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Identifying, documenting, and describing marginal phonemes: A fieldworker's guide

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ABSTRACT

This paper provides a guide to linguistic fieldworkers for identifying, documenting, and describing sound segments that may be marginal in a language's phonological system. The main contribution of this study is a detailed discussion of linguistic fieldwork methods for investigating different factors that may influence phonological marginality. A proposed scale helps assess a presumed contrast's relative position on a continuum of marginality. Each factor's possible impacts on a sound's marginality are discussed, and a holistic approach is proposed. This guide is mostly aimed at fieldworkers working with lesser-documented languages, and the emphasis is on practical application rather than theoretical modelling.

KEYWORDS

marginal, phoneme, fieldwork, documentation, phonology

1. INTRODUCTION

Sound segments are basic building blocks of spoken language. Of all possible speech sound types that most human beings are able to produce, each natural spoken language uses a subset. Phonological theory generally groups the sounds used in a specific variety into phonemes – abstract underlying units which can have as surface representation one or more of the sounds that the language uses. A phoneme does not normally encode meaning by itself, but a basic characteristic of a phoneme is that it contrasts with other phonemes to distinguish meaning.

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An often-cited diagnostic for determining whether two sounds contrast with each other is the presence of at least one minimal pair of lexical items whose meaning depends on that contrast. For example, the English words *van* and *fan* differ by their first sound. Even if very similar – both [v] and [f] are bilabial fricatives – their distinguishing feature is that of voicing; *van*~*fan* is one of many minimal pairs distinguishing these two sounds in English.

But what does a contrast actually entail? Phonemes' function to distinguish meaning means that they perform "work" in the linguistic system. However, some phonemes may be more "productive" than others. The term "functional load" has been used as a measure of "how much 'work' a contrast does for creating distinctions" (Salmons 2021, 163). This is a broad definition of functional load. Labov (1994, 328) offers a narrower measure of functional load where a proposed contrast's lexical opposition (how many minimal pairs a contrast is involved in) and lexical predictability (how skewed the distribution of the two sounds is) determine the contrast's functional load (see §§2.1, 2.2). This shows that variation in functional load is a matter of degree rather than of kind, which is also true for phonological marginality more generally (Scobbie & Stuart-Smith 2008; Hall 2013).[1] Functional load is a strong criterion for determining marginality. There are other factors that can determine functional load (both in the broad and narrow sense) and marginality more generally (see, e.g. Hall 2013; Scobbie & Stuart-Smith 2008, 106–107). The main purpose of this paper is to propose fieldwork methods for investigating factors that may play a role – and what role they may play more precisely – in determining the marginality of sounds on a continuum. Before turning to this discussion, some preliminaries are in order.

Many different terms have been used in the literature for phonemes that do relatively little work. Hall (2009, 9–10, 2013, 216) lists a number of terms, including "semi", "quazi", "weak", "partial", "fuzzy", "mushy", "gradient", or even "crazy". In the PHOIBLE 2.0 database (Moran & McCloy 2019) the authors point out the lack of standard terminology and list as "marginal" all phonemes which may be described as, e.g. "dubious" or "occur[ing] only in loan words". Here, in line with the approach of the entire volume, I adopt the term "marginal" (and derived terms), which also appears to be the most commonly used term in Hall's list and the term preferred by Moran & McCloy. It is worth pointing out, however, that Hall (2013) herself prefers the term "intermediate phonological relationships" to talk about such relationships that lie "between contrast and allophony". This choice is informed by the abovementioned fact that these relationships occur on a scale.

So far, I have only discussed sounds whose relationship to other sounds can be demonstrated by minimal pairs. If no minimal pair can be found, the general principle is that these sounds are allophones (variants of a phoneme), whether their distribution is complementary or (relatively) free. However, this does not mean that all allophones are of equal standing. Some (especially complementary) allophones may be considered to have a higher functional load (i.e. "do more work") than others because, e.g. they are involved in near-minimal pairs, and/or because their speakers may consider them to be more salient than others. Kerswill & Williams (2002, 81) define salience as "a property of a linguistic item or feature that makes it in some way perceptually and cognitively prominent". In other words, speakers may be more aware or less aware of

[1]Moreover, languages constantly change, adapting to different pressures in their ecosystems, which adds a temporal dimension to the puzzle.

a sound in their language. For example, native English speakers are not normally aware that [t] and [t^h] both exist as possible versions of the /t/ phoneme in English (Hall 2013, 223) and it can be safely assumed that the distinction between them does not play a major role in their language. Other sounds may be salient because they are found in special types of lexical items: words from a specific semantic domain, loanwords, or sound symbolic items such as onomatopoeia and ideophones.

Above, we have seen that there is scalar variation in both contrasting and non-contrasting relationships (based on the at-least-one-minimal-pair diagnostic for phonological contrast). Assuming that a non-contrasting relationship is always more marginal than a contrasting one (because of the importance of the meaning-bearing function of contrast), I propose a unified scale of phonological marginality (Figure 1) centred around the one-minimal-pair threshold, that is, around a relationship that is based on a single minimal pair in a language. Importantly, in this paper, I will use the term "marginal phoneme" to include those salient sounds that are involved in both contrasting and non-contrasting relationships (or "regular" and "not regular" phonemes, as per Evans 2022, 1003, cf. §4).

I have already mentioned a few factors that may determine whether a phoneme is marginal or not: the number of (near-)minimal pairs that it may be involved in, its phonotactic distribution, the speakers' intuitions, borrowing, sound symbolism, and semantic constraints on its distribution in the lexicon. In §2, I discuss in detail these factors as well as other factors, such as pragmatic and morphosyntactic constraints, and inter-speaker variation. I also look at what can be learned from observed patterns in the phonological system, and frequency effects. The factors I discuss are well-known, they are also among those listed in Hall (2013), and Scobbie & Stuart-Smith (2008, 106–107) and are to a large extent based on previous literature. The discussion in §2 is meant to provide a background for the rest of the paper and is not intended as an attempt to resolve theoretical issues. Hall already provides a detailed discussion of some of them including some theoretical implications, and readers are encouraged to explore that work and the many others on the topic.

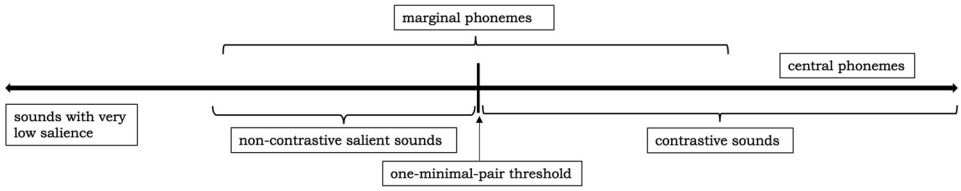

Figure 1. This marginality scale is proposed as a tool for accounting for both contrastive and non-contrastive sounds in a language's inventory. Central phonemes (which have unsubstantial distributional constraints and appear in many minimal pairs) are at the rightmost edge, while non-salient contrasts, like [t]~[t^h] in English, appear towards the leftmost edge. The line in the middle is where a sound involved in only one minimal pair would be positioned (presuming this as a basic phonemicity and salience test, and that no other factors pull this sound in either direction). It needs to be pointed out that the axis, the indicated spaces or cut-off points, in this figure are not meant to be categorical or proportionally represented

Last, but not least, an important issue when studying phonological marginality has to do with data availability. Considering the vast variety of factors that determine marginality, large amounts of detailed data are necessary in order to explore these relationships in detail. Of the 7,000 or so languages of the world, most are undocumented or underdocumented to an extent that few facts can be inferred about their marginal phonemes. Therefore, in §3, I focus on practical approaches to identifying, documenting, and describing marginal phonemes. This paper is thus especially aimed at linguistic fieldworkers working on lesser documented languages, especially those languages whose phonologies are not yet well studied. To my knowledge, this is the first detailed fieldwork guide to investigating marginal phonemes.

This paper's focus is on fieldwork and the collection of data for exploring marginal phonological contrasts. Theoretical discussions are limited here to what is relevant to the proposed methods. Resolving more concrete relevant theoretical issues is not the purpose of this paper. However, since theoretical debates depend on good quality and detailed data from as many languages as possible, this paper aims at improving the position of linguistic fieldworkers, even those without extensive training in phonetics and phonology, to collect data for investigating marginal contrasts in specific languages or from a typological perspective.

2. WHAT FACTORS CAN DETERMINE A SOUND'S MARGINALITY STATUS?

This section offers an overview of factors which may be relevant to determining marginality status in phonology, and discusses each one in some detail. It is framed around the marginality of segments, but it may be applicable to other phonological phenomena. The information in this section is based largely on existing literature, but also draw on the authors' own experiences. Hall (2013) is an elaborate account of various reasons that may explain marginality in phonology, Scobbie & Stuart-Smith (2008, 106–107) list a relatively large number of relevant factors, while numerous other publications focus on specific factors; these are cited below where relevant. I offer short summaries and explanations; longer elaborations are made where deemed necessary. Existing literature is cited for more detailed discussions. The purpose of this section is to serve as a stepping stone for formulating the guidelines for the fieldworker to identify, document, and describe marginal phonemes, which follow in §3. Its purpose is not to provide a comprehensive account of this vast topic.

The factors discussed below are: lexical opposition (§2.1), lexical predictability (§2.2), borrowing (§2.3), sound symbolism (§2.4), semantic, pragmatic and morphosyntactic constraints (§2.5), phonological patterns (§2.6), inter-speaker variation (§2.7), speaker intuitions (§2.8), and frequency effects (§2.9).

2.1. Lexical opposition

Lexical opposition is determined by the number of minimal pairs that depend on the distinction (assuming that such pairs exist) (Labov 1994, 328). In other words, this is a measure of how many homonyms would be created if the two compared phonemes were to merge. The fewer those minimal pairs are, the lower the lexical opposition is, which translates as higher marginality.

2.2. Lexical predictability

Labov's (1994, 328) lexical predictability factor is a measure of how skewed the distribution of two sounds is, with higher lexical predictability indicating higher marginality. This factor has to do with the extent to which the two sounds might be phonotactically constrained, thus straddling the space between phonemicity and conditioned allophony. This is based on the fact that two sounds may not contrast in all, or most,[2] phonological environments. For example, in languages with final obstruent devoicing (like German), voiced and voiceless obstruents may not contrast word-finally. This means that this contrast is neutralised in this position, which reduces predictability. While this skewed distribution may place sounds somewhat to the left of the rightmost edge on the marginality scale in §1, in most cases they are "still considered contrastive and thus not particularly problematic" (Hall 2013, 230).

The phonotactic restrictions may be various, e.g. a consonant may be restricted to either the syllable onset or coda, or to a certain position in a consonant cluster; a sound may only appear in specific syllables in the word (e.g. rounded vowels may only occur in the first syllables of words in some Uralic languages); a consonant may be restricted to before a certain type of vowels (e.g. linguolabials in some Oceanic languages appear only before non-front vowels, see Lynch 2020) or before a specific vowel (e.g. bilabial trills tend to appear only before /u/ in most languages, see Maddieson 1989). Arguably, these examples can be placed on a scale from less substantial to more substantial constraints, respectively (cf. Goldsmith 1995; Hall 2009).

2.3. Borrowing

The relationship between marginal phonemes and loanwords is well known. Language contact provides an opportunity for sounds from one language to enter the system of another through lexical borrowings. While lexical borrowings are often adjusted to the receiving language's phonotactics, borrowed words frequently retain some features of their original pronunciation in the donor language.

When a sound that is not native to the recipient language is retained in borrowings, such a sound can be termed a *xenophone*, and is expected to be more marginal than the recipient language's central phonemes because it is likely used in relatively few lexical items. When it comes to the effect of this on functional load, from a statistical point of view, it is less likely for xenophones to have high lexical opposition and low lexical predictability because of their restricted distribution in the lexicon.

Some examples of xenophones are: French borrowings into German may retain nasal vowels, not otherwise found in German, like the final vowel in *Restaurant* for many German speakers; the glottal and uvular plosives in Persian appear in Arabic borrowings (Bijankhan 2018); voiced plosives in Finnish appear (mostly) in words borrowed from various languages (Suomi, Toivanen & Ylitalo 2008); in Chamic languages (of the Austronesian family), implosives are found almost exclusively in loanwords from Mon-Khmer languages (of the Austroasiatic family) (Thurgood 1999). Retaining the donor language's sounds, rather than adjusting the

[2]In fact, arguably, it is somewhat rare that two sounds contrast in *all* possible environments.

pronunciation, may depend on, among other things, the receiving language's speakers' fluency in the donor language, patterns of multilingualism and speaker attitudes.

In some cases, loanwords may not introduce a new sound to a language, but may contribute to a native allophone's "promotion" towards a more phonemic (i.e. less marginal) status. Hall (2013, 238) provides an example from English where [s] and [ʃ] do not normally contrast in initial consonant clusters in native vocabulary, but Yiddish loanwords such as *schlep* [ʃlɛp], *schmooze* [ʃmuz], *spiel* [ʃpiɬ], and *schtick* [ʃtɪk] can form (near-)minimal pairs with native words.

It should be pointed out that there might be variation in how and to what extent loanwords are adjusted in the recipient language, and to what extent and under what conditions borrowed sounds spread through its lexicon. An example of a detailed study on these matters is Bostoen & Donzo (2013) on the labial-velar stops in Lingombe, a Bantu language spoken in DR Congo, which were borrowed from neighbouring non-Bantu languages and later spread through the lexicon of Lingombe due to sound symbolism and speaker attitudes.

2.4. Sound symbolism

Some marginal phonemes may be linked to sound symbolism. Sound symbolism is observed in lexical items, in which there is a perceptual connection between the phonetic form and the concept being expressed. It can take different shapes, the most common ones being onomatopoeia and ideophones. In onomatopoeia, the sound of the word imitates its meaning, like the English word *purr* to denote a sound made by cats. An ideophone is "a member of an open lexical class of marked words that depict sensory imagery" (Dingemanse 2019). Ideophones are particularly common in some African, East Asian and Southeast Asian languages.

The unusual phonetic structure involved in sound symbolic items means that they often contain phones that are otherwise not used in the language, but have a "special dramaturgic function" (Voeltz & Kilian-Hatz 2001, 3). Sometimes, sounds employed in sound symbolic items are cross-linguistically rare sounds such as clicks or bilabial trills. It may be the case that such sounds share little phonetic similarity with any other sounds in a language's phonology, which may make it difficult to identify sounds to compare them with (cf. footnote 6 in §2.6). This alone may be a reason to consider such sounds as salient, albeit marginal, parts of the language's phonological system (Hall 2013). Cross-linguistically common sounds can also perform sound symbolic functions (see e.g. Johansson et al. 2020; Ibarretxe-Antuñano 2019). Thus, sound symbolism may also provide a mechanism for non-native sounds to enter the phonological system of a language and even become contrastive. Such is the case with /p/ and /ŋ/ in the Cariban language Katuena (Smoll 2015), palatalised stops in Pastaza Quichua (Nuckolls et al. 2016), or /ɸ/ in Japanese (Hamano 2019).

2.5. Semantic, pragmatic, and morphosyntactic constraints

Another factor that may play a role in the marginality of a sound is whether it occurs in contexts that are semantically, pragmatically and/or morphosyntactically restricted. Some examples follow. Evans (2022) describes three cases: In the language Nen, spoken in Papua New Guinea, the sounds [ã, ẽ, h] are restricted to interactional contexts (interjections and deictics), which demonstrates aspects of all three types of constraints discussed in this subsection. In English, [θ, ð] are mostly contrastive word-finally in a noun-verb pairs such as *wreath* [θ] (n.) ~ *wreathe*

[ð] (v.); *teeth* [θ] (n.) ~ *teethe* [ð] (v.), i.e. the contrast is mostly restricted to these word class paradigms.[3] On the other hand, word-initially there are no [θ]~[ð] contrasts,[4] and, more importantly to the point here, [ð] is found only in words such as *thou, thy, that, then, the, though*, which are morphosyntactically restricted to closed-class function words, and semantically restricted to meanings of person, space, time, and discourse deixis. Evans's third example comes from the Australian language Bininj Kunwok, where the glottal stop is primarily used in a morpheme (which comprises the glottal stop on its own) with three different grammatical functions. Finnish offers another example of a morphosyntactic constraint: in Finnish native vocabulary, [d] and [ŋ] appear only in the weak grade of morphemes with consonant gradation, i.e. their distribution in native vocabulary is dependent on a morphophonological condition, which arguably increases their marginality status.

On the other hand, the Oceanic language Avava, spoken in Vanuatu, offers an example of morphophonological conditioning, which can be argued to decrease the marginality of a sound. Namely, the marginal prenasalised bilabial trill phoneme in this language, which normally occurs only before /u/, can also surface before other vowels as a result of the following morphophonological process: where the third person singular irrealis prefix /^{m}b^{w}V- ~ ^{m}bV-/ appears before a verb root beginning with /v-/, /w-/ or /v^{w}-/, which is followed by a vowel other than /u/, the prefix vowel is elided and a [^{m}ʙ] systematically surfaces, as in: /^{m}b^{w}e-v^{w}el/ [^{m}ʙel] '3SG:IRR-come', /^{m}bi-vi/ [^{m}ʙi] '3SG:IRR-COP (he/she/it will be)' (Crowley 2006, 31–32). As demonstrated by the examples, this process is observed in core and frequent vocabulary, which suggests lower marginality (cf. §2.9). Avava's closely related neighbouring language Neverver, exhibits a similar process – when the irrealis prefix *m-* is attached to verb stems beginning with [β], the fricative is clearly trilled as in /im-βu/ [i^{m}ʙu] '3SG:IRR-go' (Barbour 2012, 34, 174). In Neverver, this process may contribute to higher type and token frequency (see §2.9) but the effect on decreasing marginality is lower than in Avava, because it does not produce bilabial trills before vowels other than /u/ (in Neverver, an [u] is inserted after the trill if the following vowel is not [u]) and thus does not result in lower lexical predictability.

Another important factor involves the morphosyntactic properties of the items in the minimal pairs. For example, if a minimal pair involves items of the same word class (and even subclass), and with the same grammatical marking, the lexical opposition may be more likely to persist because it does some "heavy lifting" that otherwise morphology, syntax and pragmatics would do. Or, as Van der Veen & Medjo Mvé (2010, 9) put it: "because of their ability to commute in identical or similar grammatical contexts, to potentially belong to the same paradigm". An example comes from Icelandic voiceless sonorants, such as /r̥/, which are already marginal phonemes since they only contrast with their voiced counterparts word-initially (Árnason 2005). Importantly, voiced and voiceless sonorants in Icelandic mostly form minimal pairs where the two members cannot belong to the same paradigm (because they are from different word classes) and/or mark different morphosyntactic categories, making them pragmatically already well distinguishable. This suggests a relatively low workload of such phonemic contrasts. Examples of such minimal pairs in Icelandic are *reyna* [rɛina] 'to try (verb, infinitive)' ~ *hreina*

[3]One exception is the word-medial contrast in some varieties of English between *either* [ð] and *ether* [θ] (a borrowing).

[4]There is word-initial contrast between *thy* [ð] and *thigh* [θ]. The value of this contrast is, however, somewhat diminished by the fact that *thy* is mostly archaic.

[r̥eɪna] 'clean (adj. F.NOM.SG and other forms)', and *rúta* [ru:ta] 'bus (feminine, NOM.SG)' ~ hrúta [r̥u:ta] 'ram (masculine, NOM/GEN.PL)'.[5]

These are just a few examples of the semantic, pragmatic, and morphosyntactic constraints that can determine sounds' marginality status. As they demonstrate, these constraints can operate within different domains of language structure, and the range of possible constraints is vast. In the case of lesser-documented languages, these will be uncovered as the documentation process progresses, demonstrating the iterative nature of work related to marginal phonemes (see §3).

2.6. Patterns in the phonological system

The place of a sound in the phonological system of a language is also a factor in determining its marginality. One important question is whether the sound groups with other sounds in the system according to shared features (e.g. a plain voiceless plosive in a language with a row of other voiceless plosives already established as central phonemes).[6] In other words, one needs to take into account how many features a sound shares with other sounds and what features tend to be contrastive in this language. Generally, it can be presumed that a sound that fits well into the phonological system of the language is less likely to be marginal. This has to do with the prominent question in phonology about the tendency for symmetry in phonological systems and its role in language evolution (see Blevins 2004, 281–285 for a detailed discussion of this elaborate issue). A marginal phoneme may occupy a place that would have otherwise constituted a gap in a phonological system. Bye (2013, 41) offers the example of English /ʒ/ which is a marginal phoneme found mostly in French loanwords, but also filled a gap in the existing fricative inventory of English, which had a voiced-voiceless distinction in its fricative series, except at the postalveolar place where only /ʃ/ existed. In another example, Rangelov, Walworth & Barbour (2023) argued that the emergence and persistence of the very typologically rare plain voiceless bilabial trill [ʙ̥] in some languages of Malekula Island in Vanuatu, was supported by an already existing gap in the trill inventory of these languages where there was already a prenasalization contrast in alveolar trills and a prenasalised bilabial trill. In some of these languages, the plain trill is contrastive and thus a (marginal) phoneme, while in others it appears to not be contrastive, but highly salient among speakers (cf. §§2.8, 3.6).

Marginal phonemes may also be leftovers of previously central phonemes that underwent a change. Thus, in Ahamb, one of the Malekula languages with bilabial trills, Proto-Oceanic prenasalised alveolar plosives likely changed to prenasalised alveolar trills (Tryon 1976), leaving a gap in the plosive inventory that involved a prenasalization contrast at the labial, alveolar, and velar places of articulation. The only two words with [ⁿd] that have been documented in

[5]In fact, many of these minimal pairs exist because of Icelandic's rich morphology.

[6]A related detail here is that for a sound to be considered for a contrasting or allophonic relationship, it is generally agreed that it needs to share some phonetic similarity – i.e. to share at least some phonological features – with the sounds it is compared or grouped with (Pike 1947). It is possible that sounds that are outliers in the language's phoneme inventory (i.e. they share few features with other sounds in the system, e.g. a single implosive or click sound in a language with no other such sounds), may persist by means of high salience, e.g. because they are employed in loanwords or sound symbolic items. By definition, an outlier sound should be considered marginal, unless other factors suggest otherwise.

contemporary Ahamb are [^{n}das^{n}das] 'smooth' and [nali^{n}dum^{n}dum] 'whale' (Rangelov 2020). In these examples, sound symbolism may play a role in disfavouring trilling, as trilling is known to be associated with roughness (Winter et al. 2022), and [^{n}dum^{n}dum] arguably better represents the size of a whale and the noises associated with its movements than *[^{n}rum^{n}rum] (which relates to sound symbolism, see §2.4).

It is important to note here that it may be relevant to determine the marginality not just of a specific sound but of a sound type within a phonological system. For example, Güldemann (2007), Sands & Gunnink (2019), and Brenzinger & Shah (2023) explore the marginality of clicks in different African languages for the purpose of comparing whether clicks are more or less marginal in different groups of languages, rather than within a single language (see §2.9 for more details on these studies).

Lastly, the size of the (hypothesized) phoneme inventory for a language may matter for some of the factors described in this section (Dockum & Bowern 2019, 49). A larger phoneme inventory means that, statistically, there will be fewer minimal pairs per contrast on average, since the lexicon is finite, or that an observed skewed phonotactic, semantic, pragmatic or morpho-syntactic distribution may be due to chance than actual phonotactic constraints (especially when the amount of data is limited). This problem is more apparent when dealing with extreme cases of languages with over a hundred phonemes, but it should also be considered in more "trivial" cases. What is important, however, is that in a larger-sized inventory more phonemes may be more likely to be marginal, which makes the averages mentioned above become less meaningful and the variation in the phonemes' distribution and other factors all the more important. Bulgarian palatal consonants offer a case in point. In traditional accounts of Bulgarian phonology (e.g. Stoykov 1951; Tilkov 1982), there are 16 palatal consonants (out of a total consonant inventory of 37), which are considered phonemic, albeit with limited distribution. They only appear before non-front vowels, unlike in other related languages like Serbo-Croatian and Russian, where they are found before all vowels and in the syllable coda. Whether palatal consonants in Bulgarian should be considered (marginal) phonemes or not is beyond the scope of this paper, but the importance of understanding factors like their distribution and phonetics (e.g. Simeonov 1984; Pritchard 2012) becomes clear (see also §3.4). Namely, once we understand their behaviour, the "working size" of Bulgarian's consonant inventory decreases substantially to very average levels (cf. Maddieson 2013).

2.7. Inter-speaker variation

A sound may be produced in various ways by different speakers of a given variety. Hall (2013, 239) uses the term "variability" of production to refer to differences between speakers where some may maintain a contrast while others neutralise it, and provides a few examples, which I won't repeat here.

An important detail is that inter-speaker variation is often related to sociolinguistic variables such as age, sex, prestige, etc. Such variation may indicate an ongoing diachronic process. For example, out of the 23 Oceanic languages of Malekula Island in Vanuatu in which bilabial trills have been documented, this sound appears to have been completely lost in one language, Uripiv (McKerras 2001; Moore 2019), and only present in the speech of the oldest generation in two other languages, Aulua (Paviour-Smith 2005) and Nahavaq (Dimock 2009); for Ahamb,

Rangelov (2019) observed inter-speaker variation which was not related to age or sex, but, likely to a speaker's attitude towards traditional values as opposed to modern values.

One issue in discussions of inter-speaker variation, especially for understudied languages, is that one needs to be confident that one is discussing variation within what is indeed a discrete variety (whether a language, dialect, sociolect, etc.).

2.8. Speaker intuitions

The native speakers of a language have metalinguistic intuitions, which may suggest how significant a role a sound plays in that language. The lack of awareness among English speakers of any contrast between [t] and [t^h], mentioned in §1, means that the distinction between them does not play a major role in this language. An example of the opposite can again be found with regard to the cross-linguistically rare bilabial trills, which are used in some Vanuatu languages. The speakers of the language Lamap (Port Sandwich) consider the plain voiceless bilabial trill [ʙ̥] to be a salient sound in their language even though this sound is not involved in any minimal pairs, has low frequency, and has very high lexical predictability (Williams 2019, 32, see also §3.6). One reason why these speakers may be considering ʙ̥ to be salient is the presence of the arguably marginal, but salient, prenasalised ^{m}ʙ in this language.[7] Even if there is no minimal pair in Lamap where ʙ̥ and ^{m}ʙ are contrastive,[8] they form a phonetic pair based on the presence or absence of prenasalization/voicing, which is also the case with most plosives in this language, thus fitting within the language's consonant inventory's patterns. Thus, for Lamap, speaker intuitions suggest that ʙ̥ sits slightly to the left of the minimal pair threshold on the marginality scale. In the related language Ahamb, ʙ̥ is involved in a few minimal pairs and appears to have slightly higher frequency than in Lamap (Rangelov, Walworth & Barbour 2023), which puts it slightly to the right of the minimal pair threshold on the marginality scale. Furthermore, Ahamb speakers also perceive this sound as a salient feature of their language, which moves the sound even further to the right on the scale, than what lexical opposition alone would suggest.[9]

2.9. Frequency

In language descriptions, the frequency of a phoneme is often correlated with its marginality. Hall (2013, 241) points out that this criterion correlates with other criteria, such as borrowing (§2.3), namely that if a sound occurs only/predominantly in loanwords, it is likely that it will occur with little frequency overall. In fact, it can be said that frequency is a proxy for a rough

[7]Another reason probably has to do with the unusual articulatory nature of these sounds and their visual availability (Rangelov, Walworth & Barbour 2023). It appears that not only speakers, but also outsiders, are conscious of them, with some speakers of neighbouring languages that do not have bilabial trills reportedly finding these sounds "comical" (Crowley 2006). Similar attitudes have been reported regarding another type of visually available and cross-linguistically even rarer sounds – linguolabials (Guerin 2011). This is probably related to such unusual sounds' ability to take on an emblematic role, and act as linguistic shibboleths and identity markers (cf. Rangelov, Walworth & Barbour 2023; François 2012).

[8]Or any minimal pair that distinguishes ʙ̥ from other similar sounds, e.g. /p/ or /^{m}b/ (Williams 2019).

[9]ʙ̥ also has high lexical predictability in Ahamb and exhibits high inter-speaker and intra-speaker variation (Rangelov 2019); these forces can be considered to be pulling it to the left on the marginality scale.

sum of the effects of all other factors described in this section, as all of them can more or less directly influence frequency, or are influenced by frequency, thus possibly forming a feedback loop. For example, the effects of inter-speaker variation, and semantic/pragmatic/morphosyntactic constraints determine the frequency of a sound, while a sound's frequency is statistically correlated with the probability of it being involved in contrasts with high/low lexical opposition/predictability, or can influence speaker intuitions.

Two kinds of frequency are relevant here: type and token frequency. For example, Güldemann (2007), Sands & Gunnink (2019), and Brenzinger & Shah (2023) use type frequency to determine the marginality of click sounds (overall) in different languages and compare them; their method involves counting the number of click types and the number of click phonemes (see also §2.6). If one is exploring marginality within a single language, type frequency more commonly means the number of lexical items in which a sound occurs. In the same studies on clicks, the authors use a measure of the percentage of the (basic) lexicon in which clicks occur as another criterion for determining their functional load. Hall (2013, 241) lists a number of other examples where type frequency has been proposed as a proxy for how marginal a sound is.

Lexical frequency is important for token frequency, which reflects how often a sound occurs in a sample of speech (e.g. a corpus), regardless of the number of unique lexical items in which it occurs. Basic and culturally significant vocabulary, and function words, are overall used more often than many other types of lexical items, which means that if a sound occurs in a few such items, it may be much more salient in the language overall, than if it only occurred in relatively many, but very rarely used words. Token frequency is an especially useful proxy for marginality when working with larger amounts of data, comparing multiple languages and/or using statistical methods and averages, as it allows for an easy quantification of marginality. Dockum & Bowern (2019, 49) use this approach in an experimental study aimed at determining the smallest necessary word list size for making phonological generalizations about a language (see §3.1 for details). Importantly, they also warn that a language's phoneme inventory size needs to be taken into account when using frequency as a measure (cf. §2.6).

3. METHODS AND TOOLS FOR IDENTIFYING, DOCUMENTING, AND DESCRIBING MARGINAL PHONEMES

Most general linguistic fieldwork guides (e.g. Crowley 2007; Bowern 2015; Meakins, Green & Turpin 2018) have chapters on phonological and phonetic fieldwork; there are also dedicated guides to phonological analysis, such as Van der Veen & Medjo Mvé (2010) and phonetic fieldwork (Maddieson 2002; Ladefoged 2003; Butcher 2013). How to identify, document, and describe marginal phonemes is, however, rarely discussed in detail in fieldwork guides. For example, in their guide to phonological analysis for fieldworkers, Van der Veen & Medjo Mvé (2010) mention marginal phonemes only briefly (on p. 9): "Some phonemes may be marginal, for various reasons. Check whether they are restricted to certain types of words, e.g. onomatopoeic words, (recent) loanword[s and]…ideophones."

Often, fieldwork guides point out that understanding the phonology of a language (especially, of a language about which we know little), would be one of the first tasks of a fieldworker, before they move on to understanding the language at other levels of abstraction like morphology, syntax, etc. What is often emphasized is that understanding linguistic structure,

and phonology in particular, is an iterative process (e.g. Bowern 2015, 42; Meakins, Green & Turpin 2018, 118). In other words, as data are collected incrementally, our hypotheses about the phonology of a language are confirmed, rejected and/or refined, and new hypotheses are formed. For example, once the central phonemes of a language have been established, it is worth analysing the inventory. Van der Veen & Medjo Mvé (2010, 10) suggest looking for any gaps in the inventory, as well as checking against typological or areal tendencies (see also §2.6). Any gaps or "deviations" can be explored by using techniques presented throughout this section. This step will likely need to be performed multiple times and on an ongoing basis as the researcher refines their analysis and obtains results from the other methods. Each time, the results of this step can inform the hypothesized influence of various factors on marginality. This process can rarely be justifiably deemed to have been utterly exhausted, and how far it extends usually depends on resource availability. In this section, I discuss steps that a fieldworker can take in order to form, evaluate, and refine their hypotheses that have to do with deciding where a sound sits on the marginality scale.

Documenting and describing marginality is an important task because marginality constitutes an integral part of the shape of a given language, or as Bye (2009, 13) puts it "[m]arginal contrasts must be seen as fully included in the unique monolithic grammatical system of the language". This is especially important for under-researched languages, as marginal phenomena can easily be overlooked, while at the same time they may help unravel (often unusual) linguistic processes that may be of interest for linguistic theory and related fields. This is related to marginal phonemes' tendency to "exploit systemically latent possibilities of contrast" (Bye 2013, 41).

Below I introduce and elaborate on methods for data collection and analysis related to marginal phonemes. These are often based on general linguistic fieldwork methods, which are described in most fieldwork guides including the ones cited above. In the text, references to other publications are also made. Some of the insights below are also based on my own expertise. This is obviously an extensive topic and the reader-fieldworker is invited to consult the references in this paper, and other works alongside using this guide. Which steps the fieldworker takes, and in what order, may depend on multiple factors, including the availability of resources (time, funding, access to speakers, access to technology, knowledge and skills), the fieldworker's priorities, and the hypotheses that may emerge at each iteration of the analytical process. Generally, when working on a previously un(der)documented variety, it is advised to cast a wide net, i.e. to employ as many of the techniques listed here as resources allow. At a later stage, the fieldworker may refine their priorities based on their initial findings.

3.1. Elicitation

Elicitation is one of the main methods for collecting linguistic data. Different types and techniques of elicitation are described in fieldwork textbooks and other literature. Here, I propose methods aimed specifically at exploring phonemicity and marginality in the phonology of a language.

The starting point of any work on the phonology of a language should be a word list, often elicited as a list of core (basic and culturally significant) vocabulary. Dockum & Bowern (2019) find that a list of approximately 400 words (not necessarily core vocabulary) is the minimum for establishing a "basic phonological typology" of a language. While they address the issue of

marginal phonemes in general by using frequency as a proxy, longer word lists (and other data) will be necessary in order to study the marginal phonemes of a particular language in detail. Data can be elicited at different stages in the work related to studying marginal phonemes.

Some elicitation strategies that may help test for phonemic status and/or marginality are listed below. The potential of each strategy is discussed briefly, unless it is considered obvious.

- asking for words that "sound similar to" a specific target;
- asking for words that alliterate (start with the same sound(s)) or rhyme (end with the same sound(s)) with a specific target. It may be relevant here to take into account any existing poetic traditions in the community (cf. Bowern 2015, 42);
- asking for (other) words that contain sound X (a sound that the fieldworker has heard in the language but is unsure of its status), after providing one or more known examples of words with sound X;
- asking for words that contain a specific sound cluster, for example different consonant-vowel combinations;
- offering two versions of a known word with variation on a sound or feature and asking the speaker to judge which one sounds "better" (rather than "correct") (see Ladefoged 2003, 11). Ladefoged also advises to "enumerate" the versions by holding one and two fingers respectively for the speaker to choose from;
- asking speakers to syllabify words. This may be helpful for exploring phonotactic patterns or determining whether something is a complex segment or a cluster of segments. This should be approached carefully, however. For example, a token with a prenasalised plosive like ^{m}b between two vowels (V^{m}bV) may be syllabified by different speakers as V-mbV, Vmb-V, Vm-bV, or even Vm-mbV. The latter two versions may reflect a dispreference for codaless syllables that may lead to alternative analyses of an underlying complex segment;
- asking speakers to spell or syllabify words backwards can also reveal complex forms and metalinguistic awareness;
- asking speakers to provide common sound symbolic items;
- asking speakers to provide borrowed items (that they are aware of);
- asking speakers to provide impressions and intuitions about relevant inter-speaker variation;
- asking questions related to speakers' metalinguistic awareness (see also §3.6);
- asking speakers to share impressions about the speech of young children (§3.7)

Van der Veen & Medjo Mvé (2010, 3–4) suggest framing some of these elicitation activities as poetry exercises (see above) and language games. An example of a language game is using iterative infixal ludlings (Yu 2008).

The fieldworker needs to remain aware of caveats regarding some of these techniques. These may have to do with the speakers' metalinguistic awareness and their literacy levels. Another variable to take into account is a speaker's linguistic repertoire, i.e. what other languages they may be familiar with. Overall, general principles for avoiding priming should be integrated into the elicitation techniques (see, e.g. Bowern 2015, 96ff for this and other potential problems with elicitation).

Meakins, Green & Turpin (2018, 106) warn that some speakers may conflate phonetic and semantic similarity and judge homophones to be different phonetically just because they are aware of their different semantics, if the point of departure in the elicitation was based on semantics (e.g. on translations of lexical items in a contact language). As a potential solution,

they offer a test where recordings of the potential homophones are played and the speaker is asked to provide a meaning for each token.

The fieldworker also needs to be aware that there might be inter-speaker variation that affects the studied sound (see §2.7). Besides, there might be differences in observations in elicited data and natural speech (see §3.2).

The list and discussion above are not exhaustive but they demonstrate that elicitation techniques can be used to explore virtually all factors listed in §2.

3.2. Corpus exploration

Text collection, i.e. the creation of a corpus of annotated audio/video recorded natural speech, is another staple of language documentation. The data in a corpus can be mined to find (near-) minimal pairs, inform hypotheses on phonotactic, semantic, pragmatic and morphosyntactic constraints, identify loanwords and sound symbolic items, detect inter-speaker variation, and provide frequency data. For example, by exploring natural speech data, Rangelov (2019) finds much lower frequency for the production of bilabial trills in the Ahamb language than was established based on elicited data. Needless to say, the larger the corpus, the more useful it will be for the purposes of studying marginal phonemes.

Corpora that are not based on audio/video recordings (e.g. legacy materials) or where these recordings are not available, could still be useful, but any hypotheses based on them should be formed with extra care. Nuckolls et al. (2016), for example, provide an example of a method involving mostly legacy materials for exploring ideophones in Pastaza Quichua.

3.3. Data organization

Data organisation is essential for any fieldwork activity. This includes the collection of very detailed metadata. Extensive use of comments and tags on data points is always a good idea. When the fieldworker sets out to analyse marginal phonemes, it is good from the start to be on the lookout for the factors in §2 and perhaps develop special tagging and commenting conventions and strategies, which will later allow for easy searching and data filtering. For example, uncommon sound clusters that may be of interest can be tagged as soon as a relevant token is encountered. Special semantic, pragmatic or morphosyntactic information, or observed possible variation should be noted on the spot as well. Potential loanwords and sound symbolic items shall be tagged, so that lists of them can be easily compiled and analysed. The fieldworker is also advised to make a note of any potential factors during the data collection process, which may have influenced the reliability of the data (see e.g. §3.1). Needless to say, the data should be stored in formats that allow for easy searching, filtering, concordance, using standard tools such as ELAN (ELAN 2024), FLEx (Fieldworks 2024) or spreadsheet formats. This ensures not only robust data organisation but also easier measurements of frequency, for example. Needless to say, the data need to be archived according to the best practices to ensure that it can be accessed in the future by those who have been granted access by the speakers.

3.4. Phonetic studies

Understanding the phonetics of a sound can provide crucial information regarding the nature of its relationship to other sounds in the system. It can show what features a proposed contrast involves, how the sound fits into the phonological system of the language, i.e. with what other types of sound in that system it patterns. Thus, understanding the phonetics of a sound may be crucial for understanding its (non-)contrasts and phonotactics, or for understanding adjustments in borrowings or the nature of sound symbolism. Phonetic research may also inform variation studies. I refer, once again, to the dedicated works on phonetic fieldwork referenced in the beginning of §3. Below I present a few relatively accessible methods for collecting and analysing phonetic data even in remote fieldwork settings and by fieldworkers who may not feel they have substantial training in phonetics. The focus is on articulatory phenomena; methods for acoustic and perceptual studies are discussed briefly at the end with references for further reading.

When it comes to the documentation and analysis of articulatory data, one problem with many methods is that some of the necessary equipment is very bulky, expensive and/or requires infrastructure or conditions that may be impossible to guarantee in every field setting. If the researcher has access to such equipment, bringing speakers to a phonetic lab may or may not be possible or practical. Here, I want to bring attention to four relatively easy, (mostly) non-invasive techniques for documenting and analysing some articulatory features in virtually any field site with relatively little preparation, expertise or equipment requirements. Some of the techniques presented here have become a lot more accessible in the past couple of decades also due to technological developments. I discuss slow-motion video recordings, linguography/palatography, the Earbud Method for investigating nasality, and the use of portable ultrasound devices.

For any labial sounds or sound features, a slow-motion recording can help track the movement of the lips (or tongue, if it is visible, e.g. in linguolabial sounds). Painting dots (e.g. with lipstick) on points of interest (e.g. middle of lips, edges of mouth) is an easy way to later track these points with precision in computer applications. Using this method, labial or labialised sounds can be studied (e.g. Rangelov 2019). Pocket-sized cameras (also known as *action cameras*) with capabilities of recording 240 frames per second or higher frame rates are widely available for a reasonable price. Such recordings may also be useful for tracking tongue movement or other features in phonetic environments where the mouth remains open and they may be visible.

Linguography and palatography are well-established methods for determining the nature of the contact between the tongue and the hard palate or back of the teeth. These methods can provide detailed information about the exact place and manner of articulation of a large number of coronal consonants. The methods are easy to learn and very low-cost, requiring readily available materials. Linguography involves painting the palate with a mixture of medical charcoal and olive oil using a brush, then asking the speaker to pronounce a target token designed to isolate the single coronal contact, then asking the speaker to protrude their tongue, and photographing it. Palatography involves painting the protruded tongue in the same way and, later, the insertion of the mirror into the speaker's wide-open mouth in order to record an image of the contact area on the palate. This means that these methods are somewhat invasive, albeit with very small risks involved. Hygiene measures need to be extra strictly observed, and speakers need to be informed

about the inconveniences involved before they give their informed consent.[10] Ladefoged (2003, 36ff), Anderson (2008), and Butcher (2013) provide more detail on these techniques.

A relatively easy and very low-cost method for analysing nasality in virtually any field setting is the Earbuds Method first described by Stewart & Kohlberger (2017) and refined by Bruil & Stewart (2022). This method involves plugging a set of cheap earbud headphones into the microphone jack of a recorder and making a stereo recording of the speaker pronouncing targets while holding one earbud very close to their mouth and the other earbud at the entrance of one of their nostrils. This way, the relative intensity of the airflow coming out of the mouth and the nose is captured in two different channels with little interference. These recordings can then be analysed in Praat (Boersma & Weenink 2025) and allow for identification of the onset and offset (and duration) of nasal gestures and closures of the oral cavity. The details of how to perform recordings using this method, its limitations, and how to analyse the recorded data, are described in detail in the two works cited above. This method has been used to investigate various phenomena such as prenasalisation (e.g. Rangelov 2019, 2023; Seara, Quadros & Martins 2021), voiceless nasals (e.g. Lovick, Herrera & Stewart 2023), and in sociophonetic studies (e.g. Crosby & Dalola 2023 on a Korean baby talk register). Carignan (2024) offers a validation of the method, which confirms that it is reliable for establishing general facts about nasality, but more accurate methods may be necessary for establishing fine detail, which may or may not be necessary for the purposes of exploring marginal phonemes.

Ultrasound tongue imaging can be used in virtually any field setting more easily since the development of portable ultrasound systems. Such portable systems are not as affordable as the other methods described above, and they may require more resources in terms of power supply (also possible through a laptop, for example), but they offer a unique opportunity to track the position of the entire upper surface of the tongue at different points in time, in sync with an audio input. This can provide articulatory data that can shed light on the features of some sounds that may be key for determining their phonemic status. Some systems that are designed especially for phonetic research provide additional functionalities such as synced video tracking of the lips (e.g. Articulate Instruments 2024), which can be useful for exploring some complex segments and labiovelarisation, for example.

Exploring the acoustic properties of sounds usually involves recordings with widely available professional microphones that are part of the standard toolkit of fieldworkers. Even recordings made outside of a soundproofed space can be useful as long as noise levels are not excessive. For analysis, there are standard tools like Praat (Boersma & Weenink 2025).

Finally, it may also be relevant to design perceptual experiments in order to explore auditory properties of the studied sounds. This can be done by playing unaltered or edited recordings to speakers and asking for judgements. This is a form of elicitation using audio stimuli and was discussed briefly in §3.1. More details and examples can be found in, e.g. Maddieson (2002, 425–426).

[10]Informed consent, and other ethical considerations, are an important part of any fieldwork activity. Standard informed consent and ethical considerations need to be taken into account when working with native speakers of a language on any topic, including phonology. Discussing ethical issues regarding fieldwork is beyond the scope of this paper, but all best practices should be followed at all times. Most of the data collection methods in this section fall under general data collection methods and the same ethical considerations apply. The reader is encouraged to consult the latest literature on the topic and follow all institutional requirements and guidelines and the speaker's wishes.

3.5. Sociolinguistic studies

The methods of sociolinguistics can be used to inform our understanding of various factors outlined in §2 when studying specific cases of marginality. The methods of the subfield of sociophonetics (Kendall & Fridland 2021; Docherty 2022) can be used to study phonetic variation, which can inform frequency effects and lexical opposition/predictability. These methods are closely related to methods outlined above on phonetic research (§3.4) and elicitation (§3.1). More general sociolinguistic methods, including sociolinguistic interviews and participant observation (Meyerhoff et al. 2011; Schilling 2013) can shed light on these factors as well as speaker's intuitions and attitudes. These methods may require extensive preparation by the fieldworker, and various skills, including modelling and statistical analysis.

3.6. Orthography development

It is generally advised that when working on a lesser-documented language, especially one whose phonology has not yet been analysed in detail, the fieldworker should initially use phonetic transcription. A working orthography can complement and even replace phonetic annotation once the phonological system has been established with some confidence. Very often, language documentation projects also aim to provide an orthography for the community as part of language revitalization/maintenance/conservation efforts. There are many intricacies and pitfalls associated with designing a community orthography; these are beyond the scope of this paper and the reader is encouraged to review the extensive literature on the topic (e.g. Jones & Mooney 2017). In all cases, community orthographies should involve the active participation of the speaker community (cf. Hoback 2025) and here I focus on how discussions between the community and the fieldworker, and observations of how community members use the orthography, can inform their understanding of phonological marginality in their language.

Discussions regarding a community orthography and observations of speakers using the orthography can be a source of information about the speakers' intuitions and perceptions of different sounds and the phonological system. They may reveal what sounds or contrasts (different) speakers may or may not find to be salient, thus informing both lexical opposition/predictability hypotheses and variation hypotheses. Very importantly, they may also reveal speakers' intuitions. For example, community members may prefer to adopt a dedicated grapheme for a marginal sound, because they consider it to be salient enough. There are different reasons why speakers may find a sound to be more salient than a purely phonological analysis may suggest. In §2.8 (including footnote 7), identity attachment to bilabial trills and linguolabials in some Oceanic languages was discussed. In the case of the Lamap language discussed there, one of Williams's (2019) reasons to treat the plain trill as a (marginal) phoneme is that speakers told her that they preferred to have a separate notation for it in the practical orthography that was being designed for this language. They proposed the digraph <pp>, by analogy with the established <bb> digraph for the prenasalised voiced bilabial trills, which demonstrates the analogy they perceive between the two sounds.

Additionally, it may also be useful for a fieldworker to observe how speakers prefer to spell borrowings and sound symbolic items, which may shed light on related phonetic and phonological relationships.

This method presents some pitfalls, however. Firstly, speakers may intuitively prefer phonetic rather than phonemic orthography, that is, they may spell conditioned allophones differently, or exhibit variation in spelling free allophones. Secondly, the speakers' literacy skills need to be taken into account, and more specifically, the speakers' mastery of orthographies for other languages, which may heavily influence their choices. These may be non-standard orthographies of other minority languages or (often standardised) orthographies of more prestigious languages that are taught in school or used by religious institutions; related prescriptive attitudes may also play a role in speakers' orthography choices and use.

3.7. Observations of L1 acquisition

It is well known from research on first language (L1) acquisition that newborns are able to discriminate most sound contrasts that exist in natural languages, and they lose this ability to focus on discriminating the sound contrasts in the language(s) to which they are exposed (Werker & Tees 1984). The mechanisms that underpin this "learning by forgetting" (Mehler & Dupoux 1994) are based on infants being sensitive to statistical distributions in the input, i.e. they are able to create phonemic categories by tracking the frequency of segments in the input (Gervain & Mehler 2010, 201). The fieldworker might then observe that a marginal contrast may be absent in very young children and this can be used to form a hypothesis regarding marginality. These observations may be made by the fieldworker themselves or by asking caregivers about their observations and impressions. For ethical purposes, fieldworkers are advised to be open about such activities, inform caregivers and their consent to report such observations even if they are made unintentionally during routine daily activities. If possible, or deemed necessary, recordings of children can be made too. Graham et al. (2013) present extensive general guidelines for ethical research involving children.

4. DISCUSSION AND CONCLUSIONS

In this paper, I first showed that the sounds used in a language can occur along a marginality scale, and discussed various factors that can determine the marginality of a sound. The factors discussed in detail in §2 had to do with distribution in the lexicon, phonotactic constraints, patterns in the broader phonology of the language, variation, speaker intuition, and type and token frequency. Based on this, in §3, I offered a number of methods that the linguistic fieldworker can use in order to identify, document, and describe marginal phonemes, especially in understudied languages. This section contains a summary of (1) the role of the different factors on the positioning of a phoneme along the marginality scale, and (2) the relationships between the proposed methods and the factors, followed by some concluding remarks.

We saw that the factors discussed in §2 can predict marginality, that is, different factors can position a sound in a particular section of the marginality continuum or "pull" it to the left or right of the marginality scale. The proposed relative effects of different factors are illustrated in Figure 2. It is one of the researcher's tasks to investigate and hypothesize how strong a pulling force is. It is important that the effects illustrated in Figure 2 are based on each factor operating alone. In reality, as we saw in a number of examples above, these factors normally operate in

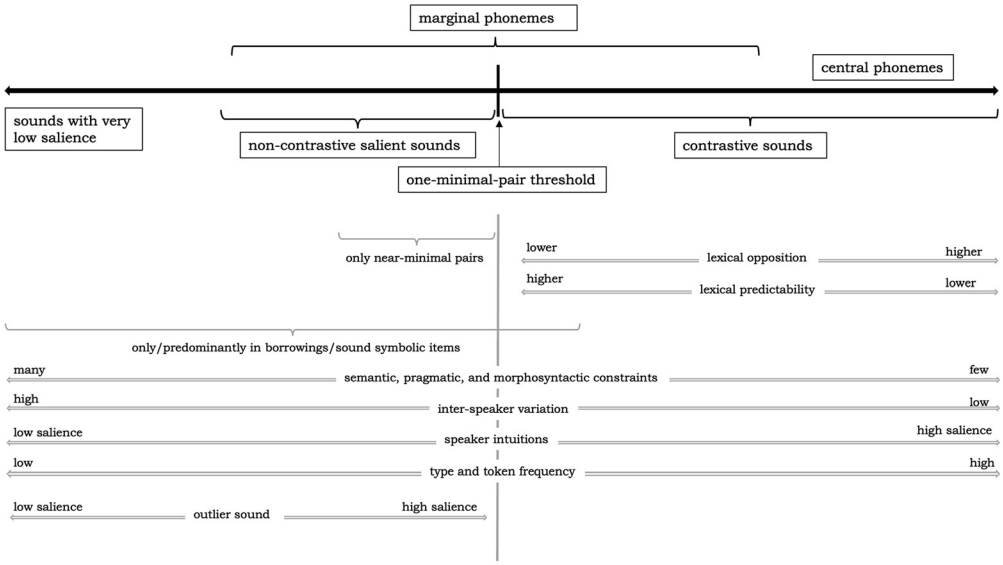

Figure 2. The effects that factors discussed in §2 can have on a sound's position on the marginality scale. The representations are meant to be illustrative, not proportional

combination. Such a holistic approach allows the researcher to investigate marginality as a result of multiple forces acting at the same time.

Besides the assumption that the one-minimal-pair threshold plays a significant role, all other scales and cut-off points in Figure 2 are relative. In this paper, I have been careful not to imply any quantitative evaluations, because this is beyond its scope. However, this model can be a stepping stone towards a quantitative model for determining phonological marginality. This would, however, require more theoretical input and, very importantly, a lot more detailed and systematically organized data on many phylogenetically and geographically diverse languages. As pointed out already, such data are particularly missing for many lesser-studied languages, including for entire large language families, and for languages that operate in diverse language ecosystems. In the meantime, as already discussed in §2.9, type and token frequency can be used for quantitative analyses as a proxy for the sum of the effects of the different factors in combination, as illustrated by Güldemann (2007), Dockum & Bowern (2019), Sands & Gunnink (2019), and Brenzinger & Shah (2023).

I now turn to a summary of what fieldwork methods can be (directly) used to explore the different factors listed in §2, based on the discussions in §3. In Table 1, we see that a lot can be achieved by employing many of the traditional methods of language documentation, which the experienced fieldworker should be well versed in – elicitation, corpus exploration, data organization. Orthography development work can also help form hypotheses regarding many of the factors, even if this method comes with many caveats (§3.6); this is another activity that many linguistic fieldworkers engage with already. Thus, it is clear that for a fieldworker to be in a better position to explore marginal phonemes, the amount of necessary additional resources may be relatively small. Namely, some fieldworkers may need to develop their expertise on marginal

Table 1. A summary of the applicability of the methods discussed in §3, to the investigation of factors discussed in §2

Apply this method → to study this factor ↓	Elicitation (§3.1)	Corpus exploration (§3.2)	Data organization (§3.3)	Phonetic studies (§3.4)	Sociolinguistic studies (§3.5)	Orthography development (§3.6)	L1 acquisition observation (§3.7)
Lexical opposition (§2.1)	✓	✓	✓	✓	✓	✓	
Lexical predictability (§2.2)	✓	✓	✓	✓	✓	✓	
Borrowing (§2.3)	✓	✓	✓	✓	✓	✓	
Sound symbolism (§2.4)	✓	✓	✓	✓		✓	
Sem., pragm., morphosynt. constraints (§2.5)	✓	✓	✓				
Patterns in phonology (§2.6)	✓	✓		✓		✓	
Inter-speaker variation (§2.7)	✓	✓	✓	✓	✓	✓	
Speaker intuitions (§2.8)	✓				✓	✓	
Frequency (§2.9)		✓	✓		✓		✓

phonemes (by using the information in this paper, among other sources), and to prepare in advance – ideally at the outset of a language documentation project – to look out for relevant data. The advice on data organization in §3.3 alone can go a long way. Two of the remaining methods – phonetic and sociolinguistic studies – may require more substantial additional resources in terms of preparation, technology and/or skills. However, the returns from such studies can be substantial so the fieldworker is encouraged to employ such methods when the resources allow them. Finally, observations regarding language acquisition by small children can provide specialized frequency data, which can complement the other methods in forming and testing hypotheses regarding marginality.

As stated above, the methods discussed in §3 should ideally be applied in combination, using a holistic approach. The process of identifying, documenting and describing marginal contrasts is iterative and the findings of one method can provide data for applying another method, which can feed other methods or back to methods already used. I demonstrated this with a few examples. Explorations of bilabial trills in languages spoken in Vanuatu, discussed in a few subsections, showed that their marginality status in individual languages can be determined by exploring their phonetics, phonotactics, lexical constraints, inter-speaker variation, speakers' intuitions, frequency, and their place in the phonological system, by using most of the proposed methods as possible and deemed necessary. Similarly, in his study of Nen's marginal sounds [ã, ẽ, h] and their restricted semantic/pragmatic distribution (§2.5), Evans (2022, 999–1003) complements that evidence with explorations of Nen's phonological system, frequency effects, borrowing, sound symbolism, lexical opposition and predictability, and inter-speaker variation to conclude that "[t]he most convincing answer is probably to say that they are phonemes, but not regular ones: that the phonology is structured around a core of fully regular phonemes augmented by an outer layer of more restricted ones". Such conclusions can be made possible by fieldworkers combining different methods in order to describe phonological contrasts in as much detail as possible. Hopefully, this guide provides a good starting point for such noble efforts.

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