

Introduction

- Multiword utterances regularly exhibit word boundaries that are not necessarily sacrosanct. For example, in the famous English slogan *Drink a pint of milk a day*, the linguistic units correspond not to the morphosyntactic representation of the utterance, but rather its **prosodic structure**:

Morphosyntactic units: (DRINK) (a PINT) (of MILK) (a DAY)

Prosodic units: [drɪŋkə]_ω [paɪntə]_ω [mɪlkə]_ω [deɪ]_ω

- This mismatch in prosodic and lexical structure points to a process in speech production where **features of connected speech** must be prepared, i.e. where *drink a* becomes *drinka*.
- Little is known about this process in **non-native (L2) speakers**. Regarding the reduction and encliticisation of auxiliaries in L2 speech, there is evidence that L2 speakers of English behave differently to L1 speakers (cf. Baker et al, 2011). Phonetic analyses of non-native speech patterns have revealed that L2 speakers of English on average produce less syllable reduction (Anderson-Hsieh & Venkatagiri, 1994) and less function word reduction (Aoyama & Guoin, 2007).
- A number of psycholinguistic tasks have revealed that English **compounds**, which contain two (or more) lexical items, are regularly treated as single prosodic units by native (L1) speakers (Wheeldon & Lahiri, 2002; Janssen et al., 2008). The present study focuses on the planning of these items by L2 speakers.

Research Questions

- How are multiword structures such as compounds and phrases prepared by native (L1) English speakers?
- How are these structures treated by L2 English speakers?
 - Are compounds still treated as single prosodic units to which clitics reduce and attach?

Experimental Design and Stimuli

Four production experiments:

- Two delayed naming tasks and two online naming tasks

Four experimental conditions:

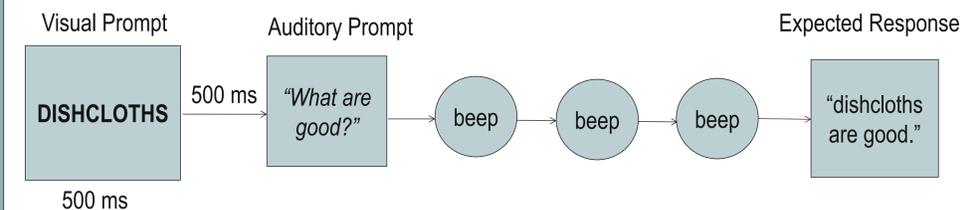
- Transparent noun-noun compounds
- Adjective-noun phrases
- Disyllabic monomorphemic words
- Monosyllabic monomorphemic words

(1) Comp	(2) Adj-N	(3) Disyll	(4) Mono
dishcloths	dark cloths	donkeys	ducks

Stimuli were matched for word length (number of letters), imageability and a number of frequency measures (simple CELEX, written, and spoken counts per million, as well as log frequency). Word familiarity and stress placement was confirmed by rating data using a native speaker judgement task (N= 35).

Delayed Design:

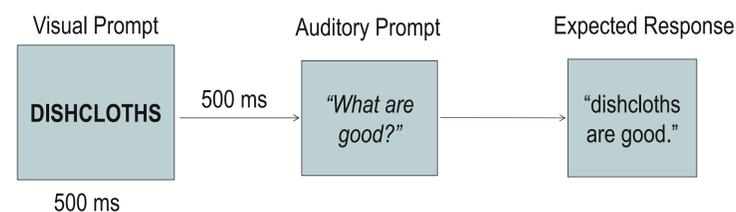
- Participants were tested individually. They were seated in a soundproof booth and instructed to prepare their responses as fully and accurately as possible before the final beep.
- Target stimuli were preceded by a fixation cross for 500 ms, followed by an auditory prompt, and then three beeps of equal duration: the final beep occurred at a variable latency (800 ms, 1200 ms or 1400 ms).



- Latencies were measured from the third beep to the onset of speech.

Online Design:

- Participants were instructed to answer as quickly and accurately as possible after the question prompt.



- Latencies were measured from the end of the auditory prompt to the onset of speech.

Participants

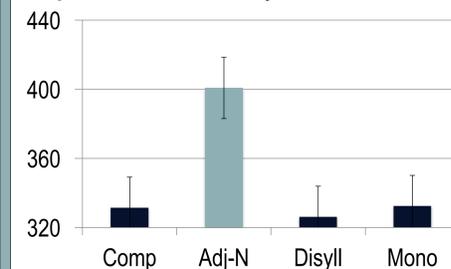
- 50 adult **native British English speakers** for Experiments 1 & 3 (all students from the University of Oxford, ages 18-24)
- 50 adult **native Bengali speakers** for Experiments 2 & 4 (all students from Gokhale Memorial College and Shri Shikshayatan School, Calcutta, India, ages 17-22)
- English proficiency in the L2 speakers was based on a language background questionnaire (cf. Li et al, 2014) as well as a reading and speaking task based on the International English Language Test System (IELTS).

Predictions

- We know from previous speech production research (Wheeldon & Lahiri, 1997; Wynne et al., in press) that English compounds are treated as single prosodic units by native speakers. Following this, we predict that clitics will attach to compounds in the same way as they attach to monomorphemic words in native (L1) speakers.
- We predict that, although production errors may increase, highly-fluent L2 speakers of English will also encode encliticised compounds as single prosodic words in both delayed and online task conditions. Phrases and clitics, conversely, will elicit significantly different naming latencies compared to the encliticised compounds in all conditions.

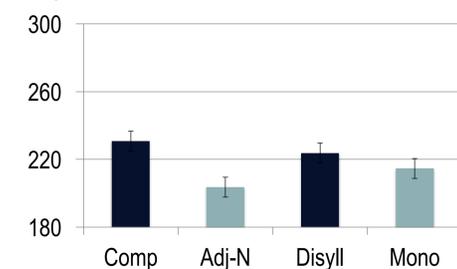
Results

Experiment 1: L1 Delayed



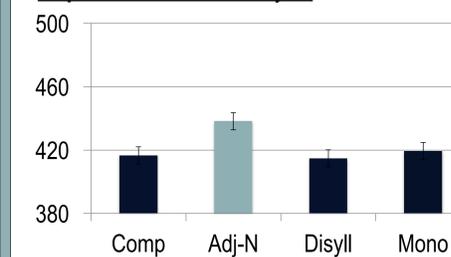
- Main effect of condition $p < .001$
- Main effect of preparation time, $p = .003^*$
- No interaction
- Phrases significantly longer than all other conditions; compounds similar to monomorphemic words

Experiment 2: L1 Online



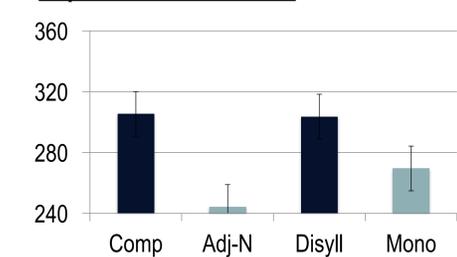
- Main effect of condition $p < .001$
- Phrases similar to monosyllabic monomorphemic words; compounds similar to disyllabic words

Experiment 3: L2 Delayed



- Main effect of condition $p < .001$
- Main effect of preparation time, $p = .03^*$
- No interaction
- Phrases significantly longer than all other conditions; compounds similar to monomorphemic words

Experiment 4: L2 Online



- Main effect of condition $p < .001$
- Phrases similar to monosyllabic monomorphemic words; compounds similar to disyllabic words

Key Findings

- The data provides substantial evidence for the encoding of prosodic units in speech production.
- In all four experiments, we found evidence that both L1 and L2 speakers of English treated compounds as single prosodic units. Adjective-noun phrases, conversely, were overwhelmingly treated as two separate prosodic units.

Delayed Tasks:

- Latencies for the delayed tasks reflected the total number of prosodic units in the target sentence.

Online Tasks:

- Latencies for the online tasks only reflected the complexity of the *first* prosodic unit.
- Response latencies in the online tasks also indicated that the clitic *are* attached leftwards to the entire compound unit (e.g. [dishcloths]are), but only to the noun in the phrasal condition (e.g. *dish* [cloths]are).

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Selected References

Anderson-Hsieh, J., & Venkatagiri, H. (1994). Syllable duration and pausing in the speech of Chinese ESL speakers. *TESOL Quarterly*, 28(4), 807-812. Aoyama, K., & Guoin, S. G. (2007). Prosody in second language acquisition. *Language Experience in Second Language Speech Learning: in honor of James Emil Flege*. Amsterdam. Baker, R. E., Baese-Berk, M., Bonnasse-Gahot, L., Kim, M., Van Engen, K. J., & Bradlow, A. R. (2011). Word durations in non-native English. *Journal of phonetics*, 39(1), 1-17. Janssen, N., Bi, Y., & Caramazza, A. (2008). A tale of two frequencies: Determining the speed of lexical access for Mandarin Chinese and English compounds. *Language and Cognitive Processes*, 23(7-8), 1191-1223. Li, A. and Post, B. (2014). L2 acquisition of prosodic properties of speech rhythm. *Studies in Second Language Acquisition*, 36(02):223-255. Wheeldon, L., & Lahiri, A. (1997). Prosodic units in speech production. *Journal of Memory and Language*, 37(3), 356-381. Wheeldon, L. R., & Lahiri, A. (2002). The minimal unit of phonological encoding: prosodic or lexical word. *Cognition*, 85(2), B31-B41. Wynne, H. S. Z., Wheeldon, L., & Lahiri, A. (in press). Compounds, phrases and clitics in connected speech. *Journal of Memory and Language*.

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