

## Abstract

According to most current approaches to intonational phonology, all intonation contours in spoken English consist of a sequence of high-pitched (H) and low-pitched (L) tones and combinations thereof, with an explicit omission of a mid-level tonal primitive. In order to represent mid-level tones, modern models and transcription systems, such as ToBI (i.e. Tones and Break indices), therefore employs theoretical devices that may not always be empirically motivated. Several additional issues arise regarding ToBI's proposed treatment of English mid-level contours when they are applied to utterances containing different numbers of stressed and accented syllables.

With a design of a series of imitation-and-completion production tasks, this project develops and tests the hypothesis that mid-level tones (e.g. mid accents, mid boundary tones) should be treated as primitives in models of English intonation in addition to high and low tones.

## Background

- ToBI and the British School's views on the status of English mid-level nuclear accents are **incompatible**.
- According to O'Connor & Arnold (1973), the mid-level nuclear tone only combines **certain types** of pre-nuclear intonation pattern (i.e. head and pre-head) to compose a tone group called Terrace, as opposed to the autosegmental view that tonal primitives can combine **freely** in the composition of melodies (Pierrehumbert 1980).
- In ToBI, the mid-level nuclear accent only occurs after a high leading tone as a **dowstepped high** accent in the bitonal accent (**H+!H\***). However, in O&A (1973), there is a **low** tonal target preceding the mid-level nuclear accent if the syllables before the last accented syllable are unaccented.
- The analyses of an example are given in (1a) according to the two views, and a mid-level tonal primitive is proposed to represent the mid nuclear accent based on the assumptions in O'Connor & Arnold (1973).

(1a) ToBI	O&A (1973)'s assumption modeled by AM approach
x	x
x	x
x x x	x x x
on Monday	on Monday
H+!H*	L+M*

- Moreover, according to O&A (1973), if there are more than one accented syllables in an utterance with a mid-level nuclear contour, then the prenuclear accent must be **high-pitched**. In ToBI, however, the mid-level nuclear accent always follows an H leading tone, regardless of the existence of a preceding accent, as shown in 1(b).

(1b) ToBI	O&A (1973)'s assumption modeled by AM approach
x x	x x
x x	x x
x x x x	x x x x
LAt on Monday	LAt on Monday
* H+!H*	H* M*

- Therefore, ToBI and the British School make contradictory predictions about the intonation patterns of utterances with mid-level nuclear accents when their metrical structures vary.

## Methods

- As we can see from the analyses in (1a) and (1b), ToBI and the British School make contradictory predictions about the intonation patterns of utterances with mid-level nuclear accents when their metrical structures vary.
- In order to better understand the tonal specification of mid-level accents in English, we first examined and modeled the pitch contours of the Terrace audio examples in O'Connor & Arnold (1973) in Praat. We also examined conversational speech obtained online to investigate the preferred contexts to use the Terrace tone group by native speakers.
- We designed a series of **imitation-and-completion tasks** to elicit English native speakers' production of mid-level nuclear contour.
- Since the mid tones are observed to be commonly used in **non-final** phrases to express continuity (O'Connor & Arnold 1973), we created experimental items including a targeted **left-dislocated adverbial phrase** that conveys a sense of **continuation**, followed by another phrase.
- In order to avoid phonetic bias, participants hear short utterances containing just one nucleus with a mid-level contour **in the training phase**, and they are asked to imitate those sentences as closely as possible with the same intonation.
- During the test phase**, participants are asked to keep using the same intonation as in the training phase while producing longer utterances with variable metrical structures.
- The experimental phase consists of **six conditions** in terms of different types of metrical structures, which are (1) **nucleus**; (2) **pre-head + nucleus**; (3) **short head + nucleus**; (4) **long head + nucleus**; (5) **pre-head + short head + nucleus**; (6) **pre-head + long head + nucleus**.

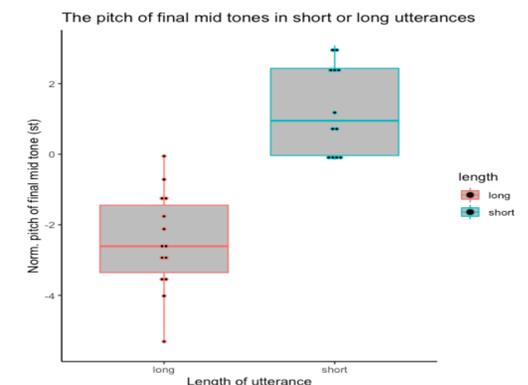
Table (1)

Training phase:	
a. <b>Thursday</b> , he'll meet his parents.	e. <b>Late on Friday</b> , he's pretty lonely.
b. <b>German</b> , he's not very good at.	4) long head + nucleus
c. <b>Mary</b> is the one who can help you.	a. <b>Later on that Monday</b> , he's really busy.
d. <b>Lately</b> , I've been working very hard.	b. <b>Early on that Friday</b> , he's a bit happy.
e. <b>Thirty</b> is too many for me.	c. <b>Later on that Wednesday</b> , he's very nervous.
	d. <b>Early on that Sunday</b> , he's really relaxed.
Test phase:	
1) nucleus	e. <b>Later on that Friday</b> , he's pretty lonely.
a. <b>Monday</b> , he's really busy.	5) pre-head + short head + nucleus
b. <b>Friday</b> , he's a bit happy.	a. <b>And late on Monday</b> , he's really busy.
c. <b>Wednesday</b> , he's very nervous.	b. <b>And right on Friday</b> , he's a bit happy.
d. <b>Sunday</b> , he's really relaxed.	c. <b>And late on Wednesday</b> , he's very nervous.
e. <b>Weekends</b> , he's pretty lonely.	d. <b>And right on Sunday</b> , he's really relaxed.
	e. <b>And late on Friday</b> , he's pretty lonely.
2) pre-head + nucleus	6) pre-head + long head + nucleus
a. <b>On Monday</b> , he's really busy.	a. <b>And later on that Monday</b> , he's really busy.
b. <b>On Friday</b> , he's a bit happy.	b. <b>And early on that Friday</b> , he's a bit happy.
c. <b>On weekends</b> , he's very nervous.	c. <b>And later on that Wednesday</b> , he's very nervous.
d. <b>On Sunday</b> , he's really relaxed.	d. <b>And early on that Sunday</b> , he's really relaxed.
e. <b>On Wednesday</b> , he's pretty lonely.	e. <b>And later on that Friday</b> , he's pretty lonely.
3) short head + nucleus	
a. <b>Late on Monday</b> , he's really busy.	
b. <b>Right on Friday</b> , he's a bit happy.	
c. <b>Late on Wednesday</b> , he's very nervous.	
d. <b>Right on Sunday</b> , he's really relaxed.	

Table (1) The experimental items used to elicit the speakers' production of the mid tones.

## What did we find?

- Due to the time constraints, we were only able to completed the experiment design without running the experiment.
- However, we observed at least **4 phonetic levels** in the recordings of Terrace in O&A (1973), instead of three levels. The mid level of the final nuclear accent is significantly lower (no overlap) when it is preceded by a high head (i.e. long utterances) than when not preceded by a head (i.e. short utterances), as shown in the following figure.
- The scaling difference may due to a pitch declination occurred in long utterances, or maybe a four-level distinguish is needed. Those scaling issues are still under exploration.



## Going forward

The next steps will be:

- Run the experiment that has been set up in Gorilla. Pitch contours will be extracted from the recorded materials using the auto-correlation pitch detection function in Praat. Pitch values will be measured at different locations in each target utterance.
- We will examine visual displays of the data carefully, and analyze relevant quantitative trends using mixed-effects regression models in R software.
- In a follow-up study, we are interested to study how downtrends affect the realization of the tone group, by grouping the target phrases in a larger word group. We could also manipulate the height of the training items and see how that affects scaling.

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## References

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