Week 6: Introduction to intonational phonology

1 Administrative

(1) Agenda

a. Today: introduction to intonational phonology

b. Thursday: phonological constituency/targets/autosegmental-metrical theory, go over homework(s)

(2) Assignments

a. Project meeting 1 this/next week. You should be clear on what to do for your model paper review and what kind of class you're going to be teaching after Spring Break.

2 Quick note on Kikuyu toneless vowel rule

(3) Derivation with rules acting on autosegmental representations:

Rule 1 (Peninitial association)**.** *Associate the word-initial tone T to the peninitial vowel in the word.*

$$\begin{bmatrix} C_0\ V\ C_0\ V \\ \\ T \end{bmatrix}$$

Rule 2 (Association convention)**.** *When unassociated vowels and tones appear on the same side of an association line, they will be automatically associated in a one-to-one fashion, radiating outward from the association line. (Goldsmith, 1990, (11)) This rule can operate only on autosegmental representations with at least one association line.*

$$\begin{bmatrix} V\ C_0\ V \\ |\quad \ddots \\ T\ \ T \end{bmatrix}$$

Rule 3 (Association of toneless vowels)**.** *Associate a toneless vowel to the tone in the same timing slot in the tone tier.*

$$\begin{bmatrix} \textcircled{V} \\ \vdots \\ T \end{bmatrix}$$

a. Note that peninitial and toneless association are language-specific while the association convention is universal.

b. Notation:

i. Dashed association line indicates structural change

ii. Circle is an element in the structural description, indicating that a segment is not associated to anything in the "facing" tier.

(4) What is with the notion of a *timing slot* as mentioned in Rule 3?

(5) In this case, the left bracket indicates the left edge of a domain, herethe left edge of the "word". So this implies counting starting at the left.

(6) Much more common initial association rule ("the first rule that associates tones and vowels in the derivation") than Kikuyu's peninitial one:

Rule 4 (Initial association rule)**.** *Associate the word-initial tone T to the initial vowel in the word.*

$$\begin{bmatrix} C_0\ V\ C_0\ V \\ \\ T \end{bmatrix}$$

(7) Hausa tone has been analyzing as having an initial association rule like the one just above: but at the right edge of the word (Newman 1986a)

a. Hausa has suffixes that "overwrite" tones of the base, and then you end up with tonal plateaus at left

i. shuugabaa LLH + ancii HL → shúugábáncìi HL 'leadership',

ii. tagangana LHL + ee LH → tàgàngànée LH 'sitting with legs apart'

(8) What happens when you have more tones than vowels and an initial association rule like Rule 4?

a. You could get tones piled up at the right-hand end of the word and association of multiple tones to a vowel

b. You could end up with a tone that is associated with no vowel at all: a floating tone, like we saw in the Ngamo tone shift data, which got associated once there was segmental material present for it to be associated to.

3 Intonational phenomena[1]

(9) See `mat/intonation/tobi/intro` in the Box folder for sound file examples

(10) Components of intonation are: (i) a **tune**, (ii) **prominence relations** among words, and (iii) **phrasing**, as defined below.

Definition 1 ***(Tune).***
A **tune** is a phrase-level melody conveying a certain pragmatic meaning and sentence type information. It's composed of a sequence of tonal events. □

Definition 2 ***(Prominence relations).***
Prominence relations between words are syntagmatic relations and can be described with grid representations. Cues for prominence relations include pitch, duration, and intensity. □

Definition 3 ***(Phrasing).***
The **phrasing** of an utterance is cued by the placement of boundary tones within the utterance. □

(11) **Tune-text association** refers to the association of a sequence of tonal elements (on the tonal tier) to a sequence of segments (on the segmental tier).

a. A tune can be produced in conjunction with a variety of texts and conveys a meaning independent of the text.

b. While the sequence of tonal elements in a tune does not change when the tune is associated with different texts, *the association between the tonal elements and segments may change*, depending on the location of stressed syllables and length of prosodic constituents.

Exercise 1 ***(Tune-text association).***

a. One tune, multiple texts: Surprise contour '$L_1H_2L_3H_4$' rise-fall-rise contour[2]

(1a) I hear Moe got a fellowship to study geology.

(1b) Moe?!

Bethany: If I'm interpreting (11) correctly, it seems like it's saying that every utterance will contain at least three tones. Is that true, even for short, one-word utterances? (Are the tones there, but just floating or not realized if the utterance is too short?)

[1] **Materials in this section adapted from Sun-Ah Jun; thank you Sun-Ah!**

[2] If you're familiar with Noah Constant's work, you might be wondering: wait a minute, isn't rise-fall-rise supposed to be a contrastive topic marker in English? (What about FRED? What did HE eat? FRED... ate the BEANS.) One thing to keep in mind is that there could certainly be homophonous tunes.

(2a) I hear Moe's taking courses to become a quantum mechanic.

(2b) A quantum mechanic?!

(2b') A temporary part-time libraries North-West inter-library loan business unit administration assistant.?![3]

What can you tell about the realization of the "suprise" tune from comparing the tune-text association in (1b), (2b), and (2b')? What are L_1, H_2, L_3 and L_4 associated to?

b. Multiple tunes, one text: **Another orange**

(3) Oh man, I can't wait to see what Dad packed me for dessert today! [opens lunch bag]. Oh no—**another orange**?

(4a) What do you think we should pack for Timmy's snack today? So far this week, we've given him an orange on Monday, an orange on Tuesday, and hmmm, yeah, also an orange yesterday.

(4b) Hmmm, well since we're on a roll—**another orange**?

Is there any generalization you can make about what kind of tonal event is associated to the most "salient" word in the utterance?

□

In sum, a tune can be produced over different texts, with a meaning independent of the associated text. The association of the tonal events in the tune to the text depends on the stress patterns and lengths of prosodic constituents. Moreover, different tunes can be associated with the same text, and these different tune-text combinations can have different meanings.

(12) **Prominence** relations are another component of intonation that are orthogonal to the choice of tune. In other words, even for the same tune, there are different prosodic structures that may be generated. Note that how prominence relations are cued is determined language-specifically, although the cues used tend to recur across languages, e.g. pitch, duration, intensity.

3.1 Representing stress

(13) Hayes (1995) argues that stress does not behave in ways that other features do (or that other features tend to do). Here's some weird properties of stress:

a. Stress can shift from segment to segment based on distance from a word edge (**ó**rigin, o**rí**ginal, orìgi**ná**lity)

b. Stress can act at long distances across other instances of stress (**Mì**ssi**ssí**pi vs. **Mí**ssi**ssì**ppi **lé**gislàtors)

c. Every content word must be "[+stress]" in many languages

d. Stress does not get assimilated, only dissimilated

e. Stress participates in phonological processes and distributions as a *relation* between syllables

f. A "stress" detector based purely on articulatory or acoustic parameters seems untenable in a way different from other distinctive feature detectors

3.1.1 The Grid (we'll skim over this section for now)

(14) How can we represent stress as an abstract prominence relation? Phonologists have argued for enriching our representations for stress beyond featural representations to *the grid* (Liberman, 1975).

[3] It's a old trick of the trade in prosodic research to vary the length of prosodic constituents. Here I picked the world's longest job title.

Example 1 ***(reconciliation (from Hayes 1995)).***

$$M = \begin{bmatrix} & & & & \times & \\ \times & & & & \times & \\ \times & & \times & & \times & \\ \times & \times & \times & \times & \times & \times \\ re & con & ci & li & a & tion \end{bmatrix}$$

□

(15) The set of possible configurations is assumed to be restricted by an (inviolable!) well-formedness constraint:

Definition 4 ***(Continuous Column Constraint).*** For every grid mark (except on the bottom layer), there must be a grid mark in the same column on the layer below.[4] □

3.1.2 Motivating grids

(16) Consider the English phrasal stress rule:

Definition 5 ***(English nuclear stress rule).*** Nuclear stress of a (prosodic) phrase is assigned to the main stress of the last word in the phrase. Exceptions: this rule may not hold in morphologically complex words (elevator operator?) and under particular pragmatic conditions (*Realistic imitators? No, I said hypothetical imitators!*) □

Exercise 2 ***(English nuclear stress).*** Assign primary and secondary stress to:

a. *hypothetical*

b. *imitators*

Where is nuclear stress assigned in *hypothetical imitators*? □

(17) If we state the nuclear stress rule over feature bundles or segments, the target may be several syllables from a phrase edge.

(18) If we state the nuclear stress rule over grid representations, we can state it very *locally*:

Definition 6 ***(English nuclear stress operating on grids).*** If the highest layer of the grid has exactly two marks, add another mark to the column of the second mark.

$$\begin{bmatrix} & \\ \times & \times \end{bmatrix} \rightarrow \begin{bmatrix} & \times \\ \times & \times \end{bmatrix}$$

The scan for the structural description over potentially many syllables gets suppressed in the "white space" between and on either side of grid marks on the same layer, and the structural description could match any (adjacent) rows of the grid. □

(19) This idea that what looks like it could be a non-local process in phonology when operating on one representation can be recast as a local process when we enrich the allowed set of phonological representations and operate over another representation should be familiar!

[4] This reminds me of those marble games where you stack marbles in different slots. Or maybe the Tower of Hanoi.

Exercise 3 ***(Hypothetical imitators on grids).*** Draw grids for *hypothetical* and *imitators* in isolation, then put them together and apply the nuclear stress rule (the grid version).

□

(20) The optional English *rhythm rule* (Prince 1983) can be recast as an interaction between an (inviolable!) constraint NoClash and a rule *Move-X*.

Definition 7 ***(NoClash).*** If two grid marks are adjacent on their layer, the grid marks under them can't also be adjacent on their layer.

$$*\begin{bmatrix} \times & \times \\ \times & \times \end{bmatrix}$$

□

Definition 8 ***(Move-X).*** Move one grid mark along its layer (triggered by violation of NoClash). In English: only leftward movement allowed. □

Exercise 4 ***(Rhythm rule).*** Draw grids for *Sunset Park* and *Zoo*. Is NoClash violated if their grids are adjacent? If necessary, apply *Move-X*. Where can you apply this without violating the Continuous Column Constraint? Is this operation local?

□

Exercise 5 ***(Contrastive focus in English).***
Maggie: Last, what is the relationship between pitch accents and stress in English? Do all stressed words have a pitch accent? Does the pitch accent dock to stress? In a grammatical sense, where do these two features of the system of English 'live' and how do they interact?

1. Consider **Another orange!**. Come up with contexts for contrastive focus on: (i) **another** and (ii) **orange**.

2. Consider **Lemons are a good source of vitamins**. Come up with contexts for contrastive focus on: (i) **lemons**, (ii) **good**, and (iii) **vitamins**.

3. Draw grid representations for each of the three prosodic structures for the lemons sentence.

4. Consider **I don't talk to anyone**. What are the prominence relations for: (i) 'I talk to no one.', (ii) 'I talk to only those people.'
5. What about 'She gave her dog biscuits.'? Can you think of two different interpretations for that?

□

In sum, the patterns of relative prominence in a prosodic constituent reflect different pragmatic meaning. Prominent words receive pitch accents, so prominence relations are indicated by the presence of pitch accents on particular words.

(21) **Phrasing** of an utterance can also change the interpretation of the utterance.

Exercise 6 ***(Prosodic disambiguation).***
What is the difference in meaning for:

a. [[Old men][and women]] vs. [[Old][men and women]]

b. [[Does Manitowac][have a library]] vs. [Does Manitowac have a library]

c. [[Ramona saw the villain][with the binoculars]] vs. [Ramona saw][the villain with the binoculars]

□

In sum, the phrasing of an utterance can also change its interpretation, and phrasing is marked by **boundary tones**, while prominence relations are marked by **pitch accents**.

(22) Swedish magic comments

a. Bethany: The discussion in 7.3.1 makes it seem as if there are two distinct kinds of pitch accents: lexical pitch accents which modulate F0, and intonational pitch accents which modulate both F0 and duration. And, apparently, Swedish has both kinds of pitch accents. Does this division do any theoretical work, or do people mostly just lump these two kinds of pitch accents together? Maybe relatedly, boundary tones are supposed to modulate both F0 and "strength of articulation", and I'm wondering about the different work or acoustic consequences these different kinds of tones are having and how that might influence our understanding of how they are represented. For example, given that each of these kinds of tones has different acoustic consequences, is it still reasonable to assume that they all exist on the same tier or that there's only Hs and Ls? How can we tell whether an H is a lexical pitch accent and will affect only F0, is an intonational pitch accent and will affect F0 and duration, or is a boundary tone and will affect F0 and strength of articulation?

b. Anissa: I had a similar question to Jonathan's as well, but regarding the statement that lexical and intonation tones are a single phonological string (130). Understanding this would of course be helped by understanding what Gussenhoven means by lexical and intonational [Jonathan: this is me not answering your question so sorry], but from what I understand if these tones can appear as a single phonological string and are distinct entities from each other. Does this mean they don't rely on each other at all? As in, the decision to use a lexical tone (which I think has something to do with the lexical meaning) has no bearing on the intonational tone (which maybe has something to do with phrase level stuff??). I have no concrete examples to support this, but I feel like there are definitely instances where the meaning of an item would have an impact on the intonation at phrase level. For some reason, I feel like these need to be separated, but perhaps all of this is explained by Stockholm Swedish or something.

c. Duygu: This, I think, overlaps with Maggie's question about tone and English. I would think that a tonal change signaling stuff related to the information structure not as a "tone" as that would mean the language is a tone language. If not, why are these boundary tones that are relevant to the intonational phrase are called "tones"? Are they relevant to something else other than the information structure? [Bethany: Yeah, I think I'm also confused about, in general, where tones come from; do they come from the syntax? information structure? lexicon? all of the above? To what extent is prosody its own grammatical module, separate from syntax/semantics/phonology/lexicon?] [Jonathan: I couldn't quite tell what Gussenhoven was assuming in this regard. But I think this is a really exciting question.]

4 Swedish word accent

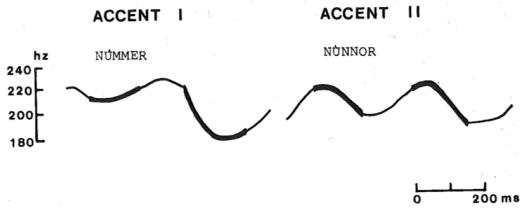
(23) See `mat/intonation/tobi/swedish` in the Dropbox folder for sound file examples

(24) Demo: examples of minimal pairs contrasting Swedish word accent. (wordlist)

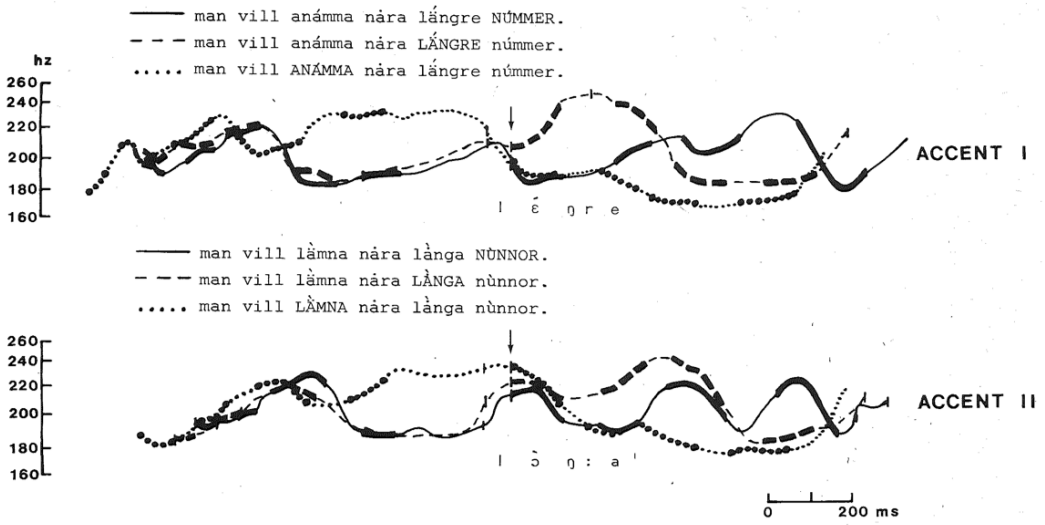
(25) Bruce (1977) `[further-reading/6/bruce1977.pdf]` laid the foundations of the **autosegmental-metrical** theory perspective on intonation.

Exercise 7 ***(The phonetic realization of Accent I and II).***

a. Describe the difference between Accent I and II in isolation, as shown in Figure 1a.



(a) Swedish word accent contrast in citation form.



(b) Swedish word accent contrast under a set of systematically varying contexts.

Figure 1: Results from production experiments in (Bruce, 1977).

Factor	Levels
Accent	Accent I, Accent II
Sentential position	Position 1, Position 2, Position 3
Contrastive focus	Absent, Present

Table 1: Manipulated factors for Figure 1b

b. Describe the experimental design for the set of sentences given in Figure 1b

c. For Figure 1b, describe the effect of the manipulated factors on the pitch contours over the target words, including which sentences you'll compare to determine this: hold the other two factors constant at some level while you vary over one of the factors. Call the top three sentences 1a, 1b, 1c. Call the bottom three sentences 2a, 2b, 2c, so you might write that you're comparing 1a vs. 1b, or 2a vs. {2b,2c}

i. A constant, effect of B; comparisons: _____

ii. A constant, effect of C; comparisons: _____

iii. B constant, effect of A; comparisons: _____

iv. B constant, effect of C; comparisons: _____

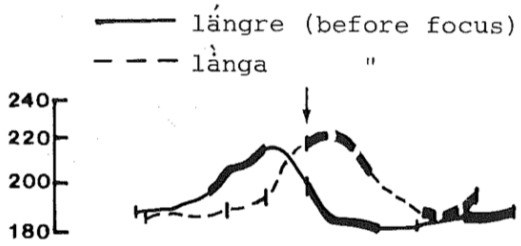
v. C constant, effect of A; comparisons: _____

vi. C constant, effect of B; comparisons: _____

d. Compare your description for the effect of the manipulated factors in Figure 1b with your description of the Accent I and II contrast in isolation.

□

Moral 1 ***(Flat structure in prosodic realization).***
Hierarchical prosodic structure can get flattened in phonetic realization, such that a sequence of tonal events can be treated as a string. Each tonal event, regardless of what prosodic structure depth it is associated with, can be localized as an element in this string. (Alternatives: "overlay" or "superposition" models, e.g. Fujisaki and Hirose (1984) on Japanese) □



(a) The Accent I/II contrast in sentence medial position, in broad focus

(b) The Accent I/II contrast in sentence final position, in narrow and broad focus.

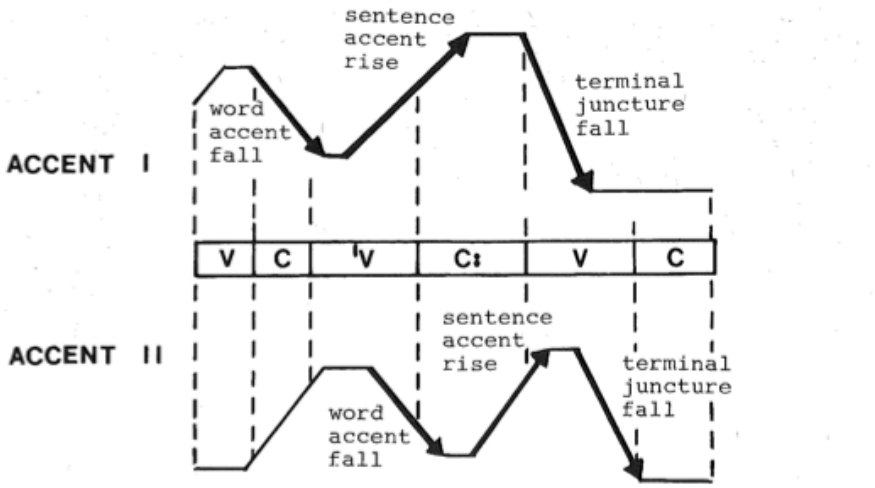


Figure 10. The Fo-contributions of word accent, sentence accent and terminal juncture. Schematized contours of one accent I- and one accent II-word. The arrows, drawn in thick lines, indicate word accent fall, sentence accent rise and terminal juncture fall.

(c) A flat sequence of tonal events.

Figure 2: Flattening in realization of hierarchical prosodic structure in Swedish (Bruce, 1977).

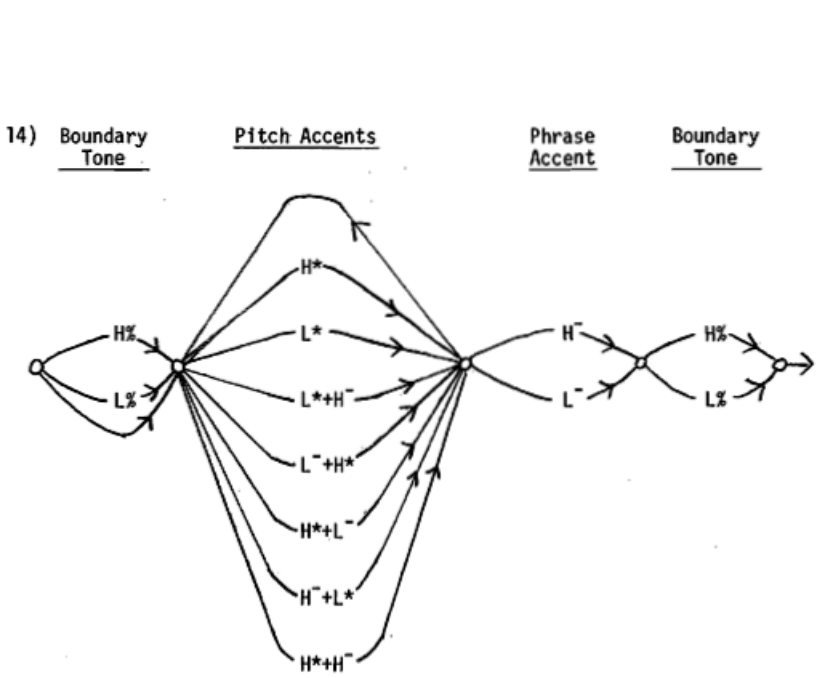
4.1 Autosegmental-metrical theory

(26) Basic idea: follows idea about "flattening", using autosegmental theory for association of tonal events and metrical theory (the grid) for describing prominence. See Pierrehumbert (1980, 2000) for overviews in `[further-reading/6/pierrehumbert1980.pdf]`, `[further-reading/6/pierrehumbert2000.pdf]`.

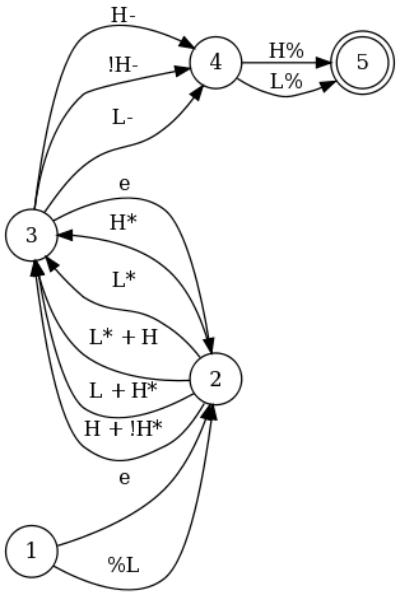
(27) Intonational grammars admit particular strings of tonal events, e.g. finite state grammar in Pierrehumbert (1980).

(28) One big partition for tonal events: **head-marking** and **edge-marking** events.

(29) English has a rich inventory of pitch accents:



(a) Pierrehumbert (1980) finite state grammar of English intonation



(b) MAE ToBI (Mainstream American English, Beckman and Pierrehumbert), the updated revision of Pierrehumbert's FSM.

Figure 3: Intonational grammars for some head-prominence marking languages

(30) while Korean has a rich inventory of boundary tones.

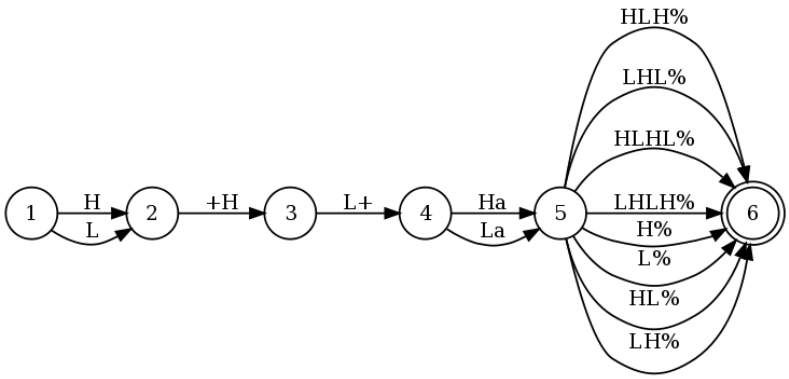


Figure 4: K-ToBI (Korean, Jun), [web]

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