Author Response to the Commentary: Prosodic Typology and the Handling of Variability in Intonation

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Grice raises several interesting points in her commentary. Many of them are the result of newer research that breaks with some traditional approaches and practices within the autosegmental-metrical (AM) approach to intonational phonology. This break from tradition is clearly beneficial not only for AM but for understanding intonation and its functions independently of theoretical framework adopted.

In this response, I focus on two points that emerge from Grice's commentary: prosodic typology and the treatment of variability in the study of intonation. I address these two points in turn and provide some suggestions for a way forward, including research that I think is likely to lead to new insights and advancements in the study of intonation.

Prosodic Typology

Grice uses data from Berber and Maltese to question the distinction between tones with a demarcative function (*edge tones* in AM)—tones that associate with prosodic constituent edges—and prominence lending tones (*pitch accents* in AM)—tones that associate with prosodic heads. Grice questions this binary distinction that conflates association with function and provides evidence that tones can show substantial variability in their synchronization with the segmental string. She thus proposes "a separation of association properties (head, edge, higher-level constituent) and their function (prominence-cueing, demarcative)" (see "Structure of Tiers and Complex Intonational Primitives").

In my view, Grice's suggestion opens up new possibilities for refining prosodic typology. First, I concur with her use of the term *prominence-cueing*, following the suggestion made in Ladd (2008, 2): pitch accents are not prominence-lending but prominence-cueing (a term coined by Francis Nolan). In other words, the function of some tones is to alert the listener to the fact that a given constituent is already prominent (due to its strength in the prosodic hierarchy). Second, I follow the proposal of Pierrehumbert and Beckman (1988), according to which tones associate to prosodic constituents rather than directly to stressed syllables. For example, a tone may associate to an intermediate phrase and percolate down to the phrase's head, which will be the stressed syllable of the metrically strongest constituent in the phrase (or designated terminal element, DTE for short). Thus, what Pierrehumbert and Beckman envision is not a direct relation between tones and tone-bearing units (TBUs) but an indirect one, while Grice seems to suggest a direct relationship between tones and TBUs and indirect connection to higher levels of the prosodic hierarchy.

If we follow these two proposals, it is possible to reframe Grice's suggestion as a consistent and testable typological distinction between languages in which tones percolate all the way down to heads of feet (i.e., lexically stressed syllables or DTEs)

versus languages in which tones associate to specific prosodic constituents, such as the prosodic word or the intermediate phrase, but without this association percolating down to the constituent's head, either because there is not one, as in Berber, or because cueing head prominence by localizing it to a DTE is not critical, as in Maltese. Another way to understand this last point is to say that the Maltese tonal events discussed by Grice cue word prominence but not the prominence of a specific syllable.

This reanalysis allows us to capture attested differences between languages with and without lexical stress but also differences between the latter. For example, Korean is a language without lexical stress in which tones associate to phrases, the accentual and intonational phrase. This association percolates to constituent edges, and thus tones are realized in the periphery of their constituent (Jun 2005). In contrast, this percolation does not apply in Berber, in which the exact location of a tonal event is consequently more variable. Similarly, a language like Ambonese Malay (Maskikit-Essed and Gussenhoven 2016) may associate tones to phrasal constituents without percolation to specific words, let alone word heads (because these are not available). The same analysis may also be applicable to data from Australian languages, such as Dalabon and Mawng (Fletcher 2015, and Fletcher et al. 2016, respectively). Differentiating these two types of association allows us to distinguish between languages with very localized tonal events and languages in which the alignment of segments and tonal events is more diffuse. Logically, the same distinction should apply to languages that have lexical stress as well. Finally, this reanalysis of the relationship between phonological association and tonal alignment allows us to distinguish between the prosodic level relevant for tonal association and the level up to which percolation applies. These levels are likely to be tone- or language-specific.

A similar typological distinction may apply with respect to Grice's point about languages in which nuclear configurations are critical and those in which no special status is assigned to the final accent in a phrase. Overall, these additional dimensions of how tonal events function and how they behave phonologically and phonetically may provide more insightful categorizations than typologies based on phonetic detail (for discussions, see Ladd 2008; Arvaniti 2016; Prieto and Hualde 2016; chapter 1, section 1.5, this volume).

Using such distinctions in cross-linguistic work will allow us, as Grice also argues, to gain greater insight into un(der)described languages, without the imposition of a model that may best fit languages of a particular type, which simply happened to be the one that has been extensively studied. Studying prosodically diverse languages will further allow us to distinguish between marked and unmarked relationships between tune and text, such as whether the Spanish pattern described in Torreira and Grice (2018) is cross-linguistically frequent or represents a rare occurrence.

The Treatment of Phonetic Variability

This discussion had identified a need for new typology distinctions. Nevertheless, it is important to consider if and when additional categories are needed and whether simpler solutions that do not require additional theoretical machinery may be possible (Arvaniti, Ladd, and Mennen 2006). This is essential for avoiding overanalysis or unnecessarily complicating AM representations.

Grice's discussion of the Berber, Maltese, and Spanish data reflects this point, as it addresses an issue underlining much of AM research, namely AM's approach to variability. As I argue elsewhere as well (Arvaniti 2019; Lohfink, Katsika, and Arvaniti 2019), AM often treats variability as a major concern and has been unduly preoccupied by the

search for tonal invariance. This search was originally motivated by the traditional autosegmental view that phonological association confers phonetic synchronization between associated autosegments (Goldsmith 1976). This view was supported by the interpretation of the findings of Arvaniti, Ladd, and Mennen (1998), a study originally motivated by the need to test competing views about the nature of intonational primitives as pitch movements or levels. In that study, we found that the rises of prenuclear pitch accents in Greek do not have stable characteristics, such as fixed slope or duration, as advocated by the Institute for Perception Research (IPO) approach ('t Hart, Collier, and Cohen 1990). Rather, in Greek, the position of both the onset and offset of the rise is stably synchronized with the onset and offset of the stressed syllable: the onset of the rise occurs slightly before the syllable onset; the peak of the rise occurs early into the vowel of the syllable following the stressed one. We concluded that this difference argues in favor of analytically treating the rise as the outcome of an L tone followed by an H tone, each with its own alignment: "The L and the H of the accent are *anchored* [emphasis added] to segmentally defined positions, and the duration and slope of the pitch movement are completely determined by the segmental composition of the accented word" (24). This finding gave rise to the notion of segmental anchoring, which was explored in detail in a series of papers by Ladd and colleagues (e.g., Ladd et al. 1999; Ladd, Mennen, and Schepman 2000; Ladd and Schepman 2003; Ladd et al. 2009) and later by many other researchers. Segmental anchoring soon became a main criterion for tonehood: pitch minima and maxima are treated as potential tonal targets reflecting underlying L and H tones, respectively. This conceptualization of the relation between phonological tones and phonetic realization led to a search for invariance in tonal alignment as a means of ascertaining whether a tonal target reflects an underlying tone. For example, Ladd and Schepman (2003) argue that the accent usually analyzed as H* in English (e.g., Pierrehumbert 1980) should be analyzed as (L + H)*, based on the finding that the dip before the rise to a peak is stable and thus must be the reflex of an underlying tone.

This search for invariance is questionable on two grounds. Statistically, it is the search to prove the null hypothesis, an overall inadvisable quest. Most importantly, variability is part and parcel of phonetics and thus unlikely to leave the realization

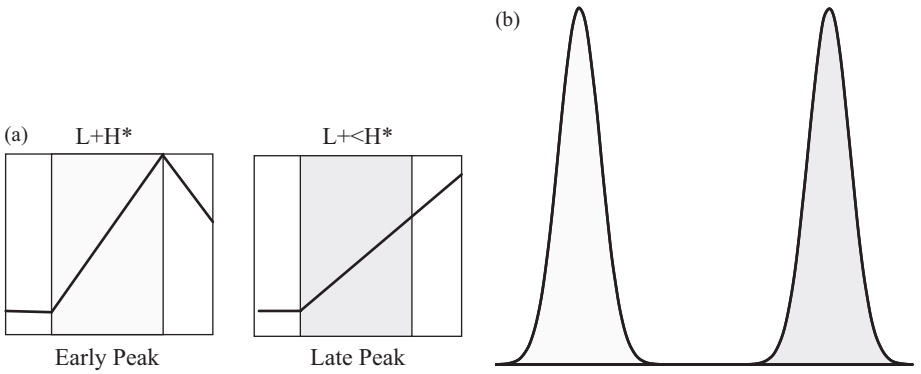

Figure 1r.1
In (a), schematic illustration of two Catalan accents, L + H* with early peak, i.e. co-occurring with the stressed syllable, and L + <H*, an accent with late peak, that is, occurring after the stressed syllable offset (after Prieto 2014); shaded rectangles represent the stressed syllable; in (b), idealized distributions of early and late peak alignment, as envisaged by the tonal anchoring approach.

of tonal categories unaffected. This is illustrated in figures 1r.1 and 1r.2. Figure 1r.1a shows schematic representations of an early peak and a late peak accent of Catalan (L + H* and L + <H*, respectively), as posited by Prieto (2014). Figure 1r.1b reflects how this phonetic difference must be distributed in a set of data if tonal anchoring and invariance hold: categories must have very narrow and completely distinct distributions, as idealized in the schematic density plots in figure 1r.1b.

However, as shown in figure 1r.2, such distributions are not attested in speech. This applies even for categories unequivocally considered distinct both phonologically and phonetically, such as the short-lag versus long-lag Voice Onset Time distinction in English. As shown in figure 1r.2a with data from Nakai and Scobbie (2016), even such categories show substantial overlap (for similar results, see also Piccinini and Arvaniti 2018). Thus, overlaps of similar magnitude should be expected for tonal categories. This is indeed the case, as illustrated in figure 1r.2b with data from Lohfink, Katsika, and Arvaniti (2019) regarding the H*, L + H* and H* + L of Greek.[1]

A possible reason for seeing such overlap as a problem is the typical visualizations of results coupled with the fact that the focus is on invariance and demonstrating that tonal categories are distinct along some dimension, such as alignment. Compare, for example, figure 1r.2c showing the box plots of the same data as in figure 1r.2b; the data show statistically significant differences by accent, but the box plots belie the extent of the overlap of the three accentual categories and, together with ideas about invariant alignment, may lead to unrealistic expectations about the realization of tonal categories.

An additional reason for the problem is the limited recognition within AM that the realization of tonal categories may rely not only on F0 but on additional cues as well. As Grice mentions, several studies show this connection, though this is typically seen as an effect of segments on tune or vice versa. Segmental material (or metrical structure, as Grice shows) can affect the choice or realization of the tune, while the tune may have repercussions for the realization of segments. An alternative perspective is to consider the latter type not as an adjustment, as Grice argues, but as the presence of redundant or secondary cues to a specific tonal contrast (much as a distinction between vowels of different length, or geminate and singleton consonants may also include a difference in phonetic parameters beyond duration; see Remijsen and Gilley 2008 on Dinka vowels; Local and Simpson 1999 on Malayalam geminates). More attention should be given to such additional cues and their relationship to F0, on the one hand, and to their role in the processing of intonation, on the other.

Phonetics, Phonology, and the Study of Intonation

The previous discussion and Grice's commentary reflect the uneasiness in AM (and other models of intonation, for that matter) regarding the relationship and division of labor between phonetics and phonology. This is not an issue that is by any means resolved in other domains. However, it remains particularly problematic in the study of intonation, which is often seen as a phenomenon on the edge, as being borderline linguistic but not quite fully so—hence, descriptions of intonation as a "half-tamed savage," as an element that may defy linguistic structure in some ways (see Gussenhoven 2004 for a discussion). Note that borderline phenomena are also found in segmental systems, as discussed in Scobbie (2007), but it is only in intonation that they are seen as the essence of the phenomenon itself.

In Arvaniti (2019) I argue against this view and in favor of a new approach, dubbed TINT (for *tame intonation*) that posits that intonation is not different from other components of a language's phonology. There are several corollaries to this approach,

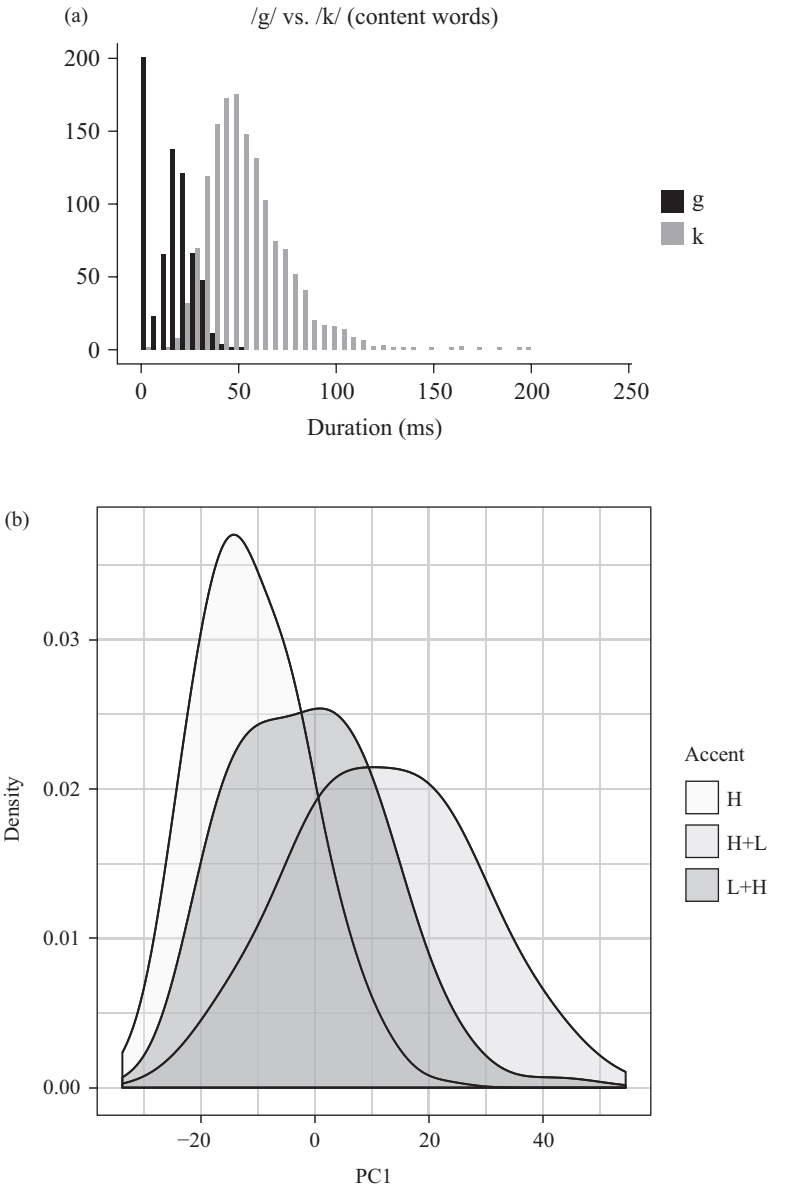

Figure 1r.2
In (a), VOT histograms for English [g] and [k] (short-lag and long-lag respectively) in word-initial position in content words (Nakai and Scobbie 2016); in (b), density plots of PC1 (first principal component in functional principal component analysis) for three Greek accents, H*, L + H*, and H* + L (from Lohfink et al. 2019); in (c) box-and-whiskers plots using the same data as in panel (b).

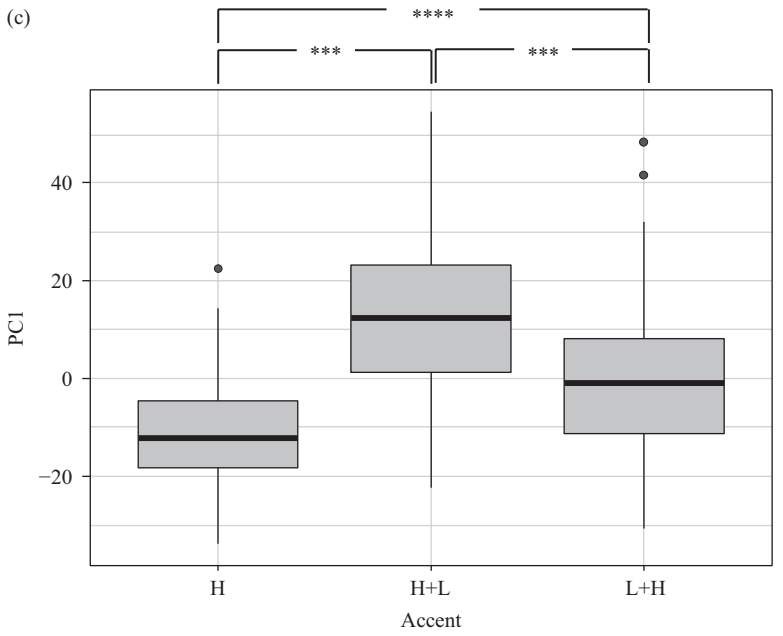

Figure 1r.2
(continued)

including a recognition that the realization of intonation is likely to present contextual, dialectal, stylistic, sociolinguistic, and speaker-specific variation and include phonetic dimensions beyond F0, which may be in trading relations with F0 itself (see Grice's commentary for some evidence). Furthermore, results such as those of Lohfink, Katsika, and Arvaniti (2019) indicate that this variation may be more pronounced for some tonal categories. For example, as shown in figure 1r.2b, the Greek H* accent is less variable in terms of PC1 in the functional principal component analysis, as compared to H* + L and L + H*; this can be interpreted as it being less variable in tonal scaling.

To be able to consider all of these facets of variation without losing sight of abstraction (which is essential for successful analysis, as argued by Arvaniti and Ladd 2009), it is important to adopt more flexible approaches, as argued by Grice, and newer techniques of examining data (cf. Lohfink, Katsika, and Arvaniti 2019). Finally, if the idea of tonal invariance is replaced or given lesser priority, AM needs to engage with pragmatic meaning, which should be an important criterion for positing phonological categories (Arvaniti 2007, 2016). Doing so should allow AM research to stop treating variation as problematic and will minimize overanalysis.

Note

1. The data come from functional principal component analysis of a corpus of 844 pitch contours elicited from thirteen speakers of Greek, following Gubian, Torreira, and Boves (2015). The data shown in figures 1r.2b and 1r.2c are from the first principal component (PC1), which accounts for 64.8 percent of the variability in the data and captures primarily scaling but also alignment differences between the accents (for details, see Lohfink, Katsika, and Arvaniti 2019).

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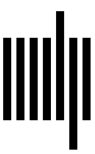

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