ATELIER / WORKSHOP

THE SOUTH CAUCASIAN CHALK CIRCLE

Philology meets linguistics

SEPTEMBER

22 ▶ 24 2016

PHONETICS-PHONOLOGY / MORPHOSYNTAX / DOCUMENTATION-VARIATION-CHANGE

DAY 1 – 9:30	DAY 2 – 9:00	DAY 3 – 9:00
TUTORIALS Formal models; Kartvelian research in Georgia	TUTORIALS Experimental work; The issue of terminology	TUTORIALS Documentation; Language corpora
POSTER SESSION Phonetics and Phonology	POSTER SESSION Morphosyntax	POSTER SESSION Documentation, variation, acquisition
PANEL MEETINGS	PANEL MEETINGS	PANEL MEETINGS

DEROT

UNIVERSITY OF CHICAGO CENTER IN PARIS

Phonetics / Phonology Panel

- Day 1 – Ioana Chitoran and Marika Butskhrikidze
- Day 2 – Gašper Beguš and Julia Sturm
- Day 3 – Jelena Borise

Paris, September 22-24, 2016

Goals

- Identifying research questions of interest for:
  - The phonetics and phonology **(henceforth PH)** of Kartvelian languages
  - Linguistics more generally:
    - Typological descriptions
    - Theoretical models
    - Phonological representations
    - Models of speech production, perception, processing

Goals

- Identify new types of data and ask new questions
- Ask new questions about old data, that have already received a lot of attention (e.g., *phonotactics*)

Consonant clusters – a "signature" of Kartvelian PH

Specific to Kartvelian, ***but*** with broad implications:

- Syllable structure and phonotactics
- Consonant clusters: distribution, restrictions
  - The role of the syllable in phonology, in speech production, speech perception, and speech comprehension
  - The syllable as a unit of structure, a unit of information, a unit of processing
  - The nature of phonological representations – formalism

Panel organization and related posters

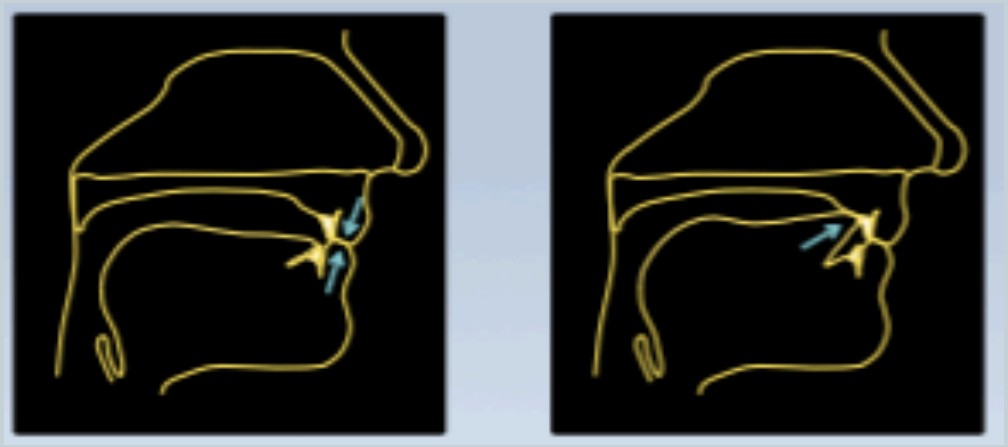
- Day 1: phonotactics (Chitoran, Butskhrikidze)
  - Posters: Akhvlediani & Gabunia; Lentz et al.
- Day 2: phonotactics (Beguš, Sturm, Butskhrikidze)
  - Posters: Beguš; Meier et al.; Sturm
- Day 3: prosody, stress (Borise, Butskhrikidze)
  - Posters: Borise

Chitoran & Kwon, in progress

- Stop-stop sequences in Georgian
- The role of *timing lag* in phonological representation

What is timing lag?

- The delay between two consonantal constrictions C1C2
  - Example – in the sequence [pt]:



C1 labial constriction C2 coronal constriction

Figures from Yip (2013)

Main articulatory events (gestures) for a stop consonant

- Constriction (closure)
- Release

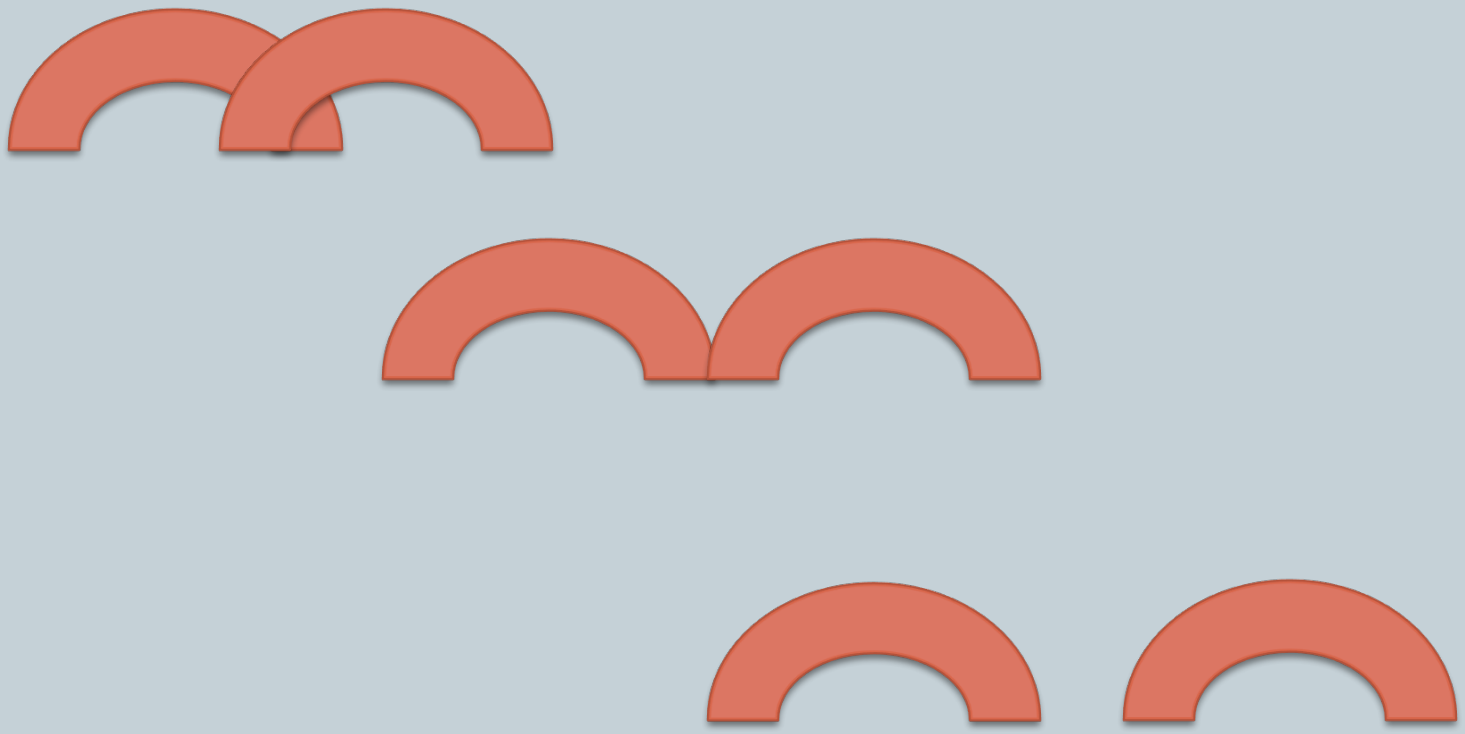
How are these two events timed relative to each other?

Patterns of stability within widespread variation

- When is the C2 constriction ***formed*** relative to C1 constriction / release?
- When is the C2 constriction ***released*** relative to C1 constriction / release?

Relative timing of C1 and C2

Shorter timing lag, more overlap …



… Longer lag, less (no) overlap

The question we want to ask:

- Do <u>timing differences</u> play a role in the phonology?
  - Is the relative timing of adjacent C1 and C2 controlled by speakers?

- <u>Working H</u>: phonologial representations are dynamic. In their abstract form they encode info about relative timing of gestures.
  - Timing patterns are learned.

Timing pattern found in production

Variation in timing is not random

<u>Order of place effect</u>

- Longer lag in back-to-front sequences *(tp, kt)* than front-to-back *(pt, tk)*

  (English: Byrd 1992, 1996; Zsiga 1994; Surprenant & Goldstein 1998; Georgian: Chitoran et al., 2002)

  - *Relates to terms used in the Georgian literature: "accessive" and "decessive" (I. Melikhishvili)*
  - *Front-to-back sequences include the harmonic clusters*

- An explanation initially proposed for the order of place effect:

The perceptual recoverability hypothesis

Not supported, at least in its initial formulation

Perceptual recoverability hypothesis

- Gestures in a stop-stop sequence (C1C2) have longer timing lag in contexts where information about C1 may be harder to recover.

- In production, speakers may control timing between C1 and C2 to increase C1 perceptibility in a stop-stop sequence.
  - They produce a longer lag, which would prevent C1 release from being hidden by C2 closure, and
  - a C1 vocalic release, which would provide clearer C1 formant transitions.

Is the C1C2 timing difference observed in production predicted by the perceptual recoverability hypothesis?

Lag asymmetries: Front-to-Back

- If C2 constriction is behind C1, some acoustic information will still be present at C1 release, even with substantial overlap.
  - In a front-to-back sequence **[pt]**:

C1 labial closure | C2 coronal closure | C1 labial release while holding C2 closure (audible)

Figures from Yip (2013)

Lag asymmetries: Back-to-Front

- If C2 constriction is ahead of C1, C1 release may be completely hidden acoustically unless the C2 constriction gesture is applied after C1 release.
  - In a back-to-front sequence **[gd]**:

C1 dorsal closure | C2 coronal closure | C1 dorsal release while holding C2 closure (inaudible)

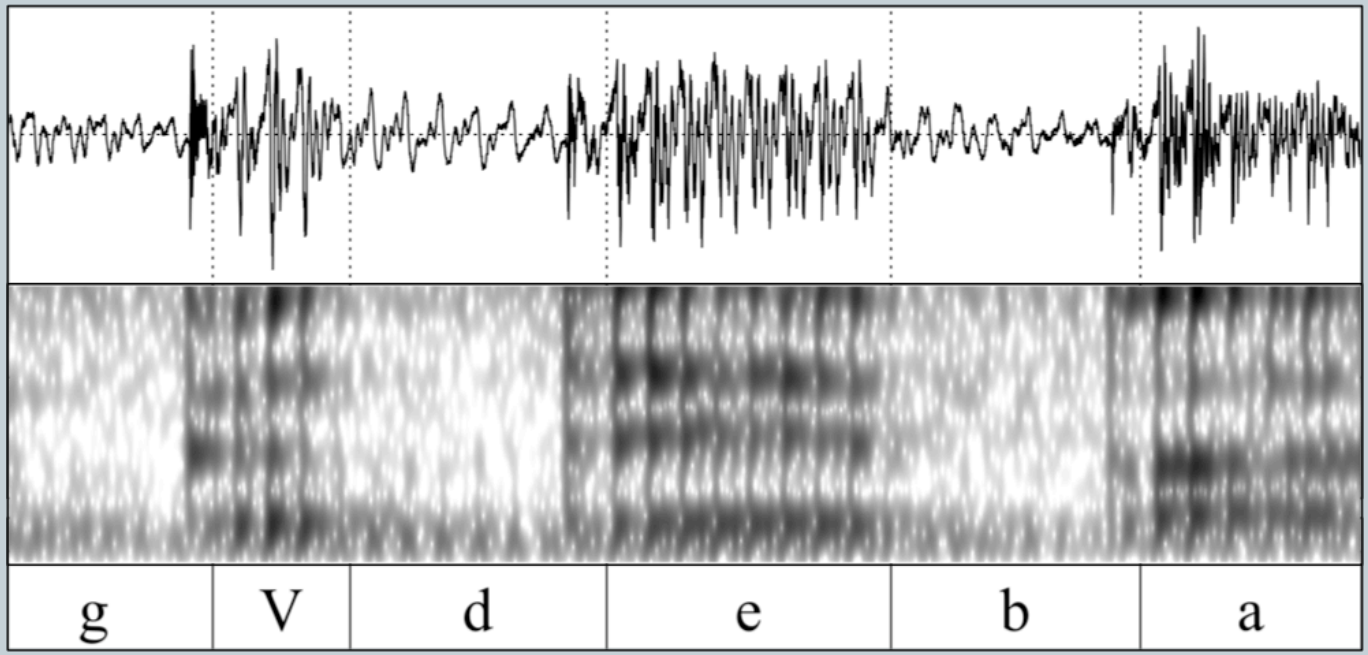
Figures from Yip (2013)

Sometimes vocalic releases are produced

In Georgian *(Chitoran et al. 2002)*

- More often in back-to-front order and in voiced context
- Inter-/intra-speaker variation (occurrence/duration)

example: /gdeba/



Vocalic release

Is the occurrence of C1 vocalic release in production predicted by the perceptual recoverability hypothesis?

- C1 vocalic releases may provide formant transitions => richer information about C1 identity
- Typically seen as a consequence of C-C coordination with longer lag

(Gafos 2002; Hall 2003; Davidson & Roon 2008; Bradley 2007)

However…

- Production patterns are NOT always predicted by perceptual recoverability.
  - Chitoran and Goldstein (2006): Georgian stop & liquid combinations (e.g., *kl, lp*) show a place order effect although neither the stop nor the liquid is in danger of being obscured by a high degree of overlap.
  - Yip (2013): Greek C1C2 sequences show a place order effect at least for some speakers, even when one of the consonants is a fricative or a liquid.
- Perceptual recoverability has not yet been tested in perception (to our knowledge).

Present study

<u>Testing perceptual recoverability in perception:</u>

Do longer lags between C gestures and/or C1 vocalic releases help listeners recover C1 in a C1C2 sequence?

- H1: Longer timing lag between C1 and C2 facilitates recovery of C1 gestures
- H2: C1 vocalic release facilitates recovery of C1 gestures

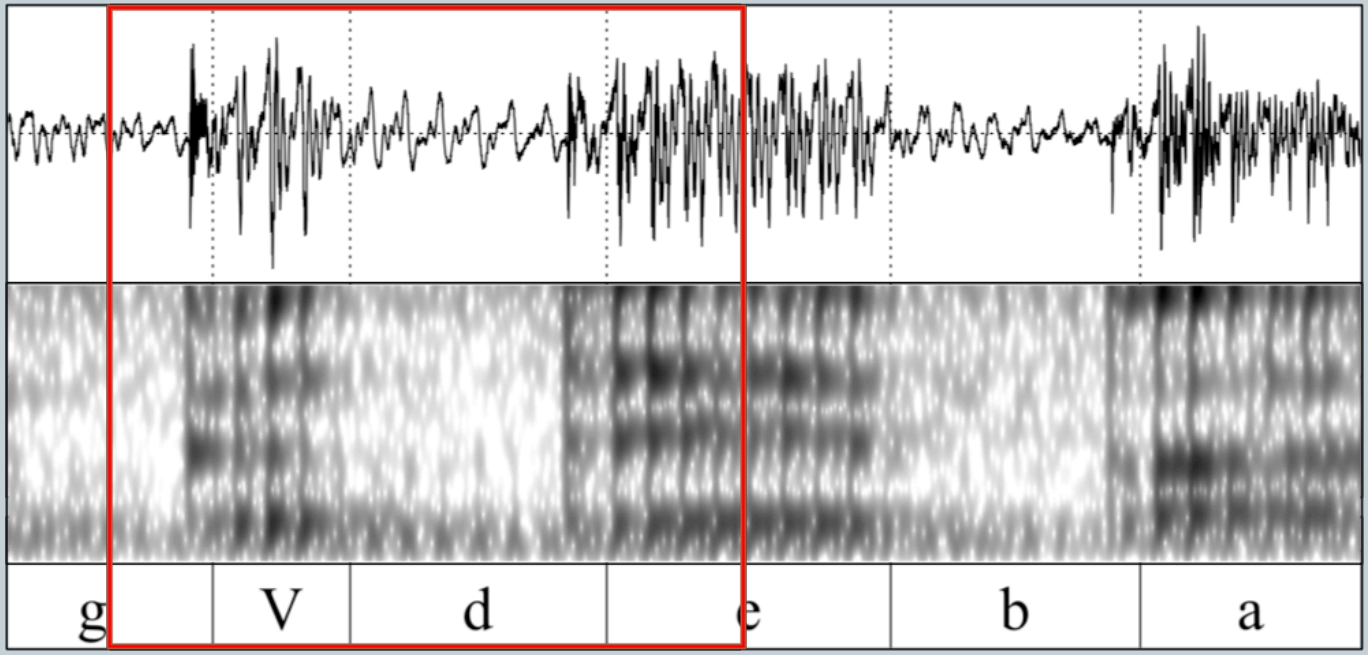
Methodology: stimuli recording

- A male native speaker of Georgian produced Georgian words
- Acoustic and articulatory (EMA) data simultaneously recorded

C1C2	front-to-back	back-to-front
target words	bgera pʰtʰila dgeba abga apʰtʰari adgeba	gberavs tʰbeba gdeba dagbera gatʰba agdeba
fillers	t'k'ena brazi batʰkʰani albatʰ#kʰeri	kʰt'itori k'bili kreba pʰakʰt'ebi albatʰ#baɣʃi
CVCV controls	bile t'ebi deba geba	

Methodology: stimuli segmentation

- C1C2V portion
  - C1 closure midpoint to V midpoint
  - Segmentation based on the acoustic signal

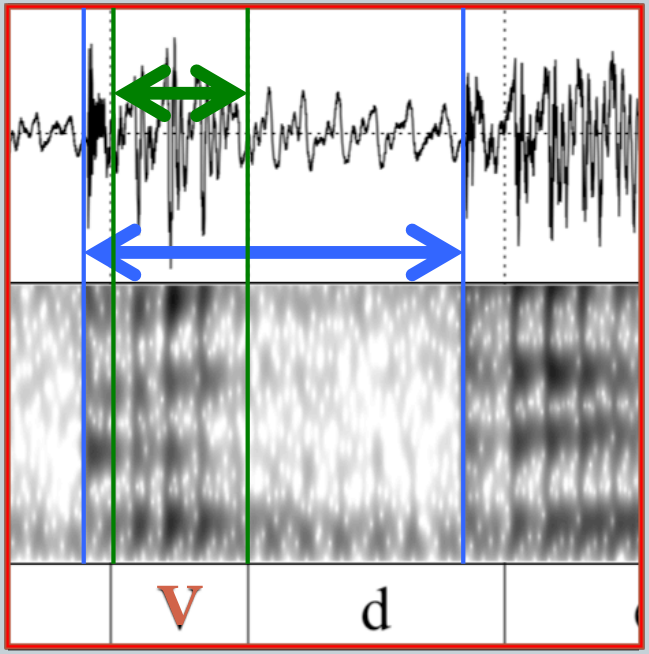


Methodology: acoustic parameters

Three acoustic parameters

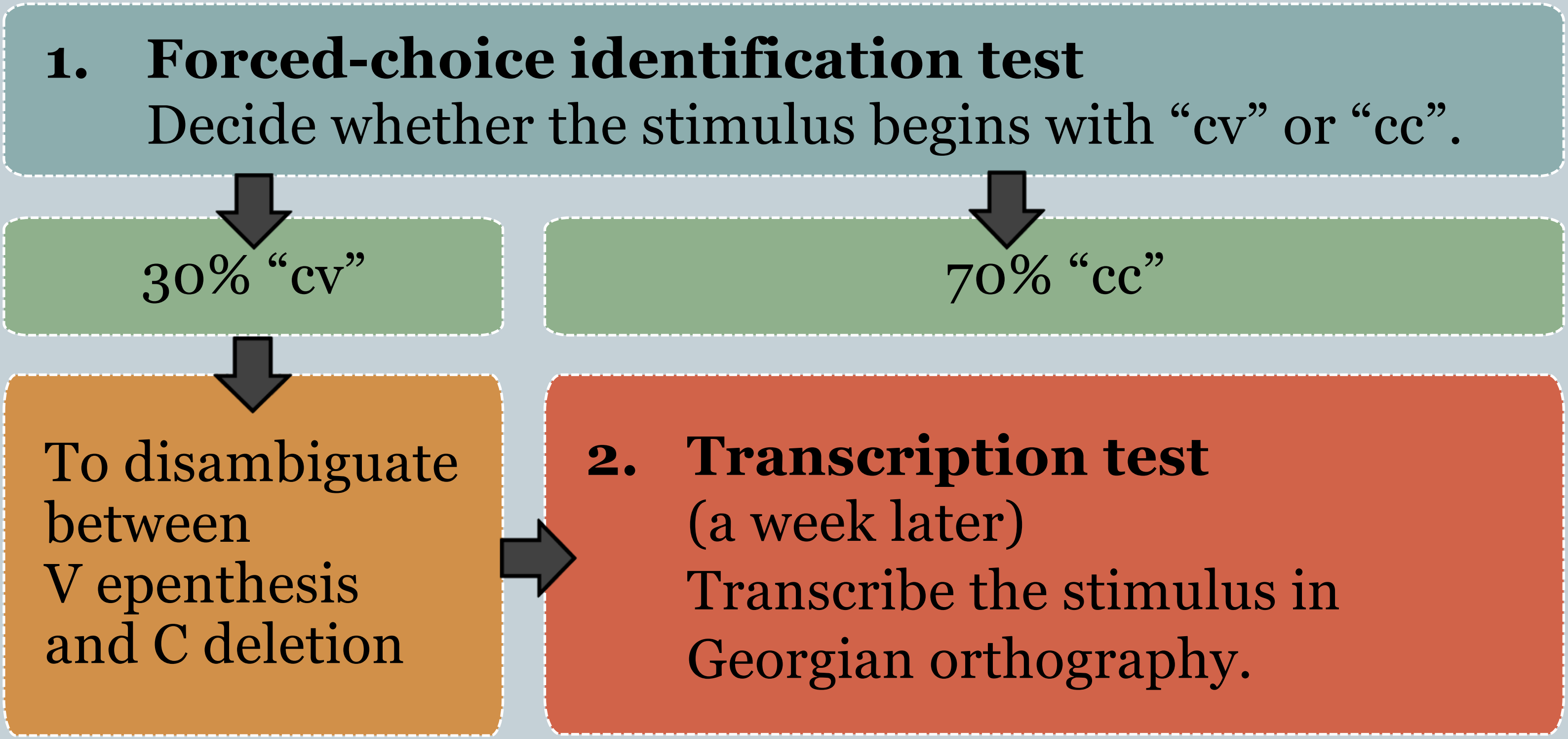
1. Acoustic Lag: C1 release burst – C2 release burst
2. Presence/absence of vocalic release
3. Duration of vocalic release (when present)

example:
/gde/



Methodology: participants and procedures

- 29 native Georgian listeners living in Tbilisi, Georgia
- Two perception experiments



1. **Forced-choice identification test**
   Decide whether the stimulus begins with “cv” or “cc”.

30% “cv”

70% “cc”

To disambiguate between V epenthesis and C deletion

2. **Transcription test**
   (a week later)
   Transcribe the stimulus in Georgian orthography.

Results: Transcription test

- C1 is correctly transcribed 66% of the time.
- Does each of the four parameters contribute to correct identification of C1?
  1. Timing lag: Acoustic Lag, Articulatory Lag
  2. Vocalic release: Presence/absence, Duration

Summary of results

- C1-C2 longer lag helps native listeners recover C1 in stop-stop sequences.
- There is no evidence that the presence of a vocalic release helps C1 identification, even though it includes richer C1 formant transition information.
- Long vocalic releases prevent listeners from correctly identifying C1.

Discussion

- Native listeners are sensitive to the timing lag differences, when making the phonological judgment of identifying C gestures in C1C2 sequences.
- Supports the inclusion of timing lag in the grammar of Georgian
- Two possible reasons for the place order effect observed in production
  - perceptually motivated online computation
  - phonologized coordination patterns
    - may have emerged for perceptual reasons
    - generalized and learned as part of phonological grammar

Discussion

In Georgian, timing lag as phonologized coordination patterns is consistent with:

- The unpredicted place order effect in stop & liquid combinations (Chitoran & Goldstein 2006)
- Historical development of Georgian stop-stop sequences
  - Two historical sources (Gamkrelidze & Ivanov 1995):
    - Back-to-front C1C2 – developed through deletion of intervening V
    - Most front-to-back C1C2 – developed from velarized stops
      - e.g., [dˠ] broken into [dg]

Concluding remarks

- Current results suggest that longer lags can be useful for the Georgian listeners.
- But we do not find evidence that vocalic releases help them.
- Patterns reported in production studies do not always seem to match what listeners use in perception.
- Question: Do speakers control the timing lags and vocalic releases for the sake of listeners?

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Thank you

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