign in particular. We have not yet included these in our classroom discussions and exercises, but hope to do so in the future.

doubt that most instructors intend for this to be the lesson learned, and recognize that changing the standard practice can be time consuming and difficult. One difficulty is that, while there are many linguistic similarities across the two modalities, there are also important differences, which instructors may not be familiar with and/or may feel are too complicated to 'get into' when there is limited time in a course. This is not a new observation; others have discussed this problem as well (see, e.g., Hochgesang 2019; Lillo-Martin and Hochgesang 2022; Sanders, Umbal, and Konnelly 2020; Zuraw 2022).

Our goals in this paper are (1) to motivate the importance of including sign languages in the linguistics classroom, from sociocultural, empirical, and theoretical perspectives, and (2) to share our experiences of getting started on such efforts in our phonetics and phonology courses, from a practical perspective.

It is important for us to acknowledge that we are both hearing and in the process of learning a sign language, specifically American Sign Language (ASL), and about Deaf culture(s). We hope that, by foregrounding d/Deaf-authored[2] resources that we have consulted, we contribute to ensuring that future discussions of sign languages in the classroom are accurate and culturally sensitive. We also hope that this paper addresses some of the concerns that may have been keeping other hearing instructors from taking the first step in starting such discussions.

The paper is structured as follows: we start by sharing our motivation for incorporating sign language data throughout the curriculum (Section 2). This is followed by a discussion of some of the practical considerations that we have faced in the process of including sign languages in our courses (Section 3), namely understanding the sociocultural contexts of sign languages (Section 3.1), thinking about finding data sources (Section 3.2), and dealing with the question of how to present data to students (Section 3.3). This includes the issue of transcription, which we see as one of the major obstacles in engaging students in in-depth phonetic and

[2] We follow the convention to "use the lowercase *deaf* when referring to the audiological condition of not hearing, and the uppercase *Deaf* when referring to a particular group of deaf people who share a [sign] language...and a culture" (Padden and Humphries 1988: 2). See also discussion in e.g. Padden and Humphries 2005, who note that the convention was started by James Woodward in the 1970s.

phonological analyses of sign languages within the limited course time. These topics are illustrated by exercises that we have designed for use in the undergraduate curriculum.

2 Motivation for incorporating sign language data

2.1 Sociocultural and empirical perspectives

The linguistics classroom can and should be a place where students can become increasingly aware of minority communities through respectful and accurate discussions of minority and/or under-represented languages. In the context of sign languages, our goal is to ensure that every student coming out of our curriculum has accurate knowledge of sign languages, Deaf cultures, and issues of audism ("the notion that one is superior based on one's ability to hear or behave in the manner of one who hears," coined and defined in Humphries 1977: 11–12), so that they can be allies to d/Deaf communities in the larger society.

As Henner and Robinson (2023) point out, *modality chauvinism*, which they define as "beliefs and actions that support the superiority of one modality over others" (11), is still perpetuated in research and teaching practices in theoretical linguistics, both through limited discussions of sign languages and the nature of such discussions. One of the examples they provide is the common practice of defining *linguistics* (and phonetics and phonology in particular) with focus on speech sounds and no reference to sign languages. They remark, "[t]he artificial limitation of linguistics to speech is an extension of the cultural belief that the most or only valid languaging is speech" (12). It seems then that the linguistics classroom must be one of the first places to challenge such a belief. Of course, this presupposes that we as researchers and instructors are aware of the issues and educate ourselves (see also Section 3.1). Lillo-Martin and Hochgesang (2022) similarly emphasize the importance of instructors who are not involved in research on sign languages nonetheless understanding such research and including discussions of sign languages in their teaching. They argue that failure to include sign languages in linguistic theories is failure to understand the full capacity of the language faculty.

At the same time, we are not advocating for having sign languages be used in examples for *all* topics in all courses. However, we do think that

it is essential to incorporate discussions of sign languages into the curriculum in a periodical, programmatic manner rather than consolidating them into a section specifically on sign languages, or relegating them to a separate course. Again, the latter approaches would likely reinforce the misconception that research on signed languages is somehow secondary to that on spoken languages.

2.2 Theoretical perspectives

From the perspective of theoretical training, one significant merit of discussing sign language data in the classroom is that actively comparing how the same linguistic properties manifest in both spoken and signed languages helps reinforce students' understanding of theoretical concepts they encounter. For example, in an introductory phonology course after the concept of minimal pairs has been introduced, a data set from a sign language can provide an opportunity both for the instructor to check the students' understanding of the concept and for the students to practice applying the concept. Figure 1 illustrates such an exercise. A set of words from ASL are provided, with some of them forming minimal pairs or near minimal pairs with each other (the figure shows an excerpt from the original, which had nine signs for students to examine).[3]

This is a new challenge for the students; through similar minimal pair exercises on spoken languages, they may have developed a habit of looking for two strings of IPA transcriptions that differ in one symbol, but the same 'recipe' would not work when faced with raw data from a sign language. Without a transcription, and especially if they have limited knowledge of each parameter in the signed modality, the students may have no preconceptions about which parameters they should argue to be contrastive. They must extend their understanding of the concept of contrast and a 'minimal pair' to a more abstract level. At the same time, working on this exercise allows the students to find out about the highly

[3] We recognize that the use of raw, visual data instead of machine-legible transcriptions in the exercises presented in this paper may make them inaccessible to blind and deafblind students and instructors. This issue is partially due to the lack of universally adopted, machine-legible transcription systems (see Section 3.3; though see SiGML (Elliott, Glauert, Jennings, and Kennaway 2004)). In this particular case, the issue could be addressed by providing prose descriptions of each element in each video.

Parameters in ASL

Below are data from American Sign Language (ASL). Among handshape, location, movement, orientation, the number of the hands involved, and duration, which ones can be argued to be contrastive in ASL, and why? Use the data to support your answer. (The images are the final state of the sign. Click on the link to see each video.)

Figure 1: An example of a minimal pair exercise in ASL, with data from Sehyr et al. (2021).

simultaneous nature of phonological structures in sign languages, even with relatively little theoretical knowledge of sign language phonology. See also Figure 3 in Section 3.3 for an exercise using a morphological process in ASL to reinforce the concept of auto-segmental representation.

3 Practical considerations

Once the decision has been made to incorporate sign languages into the linguistics curriculum, the actual implementation can begin. There are a variety of considerations that make doing research with signed language data different from doing research with spoken language data (see e.g., Quer and Steinbach 2019), and the same considerations hold when trying to incorporate these languages into our classrooms. In this section, we focus on three issues: understanding the sociocultural context of sign languages, obtaining linguistic data, and presenting those data to students.

3.1 Sociocultural contexts

The very first step is to learn about the cultural contexts of sign languages.[4] One thing to keep in mind is that some of the materials about sign languages found online, including language teaching materials, are created by hearing people who are not fluent in the language nor part of a Deaf community. Use of inauthentic materials by hearing people would contribute to misrepresentation and cultural exploitation, and we recognize that ignorance on our part could have a negative sociocultural impact on d/Deaf communities. We check the resources we use for the cultural and linguistic status of the authors, in addition to the licensing and permissions associated with the re-use of such materials.

This is not to say that hearing people can't be fluent signers nor that they can't research sign languages. Nevertheless, we do prioritize highlighting the works of d/Deaf signers whenever possible.[5] Our own literacy for finding culturally authentic sources primarily comes from learning ASL from Deaf instructors and meeting members of the local Deaf and signing communities, and we are in a continuing learning process. We believe that cultural sensitivity can be fostered in the classroom as well. In fact, discussions about finding linguistically and culturally accurate resources about sign languages periodically come up in our classroom, especially in upper-year seminars with a research paper component.

Some examples that we have used for educating both ourselves and our students include the book *Inside Deaf Culture* (Padden and Humphries

[4] We think it's useful for linguistics instructors to think about the cultural context of *all* languages they include in their courses, but also recognize that it's not practical to go into depth if one includes a diverse range of languages. However, for sign languages in particular, there is a wealth of misinformation that students often come in with, and we do think it is imperative that some of it be addressed (especially for programs in which students are likely to be interested in careers in Speech Language Pathology or Audiology).

[5] Note that we specifically avoid referencing 'native' signers, regardless of hearing status. See e.g. Cheng, Burgess, Vernooij, Solís-Barrosol, McDermott, and Namboodiripad (2021) for discussion of why the concept of a 'native' user of a language is problematic for all languages and Quer and Steinbach (2019) for discussion of why it's particularly problematic for sign languages. See also Henner and Robinson (2023) for more general discussion of the problematic history in linguistics of assigning value judgments to different ways of using language, including the idea of 'fluency.'

2005) by Carol Padden and Tom Humphries, who are long-time leaders in the Deaf ASL language / linguistics studies community, and the novel *True Biz* by Deaf writer and instructor Sara Nović (Nović 2022), which introduces a lot of context for Deaf culture and the importance of access to sign language in a less formal/academic style. It is also important to note that many sources authored by members of Deaf communities will themselves be in sign languages and therefore video-based: the documentary *Audism Unveiled* (Bahan, Bauman, and Montenegro 2008) is produced by members of the Deaf Studies department at Gallaudet University and entirely narrated in ASL (with subtitles in several spoken languages), and there are also various YouTube playlists of presentations hosted by e.g. TEDx Gallaudet (TED 2014). The website HandSpeak® (Lapiak 1995), created and maintained by Deaf and natively signing ASL instructor and literary media creative Jolanta Lapiak, offers a collection of her articles on ASL and Deaf culture that are searchable by topic. This is by no means an exhaustive list of resources — just a starting point for instructors looking for Deaf-led general introductory materials.

We should say, too, that starting the initial discussion of sign languages in an introductory course involves devoting designated class time for both cultural and theoretical contextualization. Devoting this time in an introductory course means that students acquire the basic foundation that instructors of subsequent courses can build on whenever data from a sign language become relevant. Otherwise, having sign languages appear only sporadically in a student's curriculum can lead to additional practical difficulties in re-introducing foundational concepts across courses.

3.2 Sources of linguistic data

Once the sociocultural foundations are laid, specific sign language data for illustrating particular linguistic concepts need to be found. Given both the visual nature of sign languages and the fact that many are understudied, we are often required to look for sources outside of the traditional academy (see also Quer and Steinbach 2019). Hou, Lepic, and Wilkinson (2022) discuss many of the practical and ethical considerations that arise when using sign language data collected from the internet for research purposes, and again, many of the same points hold for developing data sets for the classroom. One particular consideration is that instructors

may have a limited understanding of dialectal differences within a sign language. To avoid unknowingly misrepresenting data from multiple dialects as a single dialect, whenever possible, we try to use data signed by a single person within one exercise, unless we have a good reason to think that the data come from the same variety (or are specifically trying to illustrate linguistic variation).

For ASL in particular, most of our existing exercises draw from five lexical databases / dictionaries: (1) the dictionary on HandSpeak® (Lapiak 1995; https://www.handspeak.com/); (2) the dictionary on a site called 'American Sign Language University,' created by Deaf professor Bill Vicars (Vicars 1997; http://www.lifeprint.com/index.htm); (3) the online lexical database ASL-Lex (Sehyr et al. 2021; https://asl-lex.org/index.html); (4) the ASL portion of the global SignBank project (https://signbank.cls.ru.nl/), ASL SignBank (Hochgesang, Crasborn, and Lillo-Martin 2023; https://aslsignbank.haskins.yale.edu/); and (5) the print-only *Canadian Dictionary of American Sign Language* (Bailey and Dolby 2002).

One excellent starting place for looking for sign language data in sign languages beyond ASL is the 'Sign Language Dataset Compendium' (Kopf, Schulder, and Hanke 2022; https://www.sign-lang.uni-hamburg.de/lr/compendium/index.html), "an overview of digital resources for signed languages suitable for research." It includes resources for more than 80 different sign languages, including both corpora and lexical / dictionary resources, and provides information on what data are available and how they may be accessed, shared, and cited.[6]

Another resource is Berez-Kroeker, McDonnell, Koller, and Collister (2022), which contains several chapters specifically dealing with different kinds of sign language data. The focus of the volume is on data management for research use, but there are many references to existing data sources that may prove useful for instructors looking for data sets. Relevant chapters include Palfreyman (2022) on fieldwork data, Hochgesang (2022) on acquisition data, and Crasborn (2022) on corpora. Relatedly, Fenlon and Hochgesang 2022 is an entire volume on sign language corpora, with a dedicated chapter on utilizing such sources (Börstell 2022).

[6] Note that being listed in the compendium does not mean that the data are freely available for use in exercises or publications; each source simply has its license information listed.

3.3 Presenting data to students

The final practical consideration we address here is how to actually present sign language data to students, with specific focus on the phonetic and phonological domain. Many of the differences between signed and spoken languages come down to the very difference in modality (see e.g. Meier 2002; Quer and Steinbach 2019). That is, while there are many similarities in phonological structure between signed and spoken languages, the fact that they are communicated using different modes results in many apparent differences. For example, signed and spoken languages are similar in that they both show duality of patterning; they both have 'phonemic' elements that can be substituted to form minimal pairs; these phonemic elements can be broken down into phonological features; these various elements have hierarchical structure; there are processes like assimilation and deletion that can apply to these elements; there are higher-level, prosodic elements; and phenomena like markedness govern the distribution of these elements (see e.g., Fenlon, Cormier, and Brentari 2015; Sandler 2012). However, the details of each of these areas diverge when it comes to actual implementation (oral/acoustic vs. corporeal/visual). While in some sense, this difference in the substance of the elements is 'small', it is also *fundamental* when every structural similarity to be found in the domain of phonology is embedded in, and perhaps masked by, the physical substance. In a classroom, especially in introductory courses, students are often only beginning to understand how to think about *any* language in terms of its internal structure. Such unfamiliarity with the basic elements then magnifies the apparent differences between signed and spoken languages, and these differences are not at all insignificant when it comes to including exercises on sign languages in the classroom.

Particularly notable is the fact that language data in these two modalities must be represented differently. Much of the data typically included in linguistic exercises is transcribed, and for spoken languages, this usually means using the International Phonetic Alphabet (IPA) or an adaptation of it. Teaching students about the IPA and having them practice it enough to at least recognize transcriptions generally takes at least a week in our introductory courses, and often focuses on transcription of a language that the students are presumed to be familiar with (e.g., English at

universities in Anglo Canada), with the expectation that students can then extrapolate the principles to other spoken languages as they encounter such data. Because sign languages use a different modality, the transcription system *cannot* be the same. This means that, if transcribed data are to be used, a significant period of time would also be needed to teach students about a second method of transcription, and the amount of time needed would likely be even greater than the time it takes to introduce students to IPA, because of the greater degree of starting unfamiliarity with sign languages for many students. Added to this are the facts that there is no single agreed-upon transcription system for signed languages akin to the widespread acceptance of the IPA for spoken languages and that many instructors are themselves not already familiar with such systems as do exist (e.g., Stokoe notation (Stokoe, Casterline, and Croneberg 1965), Prosodic Model notation (Eccarius and Brentari 2008), the Hamburg Notation System (HamNoSys; Prillwitz, Leven, Zienert, Hanke, and Henning 1987), or Sign Language Phonetic Annotation (Johnson and Liddell 2010, 2011a,b, 2012, 2021; Liddell and Johnson 2019); for discussion of these various systems, see Hochgesang 2014). This means that choosing a means of representation to make sign language data accessible is not trivial.

In many cases, it may be easiest to simply represent the data in visual form, as images or videos. While this can be effective, it should also be approached with caution. There are reasons that instructors tend to present data in phonologically transcribed forms to students: such forms have already been 'massaged' by the transcriber to reflect the important information and level of detail needed for further analysis. Most instructors would probably consider handing introductory students a set of sound files from an unfamiliar language and asking them to analyse a phonological process within them a completely ridiculous idea. The implausibility of such a task largely comes from the level of detail present in a recording; how is a student to know from a small data set whether, e.g., variations in pitch are phonemic, syntactic, semantic/pragmatic, or accidental in nature? The same is true for sign language data: unless the viewer is familiar with the language, there is no way to know which formational elements play which role. For example, consider the two signs shown in Figure 2. These are still images from tokens of two different lexical items in ASL; the one on the left is an image from the sign for the third person singu-

lar reflexive pronoun (HIMSELF/HERSELF), while the one on the right is an image from the sign for BEAT or ABUSE. Which elements are phonologically important? In fact, the key difference between these signs as visible here[7] is the extension of the thumb on the right hand in the reflexive, as compared to its being folded under in BEAT.

Figure 2: Two different lexical items in ASL, SELF on the left (Vicars 1997; http://www.lifeprint.com/asl101/pages-signs/s/self.htm) and BEAT on the right (Vicars 1997; https://www.youtube.com/watch?v=Y5NQ0WsJ_zk), illustrating both phonological differences and non-lexical variation.

At the same time, there are visible differences in other properties of these tokens. First, this token of BEAT has a facial expression absent in SELF (3.sg). Second, the angle at which the left index finger is pointing is different between the two pictures. While both facial expression and hand orientation can be lexically contrastive, they are not in this particular instance. (For evidence of the non-lexical status of these properties in these signs, compare the tokens pictured here to those shown on Handspeak® (Lapiak 1995), for example: the second video at https://www.handspeak.com/word/3584/ (SELF, 3.sg.) vs. https://www.handspeak.com/word/5096/ (BEAT).)[8]

[7] The movements are also different in the signs, but that is not detectable in a still image without adding e.g. arrows.

[8] That is not to say that the orientation and facial expression are not related to the semantic content of the sign. This might be considered somewhat similar to the fact that the English word 'beat' is lexically /bit/ but could be produced with different pitch, volume, rhythm, or voice quality characteristics, some of which

The point here is that examining 'raw' data, while it avoids the problem of transcription, also deprives students of the benefits of clean transcriptions to compare. This problem of representation has cascading effects for instructors: almost all of our typical phonological exercises involve transcribed data; how do we present an advanced problem on a specific topic if there's not a foundational transcription system to use? More broadly, given the limited amount of time to discuss these issues in most courses, how can we set students up for a successful understanding of linguistic structure with sign language examples, when there are so many modality-specific representational differences?[9]

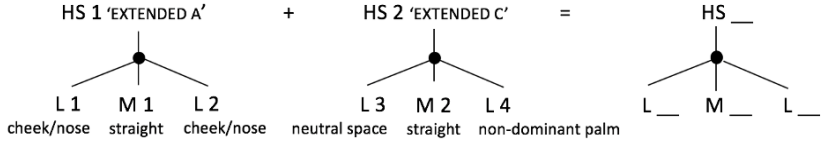
The approach we have used most has been scaffolding, or providing students with basic support for tasks that are somewhat outside of their current state of understanding (Wood, Bruner, and Ross 1976), when discussing sign language data at any point of the curriculum. As an example, consider an exercise from a relatively advanced phonology course, after the concept of auto-segmental representation is introduced. Data about phonological assimilation in ASL compounds provide an excellent opportunity for testing and reinforcing students' understanding. An excerpt from one such exercise is in Figure 3. This exercise requires students to figure out which phonological elements of each component sign end up in the compound sign. In doing so, the students are expected to observe and describe instances of delinking and spreading. However, other than having a basic background in knowing that sign languages have linguistic structure, students do not need to be able to phonetically analyze the data or read transcriptions. Instead, all relevant vocabulary is included in the exercise itself, and the actual response from students involves simply giving the labelling number for the handshape, movement, and locations that appear in the final compound; no transcription system is needed.

may illustrate or reflect a particular instance of beating.

[9] Also important, though not addressed here, is that instructors need to be careful in interpreting data. It is important for instructors who are not themselves familiar with sign language data that they are using not to make assumptions about the phonological structure, but rather to rely on expert analysis.

Compounds in ASL

Below is a sample representation of a compound sign WIFE using the Hand-Tier model (Sandler and Lillo-Martin 2006). "L" stands for Location and is defined as "the starting and ending point that the hand traverses in articulating the sign" (p. 133). "M" stands for Movement. "HS" is a shorthand for handshape.
Complete the representation of the compound sign WIFE. Fill in the blanks with numbers to indicate which HS, L, and M from the component signs are seen in the compound.



GIRL: Thumbtip of right EXTENDED A hand, palm left, is placed on the right cheek and is stroked forward/downward. Motion may be repeated.

MARRY: EXTENDED C hands are held apart with palms facing and the right hand slightly above the left. The hands are then clasped together.

WIFE: Thumbtip of right EXTENDED C hand, palm down, is positioned at right cheek and the hand is brought downward to clasp left EXTENDED C hand, of which palm faces upward.

Figure 3: An example of an exercise on compounding in ASL, with data from Bailey and Dolby (2002: 279, 406, 825).

Similar approaches can be used for almost any level of exercise. The example in Figure 1 above, for example, uses these techniques. The instructions explicitly provide the list of characteristics to focus on, and brief descriptions of each of these could also be provided if needed. Other examples might include having students match signs to descriptions of the phonetic content to learn about articulation or to specific phonetic transcriptions using one (or more!) of the proposed transcription systems for sign languages to learn about transcription, or having them put a set of

signs in order of phonological markedness or predicted age of acquisition, etc. The key idea of scaffolding in this context is that the instructor has done a fair bit of work on the selection of individual signs and provided relevant descriptions, to allow the students to focus on the conceptual structure of an analysis and not worry about the vocabulary and lack of transcription of the specific items.

4 Conclusion

In this paper, we have shared our experiences of developing and incorporating phonetic and phonological exercises on data from sign languages in the linguistics classroom. Our motivation for this effort includes 1) increasing our students' awareness of sign languages as a fundamental part of empirical linguistic data and 2) enhancing our students' understanding of theoretical concepts by applying them to different modalities. We have addressed some practical considerations, namely understanding the sociocultural contexts and prioritizing d/Deaf-led resources in that process, finding linguistic data, and presenting data to students, with particular focus on the issue of transcription.

We hope that our lessons learned, specific pointers to cultural and linguistic resources, and examples of exercises we have developed have addressed some of the initial challenges likely faced by readers considering undertaking similar efforts. We strongly hope that such readers will not stop at our paper. Instead, it is intended as a starting point, for referring to the resources cited here and beyond, especially those authored by d/Deaf people, and for thinking in practical terms about incorporating discussions of sign languages into the curriculum in accurate and culturally sensitive ways.

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