

The Interaction between Final lengthening and Accentual Lengthening: Dutch versus English

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1. Introduction

In stress-accent languages such as Dutch and English, prosodic features are used to indicate which parts of the speech stream are most important, and to segment the continuous flow of speech into smaller units at several different levels. The boundaries signalled by prosodic features are referred to as *prosodic boundaries*, and the units delimited by these boundaries as *prosodic constituents*. The parts of speech made salient by prosodic features will be called *prominent*; the term ‘stress’ will be used to refer to prominence at the word level, i.e. lexical stress, while the term ‘accent’ is reserved for prominence at the phrasal level, which is always marked by a conspicuous (‘accent-lending’) pitch movement.

The relative importance of each of the prosodic features (intonation, duration, amplitude, spectral quality and spectral balance) in marking the position of prosodic boundaries and prominences depends on several factors, such as the constituent level (deeper boundaries are marked by other means than shallower ones, and accent has other acoustic correlates than stress), the context (from the segmental level up to the textual, semantic level), and language-specific as well as speaker-dependent properties. In this paper, I will only be concerned with the use of *duration* to mark both prominences and boundaries. **Final lengthening** marks prosodic boundaries, particularly the Intonational Phrase, by lengthening of the preboundary segments (Wightman et al. 1992, and references therein). It has also been claimed to mark smaller constituents like the (phonological) word, yet word-final lengthening is not nearly as clear and consistent as Intonational Phrase-final lengthening (Beckman and Edwards 1990). **Accentual lengthening** is defined as lengthening due to a pitch accent, i.e. it is a secondary cue to phrasal prominence (the primary cue is intonation; cf. Sluijter 1995).

While final lengthening has regularly been the primary focus of phonetic studies, accentual lengthening has often only been investigated as one of several cues to prominence. Furthermore, the two effects have often been studied separately; especially studies on cues to accent have been careful to avoid phrase-final

positions, in order to avoid any interaction effects (but see Beckman et al. 1992, Edwards and Beckman 1988 for exceptions). In this paper, an experiment will be described which investigates the interaction between final lengthening and accentual lengthening. More precisely, the experiment was designed to investigate effects of position in the phrase on the amount of accentual lengthening found. Prior to the description of this experiment, some data from previous work concerning the domain of accentual lengthening in Dutch and English will be discussed, since these data led to the hypotheses on which the interaction experiment is based. In section 2, these preliminary data will be given and discussed. In section 3, the interaction experiment will be described, and the conclusions are given in section 4.

2. Previous work on the domain of accentual lengthening in Dutch

Since accentual lengthening is defined as being a secondary cue to accent, its occurrence or location is predictable; it is found wherever we find a pitch accent. Besides the indirect influence of linguistic structure on the *location* of accentual lengthening (through its influence on the location of pitch accents), linguistic structure may also influence the *spreading* or *distribution* of this lengthening. Numerous researchers have shown that it is not only the accented syllable which is lengthened; the lengthening effect may spread to neighbouring unaccented syllables as well. The unit which is durationally affected by a pitch accent is what I will call the **domain of accentual lengthening**.

For Dutch, the domain of accentual lengthening is said to be the word (Eefting 1991, Sluijter and van Heuven 1995). A study on English, however, claimed that in this language accentual lengthening starts in the pitch-accented syllable and spreads only to the right (Turk and Sawusch 1997). The exact research questions and consequent designs of the material in these studies were not identical, though. Closer investigation of the experimental paradigms used in these studies reveals that the different conditions included in the Dutch versus the English studies could have been the cause of the different conclusions that have been drawn for these two languages. If this is the case, the different conclusions are due to experimental artifact. In order to allow for a methodologically sound comparison between the two languages, the design employed for English by Turk and Sawusch was applied to Dutch. This experiment is reported on in Cambier-Langeveld and Turk (submitted).

The English experimental design was set up to investigate under what conditions *unstressed syllables neighbouring an accented syllable* are lengthened. In (1),

examples of the English test material (Turk and Sawusch 1997) and of the Dutch replication experiment (Cambier-Langeveld and Turk, submitted) are given, with accented syllables in capitals and the relevant material underlined:

- (1) a. English I said 'BAKE enforce', not 'BANK enforce'.
I said 'bake enFORCE', not 'bake reMORSE'.
- b. Dutch Ik zei 'PANda masten', niet 'HINde masten'.
'I said panda masts, not hind masts'
Ik zei 'panda MASTen', niet 'panda POORten'.
'I said panda masts, not panda gateways'

Although these materials were not designed to investigate the lengthening of the accented syllables, what is crucial for the present purposes is that the materials contained words in phrase final position (*enforce* and *masten* in (1)) and in non-final position (*bake* and *panda* in (1)), and all occur in focused *and* in non-focused position (i.e., are either accented or unaccented). In Turk and Sawusch (1997), eleven similar sets were included; in the experiment on Dutch, 3 x 10 comparable sets were used. In what follows, the set of syllables occurring in non-final position (like *bake* and *panda*) will be referred to as the first set of accented syllables; the syllables in final position (like *enforce* and *masten*) are referred to as the second set of accented syllables.

In Dutch, averaging over test sets, the first set of syllables (i.e. those in non-final position) were lengthened by 25% when accented. The second set of syllables, i.e. those in final position, were only lengthened by 6%. In fact, the lengthening in final position was often not significant. Noticeably, this asymmetry was not encountered in English; all English experiments using similar conditions (Turk and Sawusch 1997; Turk and White 1997; Turk and Shattuck-Hufnagel, to appear) found comparable amounts of accentual lengthening in these two positions, ranging between 19% and 29%. In Turk and Sawusch (1997), there was actually *more* lengthening in final position than in non-final position. In (2), the mean lengthening found in each position, with an example from the test material in which the accented syllable is underlined, is given for English and Dutch:

(2) English		Dutch	
<u>BAKE</u> enforce	20%	<u>PAN</u> da masten	25%
bake en <u>FORCE</u>	25%	panda <u>MA</u> Sten	6%

The lack of accentual lengthening in final position in Dutch posed a problem for the interpretation of the data, because the material was set up to investigate the

lengthening of unstressed syllables neighbouring a pitch accented syllable. Thus, a fair amount of lengthening on each of the accented syllables was required in order to have comparable environments for the unstressed test syllables. The asymmetry between the amount of lengthening in final versus non-final position in Dutch, **and** between the amount of lengthening in final position in Dutch versus English, is the central observation leading to the experiment described in the next section.

As far as the domain of accentual lengthening is concerned, a second attempt was made to obtain material with more comparable amounts of accentual lengthening across positions (also in Cambier-Langeveld and Turk, submitted). Assuming that the problem noted above was caused by the final position of the second set of accented syllables, a new carrier phrase was constructed such that the test material was separated from the Intonational Phrase boundary by a disyllabic word:

- (3) Ik heb 'PANda masten' gezegd, niet 'HINde masten'.
 'I have panda masts said, not hind masts'

With this new carrier phrase, the following amounts of accentual lengthening were found:

- (4) PANda masten 22%
 panda MASten 11%

Comparing (4) with (2) shows that the results have levelled out, although part of the asymmetry between the two positions remains. Now that the test material is no longer in phrase-final position, at least a significant amount of accentual lengthening was found in all conditions.

The data thus obtained showed that English and Dutch do not have different domains of accentual lengthening after all; when the same experimental paradigm is used, the results look very similar. Still, while refuting the claim that Dutch and English are different with respect to the domain that is lengthened due to a pitch accent, it looks as if we have stumbled across another temporal difference between the two languages; in Dutch, the amount of accentual lengthening seems to depend on position in the phrase, while a fairly constant amount of lengthening is found in all positions in English. It is this observation that will be further investigated in the experiment described in the next section. Note that even though the above results are taken from a fairly large set of data, strictly speaking the sets of syllables in the two positions are not comparable; they differ segmentally, occur in different words, etc. In other words, the material was not designed to make such a comparison. Material which is set up specifically to investigate the effect of position in the phrase on the amount of accentual lengthening is therefore required to confirm our suspicions.

3. The amount of final lengthening in different positions: Dutch versus English

The present experiment is designed to address the following question:

(5) **Research question:**

Does the amount of accentual lengthening depend on position in the phrase in Dutch, but not in English?

In the previous section, where the data leading to this research question were presented, *final versus non-final* position was suggested as a relevant factor determining the amount of accentual lengthening in Dutch. There is, however, another difference between the final and the non-final words in the Dutch material (as exemplified in (1)b, which is repeated below for ease of reference):

- (1) b. Dutch Ik zei 'PANda masten', niet 'HINde masten'.
 'I said panda masts, not hind masts'
 Ik zei 'panda MASTen', niet 'panda POORten'.
 'I said panda masts, not panda gateways'

In unaccented condition, 'panda' is *prenuclear*, whereas 'masten' is *postnuclear*. These different positions relative to the pitch accent may affect the unaccented durations of the target words, even though the effect of pre-nuclear vs. post-nuclear position on segment durations (or speech rate) is far from clear. Still, if there is such a thing as a slower speech rate in post-nuclear position, this could explain the smaller accentual lengthening effect on *masten*, since it would have longer unaccented durations. In the material in (1)b, however, one cannot distinguish between an effect of final position and an effect of unaccented post-nuclear position, since these positions coincide. Furthermore, these effects are not mutually exclusive. Both of these effects will therefore be considered in the experiment described below.

When the test material was taken away from the phrase boundary using the carrier phrase in (3), the amount of accentual lengthening on the second set of accented syllables increased (compare the results for *MASten* in (2) with those in (4)). It is therefore likely that final versus non-final position is indeed a relevant factor. The remaining asymmetry in (4) may indicate that there is also an effect of pre- versus post-nuclear position. Alternatively, the left-over asymmetry could be due to the remaining boundary following the second set of accented words even after the revision of the carrier phrase: the boundary following the second set of accented words, i.e. that between the test material and *gezegd* 'said' (see (3)), is still deeper than the boundary following the first set of accented words (e.g. *panda*).

In addition, the fact remains that the sets of syllables compared were not controlled, so that segmental properties could also have played a role.

3.1 *Material*

Dutch and English carrier phrases were made up containing proper names in three positions, as exemplified in (6):

- (6) Dutch:

123
Volgens mij sprak Ko met Jan over Mie.
'according-to me spoke Ko with Jan about Mie'

English:

123
I think that Joe told John about May.
- The name positions will be referred to as 'initial' (1), 'medial' (2) and 'final' (3), even though position 1 is not really domain-initial; rather, the term 'initial' refers to its sequential position within the phrase (relative to the other proper names).
- In each of these positions, four monosyllabic and four disyllabic names occurred in each language. Names were chosen such that the disyllabic names were like extensions of the monosyllabic names. The monosyllabic names were of the form CV(C), while the disyllabic names were of the form CVcv(c).
- (7)

	DUTCH		ENGLISH	
	<u>monosyllabic</u>	<u>disyllabic</u>	<u>monosyllabic</u>	<u>disyllabic</u>
CVC — CVcv	Jan	- Jannie	John	- Johnny
CVC — CVcvc	Peet	- Peter	Mike	- Michael
CV — CVcv	Mie	- Mina	May	- Macy
CV — CVcvc	Ko	- Kobus	Joe	- Joseph
- All these names occurred in each of the three target positions. The carrier phrase contained either three monosyllabic names or three disyllabic names, so that the total number of syllables in the phrase was the same for each occurrence of any particular name.
- A preceding question put narrow focus on only one of the three names. The name which was consequently accented is given in capitals and bold face in (8), giving English examples:
- (8)

a. Who told John about May?
I think that **JOE** told John about May.

b. Who did Joe tell about May?
I think that Joe told **JOHN** about May.

- c. Who did Joe tell John about?
I think that Joe told John about **MAY**.

Any name in any position was thus once accented, and twice unaccented (i.e. when one of the other two names was accented). When unaccented, the position relative to the accented name will be expressed using the terms 'prenuclear' (preceding the accent) and 'postnuclear' (following the accent), and 'close' (one word intervening) and 'far' (three words intervening). This is exemplified in (9) for the name 'Joe' (in italics):

- (9) a. I think that *Joe* told **JOHN** about May. *Joe* = prenuclear, close
 b. I think that *Joe* told John about **MAY**. *Joe* = prenuclear, far
 c. I think that **JOHN** told *Joe* about May. *Joe* = postnuclear, close
 d. I think that John told *Joe* about **MAY**. *Joe* = prenuclear, close
 e. I think that **JOHN** told May about *Joe*. *Joe* = postnuclear, far
 f. I think that John told **MAY** about *Joe*. *Joe* = postnuclear, close

Naturally, an unaccented name in initial position is always prenuclear, and an unaccented name in final position is always postnuclear; similarly, an unaccented name in medial position is always close to the accented name, whether preceding or following it. Only the unaccented durations in medial position can therefore be used to see if prenuclear versus postnuclear position has an effect on the name durations.

In all, (8 names x 3 positions x 3 accent environments =) 72 items were included for each language. Since every utterance contains three names, (72/3 =) 24 utterances were required for each language to obtain a complete set of stimuli.

3.2 Method

The utterances were quasi-randomized such that two utterances in sequence never had the same accent position. The test utterances were preceded and followed by a number of dummy sentences, which were taken from the test material. All utterances were preceded by a question, putting focus on one of the proper names, as in (8). The name which was to be accented was given in capitals. In the English experiment, some additional utterances were recorded with other names than the ones given in (7); these will not be discussed here.

Subjects were seated in a sound-insulated booth. The Dutch subjects' speech was recorded onto DAT-tape, copied onto a computer disk and down-sampled to 16 kHz. The English subjects' speech was recorded directly to disk, after being amplified, low-pass filtered at 7.8 kHz and sampled at 16 kHz.

After some practice utterances, subjects read the questions and the test sentences first in the order A-B, and then in the order B-A, with a minor break in between. They were instructed not to pause within utterances. The experiment was monitored by the author. In case of speech errors, speakers were asked to repeat the whole question-answer pair.

Most speakers produced the test utterances with a default 'pointed hat' (1&A, cf. 't Hart, Collier and Cohen 1990; or H*L, cf. Gussenhoven 1988) on the accented name, without being told to do so; if a speaker did not, (s)he was interrupted and told explicitly what the desired intonation contour was. It is therefore reasonable to assume that intonation was comparable across speakers.

3.3 *Subjects*

Six native Dutch speakers with no obvious regional accents or speech impairments participated in the Dutch part of the experiment. Six native speakers of RP-English participated in the English part of the experiment.

3.4 *Results*

The results for each language are based on (8 names x 3 positions x 3 accent environments x 6 speakers x 2 repetitions =) 864 measurements in total (108 per name). Segmentation was done by hand. Several oneway ANOVAs were run with repeated measures over names, speakers and repetitions. The results for Dutch and English will be discussed in turn.

In Figure 1, the mean total name durations are presented per position and accent condition for Dutch. Position in the phrase has a highly significant effect on the results ($F[2,861]=234.6$; $p<.001$): names in final position are much longer than in non-final position due to final lengthening. A significant effect of accent condition is found only in initial and medial position ($F[2,285]=23.3$; $p<.001$ and $F[2,285]=13.2$; $p<.001$ respectively), but not in final position ($F[2,285]<1$). Post-hoc analyses (Newman-Keuls) show that in both non-final positions, names in accented condition are longer than in each of the unaccented conditions.

In each position, there are two unaccented conditions (cf. (9)), which do not differ from one another ($F[1,190]<1$ in all three positions). This means that neither pre- versus postnuclear position nor being close versus far from the accent have any effect on the duration of the unaccented names. Regrouping the accent environments into accented versus unaccented, the overall accentual lengthening effect is significant ($F[1,862]=28.4$; $p<.001$). An ANOVA with position in the phrase and accent condition (accented/unaccented) as fixed factors shows that the interaction

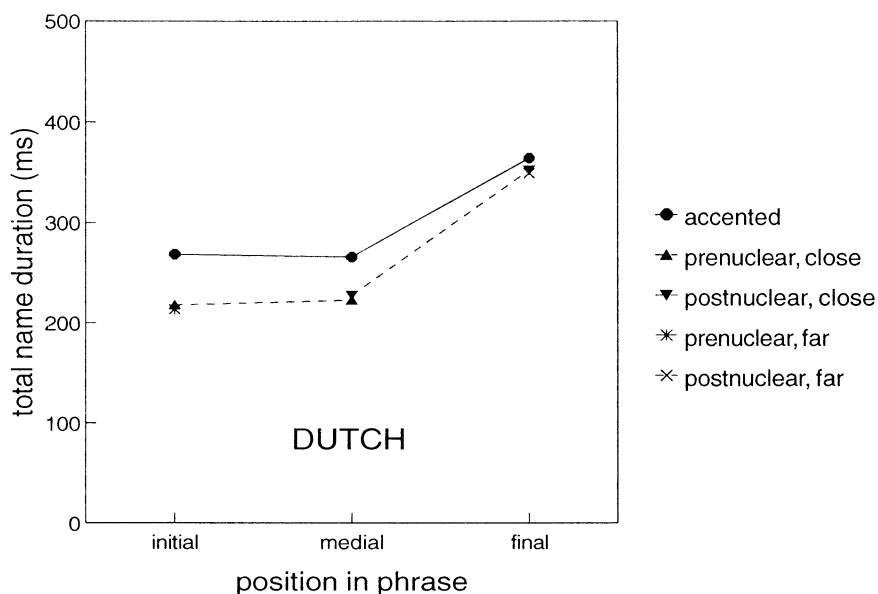


Figure 1. *Total name durations in Dutch, broken down by position and accent condition.*

between these two factors is significant ($F[2,858]=4.8$; $p=.008$).

In Figure 2, the same data are shown for English. As in Dutch, position in the phrase has a highly significant effect on the results ($F[2,861]=258.5$; $p<.001$). Contrary to Dutch, however, a significant effect of accent is found **in all three positions** ($F[2,285]=26.4$; $p<.001$ in initial position; $F[2,285]=16.8$; $p<.001$ in medial position and $F[2,285]=12.1$; $p<.001$ in final position). Again, no effects of pre- versus postnuclear position or close versus far from the accent were found, since none of the unaccented conditions within each position differ from one another ($F[1,190]<1$ in all three positions). Grouping all unaccented conditions together, a highly significant overall effect of accent is found ($F[1,862]=62.0$; $p<.001$), and no interaction with position in the phrase ($F[2,858]<1$).¹

Since durations in initial and medial (i.e. non-final) positions are comparable, and there are no effects within the various unaccented conditions, the phrase positions can be regrouped into +/- final, and the accent environments into +/- accent. This is done in Figure 3, in which the total name durations are given for the monosyllabic and disyllabic names separately. On the left, the results for Dutch are given. The converging lines for Dutch show the interaction between final lengthening

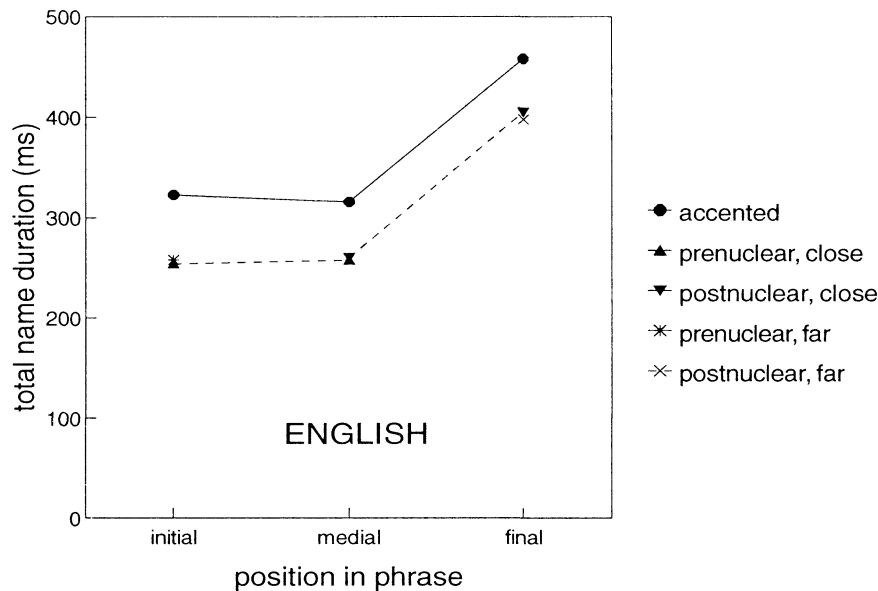


Figure 2. Total name durations in English, broken down by position and accent condition.

and accentual lengthening. This is seen both in the monosyllabic and in the disyllabic words ($F[1,428]=10.2$; $p=.001$ and $F[1,428]=8.2$; $p=.004$ respectively). On the right, the results for English are shown. The lines run virtually parallel, implying that there is no interaction between final lengthening and accentual lengthening in either the monosyllabic words or the disyllabic words ($F[1,428]<1$ and $F[1,428]=1.2$; n.s. respectively).

In Table 1, the durations of the Dutch and English names (monosyllabic, disyllabic, and all taken together) are given per accent condition and position.

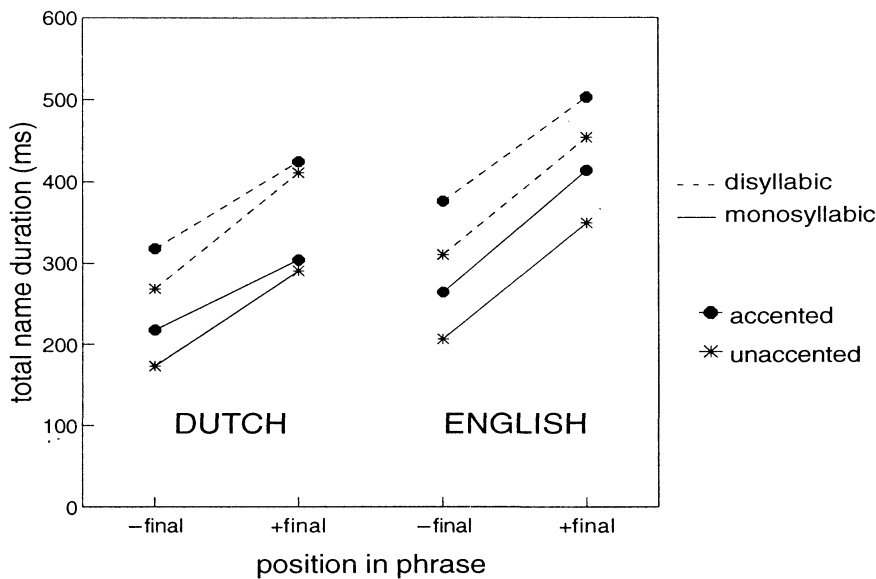


Figure 3. Total name durations in final vs. non-final position and in accented vs. unaccented conditions in Dutch and English; monosyllabic vs. disyllabic names.

Table 1. Mean durations and standard deviations (between brackets) in ms. of the monosyllabic and disyllabic names and all names taken together for each language, broken down by accent condition (accented/unaccented) and position in the phrase.

language ▶		DUTCH		ENGLISH	
accent condition ▶		accented n=48	unaccented	accented	unaccented
names▼ position▼		per cel	n=96 per cel	n=48 per cel	n=96 per cel
MONO-SYLLABIC	initial	219.5 (40.9)	169.2 (33.7)	272.0 (55.1)	207.9 (33.8)
	medial	215.1 (31.7)	176.6 (30.4)	256.0 (60.8)	204.5 (42.8)
	final	303.8 (61.8)	290.4 (61.2)	413.5 (72.5)	349.4 (69.7)
DI-SYLLABIC	initial	318.4 (47.0)	262.4 (42.2)	374.6 (73.2)	305.4 (59.0)
	medial	317.3 (46.9)	274.6 (46.4)	376.6 (64.1)	315.0 (53.1)
	final	424.5 (73.1)	410.8 (78.0)	502.6 (90.7)	453.7 (81.2)
ALL		n=96 per cel	n=192 per cel	n=96 per cel	n=192 per cel
	initial	269.0 (66.2)	215.8 (60.3)	323.3 (82.5)	256.6 (68.5)
	medial	266.2 (65.0)	225.6 (62.8)	316.3 (86.8)	259.7 (73.4)
	final	364.1 (90.6)	350.6 (92.4)	458.0 (93.2)	401.6 (91.8)

4. Conclusions

Previous results suggested that the amount of accentual lengthening depends on the position of the accented word in the phrase in Dutch, but not in English. This was confirmed by the results of the present investigation. For the interaction in Dutch, two possible factors were considered: (1) final versus non-final position and (2) postnuclear versus prenuclear position (when unaccented). Only the former was found to have an effect on the amount of accentual lengthening: a significant accentual lengthening effect was found only in non-final positions in Dutch. In English, the effect of accent is consistent across positions.

The amount of accentual lengthening in Dutch decreases only in final position, i.e. where final lengthening occurs. This suggests that there is an interaction between final lengthening and accentual lengthening, in the sense that the two effects are not additive: if both were to apply, presumably a maximal durational expansion of segments would be exceeded (cf. Allen et al. 1987, chapter 9). In English, on the other hand, the extent to which segments may be lengthened must be higher (as seen in Figure 3). The same observation has been made at the phonemic level (Elsendoorn 1984): due to a phonological rule which lengthens vowels before voiced obstruents in English, the range of vowel durations is much larger in English than in Dutch (for both long and short vowels). Thus, the language-specific interaction between final lengthening and accentual lengthening may be linked to independently motivated differences in durational expandability between English and Dutch.

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Note

- 1. The interaction between Accent condition (accented/unaccented) and Position in Dutch, and the lack of interaction in English, is consistent across speakers and names. ANOVA's with name duration as the dependent variable, fixed factors of Accent condition and Position and either Speaker or Name as random factor show that the interaction in Dutch is significant both by Speakers and by Names, while there is no such interaction in English:

	Dutch	English
by Speakers:	$F(2,10)=146.44; p<.001$	$F(2,10)<1$.
by Names:	$F(2,14)=47.45; p<.001$	$F(2,14)=1.12, n.s.$

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