WHOLE TUNES, NUCLEAR AND PRE-NUCLEAR PATTERNS AND PROSODIC FEATURES IN THE PERCEPTION OF INTERROGATIVITY AND NON-FINALITY IN DUTCH.

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ABSTRACT
The paper deals with some aspects of production and perception of yes-no questions and non-final clauses in Dutch. The analysis of the prosodic characteristics of naturally produced utterances and the subjects’ responses obtained in the course a series of perception experiments with naturally produced and modified utterances yielded the following conclusions:

• the identification of utterance type is to the largest extent determined by the presence of relevant prosodic cues in the nuclear accent
• cues to utterance type in the pre-nuclear pattern appear to be used by listeners when the nuclear accent type allows of several possible interpretations
• timing of the nuclear accent may be considered a relevant cue to utterance type, «early» vs. «late» rise accounting for «non-final» vs. «interrogative» preferences, «early» vs. «late» fall eliciting «statement» vs. «question/statement» reactions.

INTRODUCTION
The establishing of a set of categorically distinct intonation units forming the intonation system of a language is still one of the most challenging tasks for linguists. It is not yet clear how exactly the linguistic relevance of a certain type of intonation unit should be tested and some disagreement exists as to what differences should be called categorical rather than gradient [6]. There is no agreement either as to the function of intonation. Are intonation units associated with certain invariant categories of meaning and if so, in what terms should these meaningful distinctions be described? These and other fundamental questions are still open for discussion. At the same time it is evident that intonation is capable of changing the interpretation of an utterance and thus may be said to perform a certain communicative function, which finds its expression, among others, in the specific patterning of various utterance types.

Previous research in the intonation of Dutch questions (e.g. [2], [3], [4]) has proved the already reported for other languages founding that the concept of interrogativity is mainly associated with a local terminal rise. Other cues to interrogativity include a raised register and absence of downtrend.

Non-finality (or «continuation» - we shall leave the terminological discussion beyond the scope of the present work) is also said to be cued by rising pitch. In her work devoted to the melodic marking of continuation versus questions in Dutch [2] J. Caspers claims that while the former are signalled by the accent-lending rise followed by sustained level pitch (1Ø in the IPO notation [1]), the latter are associated with a combination of an accent-lending rise and a final rise (12). One possible interpretation of these findings is that they provide extra evidence in support of the previously mentioned claim that questions are characterised by higher pitch values than other utterance types.

The study reported here is concerned with finding further prosodic cues to non-finality and interrogativity.

The experiments reported in this paper included the following:

• What are the most typical intonation patterns realised in non-final clauses and yes-no questions (in terms of nuclear and pre-nuclear patterns and their combinations)?
• To what extent can the perception of utterance type be influenced by the cues contained in the pre-nuclear vs. nuclear part of the utterance?
• What is the role played by the timing of the nuclear accent in the perception of the utterance type (Rise 1 vs. 2 and Fall A vs. (1)A in the IPO notation)?

EXPERIMENTS - 1:
ANALYSIS AND PERCEPTION OF (FRAGMENTS OF) NATURALLY PRODUCED UTTERANCES

9 Yes-no questions with the inverted word order and 9 lexically and syntactically identical to them non-final clauses (mostly subordinate clauses of condition and concession also having the inverted word order) were embedded in appropriate contexts, printed on cards and read by 8 native speakers of Dutch (5 male, 3 female). The acquired recordings (144 utterances) were digitised and F0 contours were extracted using speech analysis programs WinCECIL (distributed by SIL as freeware) and PRAAT (developed by P. Boersma and D. Weenink). Pitch patterns produced by the speakers were transcribed using largely the notation developed in the framework of the Dutch School [1], with some modifi-
cations introduced in the course of the experimental analysis of the data, and then classified (following the British tradition in intonation analysis [7]) according to the type of nuclear and pre-nuclear pattern and frequency of occurrence in either type of utterance. 6 types of nuclear pitch accents were distinguished («&» means that the pitch movements are associated with one accented syllable, A* is used to indicate a delayed fall not distinguished in the IPO system):

IPO Notation:
1. Rise 1 (early ) 1
2. Rise 2 (late) (a)2, (b)A&A
3. Fall 1 (early) A
4. Fall 2 (late) (a)A*, (b)1&A, (c)5&A
5. Fall-rise (a)A&2, (b)1&A&2, (c)5&A &2
6. Half-fall E

The first five types of nuclear accents were observed in both questions and non-final clauses, the last type was only observed in non-final clauses. Pre-nuclear patterns (if any) were also analysed yielding 6 possibilities:

IPO Notation:
1 High (pre-)head (1) Ø
2 Low (pre-)head O
3 Falling (pre-)head (1)D
4 Rising (pre-)head 4
5 Stepping head (1)E
6 «Jagged» head (1A)²

The established nuclear accents and pre-nuclear patterns combined to form 22 tunes which won’t be listed here due to the lack of space. The most frequent configurations for each utterance type are given below.

Diagrams in Figures 1 and 2 show the frequency of occurrence of the established types of nuclear (terminal) accent in non-final clauses and questions.

Figure 1. Terminal pitch accent in non-final clauses.

Figure 2. Terminal pitch accent in yes-no questions.

As the diagrams show, although the majority of both non-final clauses and questions had a rising nuclear (terminal) accent, different types of rise were preferred: rise 1 (early) in non-final clauses and rise 2 (late) in questions. Whenever post-accented syllables were present no significant variation in the realisation of rise 1 was observed - a steep rise early in the accented syllable was followed by a level or slightly descending pitch on the post-accented syllable. Rise 2 was in most cases realised as a succession of two level tones: low on the accented syllable and high or slightly rising on the post-accented syllable(s).

In order to establish if the interrogative sentences and non-final clauses contained unambiguous prosodic cues to utterance type and when taken out of context were still perceived as intended, a recognition test was carried out in the course of which subjects (16) were presented with the recorded utterances and instructed to restore the context the utterance was most likely to have been taken from, thus characterising it as a (final part of) statement/command, a non-final clause or a yes-no question. Subjects listened to each realisation 2 times. The contextual options can be illustrated by the following example:

a) Voor zover ik weet gedroeg hij zich in het begin verlegen.
b) Gedroeg hij zich in het begin verlegen, gaandeweg onttoppte de jongen zich al een echte deugniet.
c) Gedroeg hij zich in het begin verlegen? Dat is gewoon natuurlijk.

The recognition test showed that only 46 % of non-final clauses and 62.5 % of questions could be identified correctly by the majority (≥ 12) of subjects. One possible explanation for the fact that the recognition results were rather poor is that there exist several alternatives in pitch patterning and some of them might be «shared» by different utterance types. The higher percentage of «confusions» with non-final clauses may be explained by the fact that listeners were inclined to perceive the stimuli rather as finished utterances than unfinished ones and seemingly chose the «continuation» option only when unambiguous cues to non-finality were present which excluded other interpretations.

On the basis of the prosodic analysis of the recorded utterances and the recognition results the most typical combinations of pre-nuclear and nuclear patterns (tunes) were established for either of the utterance type.
Non-final clauses:
• Falling (pre-)head + Rise 1
• «Jagged» head + Rise 1
• all patterns with the terminal half-fall E

Questions:
• High (pre-)head + Rise 2(b)
• Falling (pre-)head + Rise 2(a)

For further experiments utterances produced by 4 speakers (2 male, 2 female) and previously unambiguously identified as non-final clauses or questions were selected. They were segmented into nuclear and pre-nuclear parts which were then presented to subjects (8) with the same task as before - to chose the most likely context.

Nuclear and pre-nuclear parts with a high score of correct recognition (6-8 correct responses) were selected and 12 utterances were constructed by pasting pre-nuclear and nuclear parts previously identified as belonging to different utterance types.

Again the realisations were presented to subjects. When choosing the context the subjects invariably preferred the one associated with the nuclear accent, which means that when differentiating between utterance types the listeners mainly concentrate on the terminal (nuclear) pitch accent and may miss or neglect evident cues signalling another meaning contained in the pre-nuclear pattern.

EXPERIMENTS - 2:
PERCEPTION OF RESYNTHESISED (FRAGMENTS OF) UTTERANCES WITH THE TIMING OF NUCLEAR ACCENT MANIPULATED

As has already been mentioned above, speakers preferred different types of rising nuclear accent in non-final clauses and questions. In order to check whether listeners’ preferences of utterance type could be changed by manipulating the timing of the nuclear accent the following experiment was carried out. 10 nuclear parts with and without post-accented syllables were extracted from the utterances (both non-final clauses and questions) produced by 4 speakers (2 male, 2 female). The fragments were stylised and resynthesised (using PSOLA technique within the PRAAT analysis package) first with early timing of the nuclear rise (i.e. completed by the middle of the accented vowel) and then with late timing (starting in the middle of the accented vowel or in the post-accented syllable if there were any). Pitch range and steepness of accents were not modified.

Subjects had to listen to the resulting 20 utterances and decide, with the help of suggested contexts, if the fragment they heard was a terminal part of a statement, question or non-final clause.

The results are presented in Figures 3 and 4.

As may be inferred from the diagrams in Figures 1 and 2 the majority of questions and non-final clauses had a rising nuclear accent. Falling patterns were by far less frequent (12% in non-final clauses and 21% in questions).

Figure 3. Perception of rise 1 nuclear accent.

Figure 4. Perception of rise 2 nuclear accent.

As the diagrams show, there is a clearly expressed preference for rise 1 in non-final clauses and a less decided preference for rise 2 in questions.

In addition to the experiment with nuclear parts another test was carried out, in the course of which rising nuclear accents in correctly recognised utterances were modified so that non-final clauses originally having an early rise 1 were resynthesised with the rise shifted to the right and questions with a terminal late rise 2 were modified to have an early rise. The perception results were slightly worse than in the experiment with nuclear accents only, but the same tendency could still be observed: the «non-finality» score for questions resynthesised with rise 1 was 85%, the «interrogation» score for non-final clauses resynthesised with rise 2 - 60%. It was found that utterances originally produced as questions could more easily be «turned» into non-final clauses by just shifting the rise onset time to the beginning of the syllable, whereas non-final clauses resynthesised with a late rise still gave a rather high «non-finality» score. This could be attributed to a narrower pitch range of rises realised in non-final clauses as compared to questions and to the peculiar prosodic patterning of pre-nuclear parts (including the accentual pattern). As has been shown above (see Figures 3 and 4), when only the nuclear parts were presented to subjects in isolation the preferences became more clear.
Since non-final clauses in our material were mostly subordinate clauses, the occurrence of falling nuclear patterns was highly unlikely. Questions ending in a fall either expressed some sort of presupposition hinted by the context: Hoe komt het dat hij dat wist? Had hij naar ons geluis-
terd? Or they contained negative particles: Leest u het boek niet?
Utterances with a terminal early fall 1 (1 non-final clause, 1 question) were identified by the majority of subjects as (final parts of) statements. Utterances with the late fall 2 gave better results (23% of correct recognition for non-final clauses and 52% for questions).
In order to check the significance of timing (in relation to the recognition of utterance type) in falling accents, an experiment similar to the one with rising nuclear accents was carried out, in the course of which falling nuclear accents as realised in 6 utterances (questions) produced by 3 speakers were resynthesised with two types of falling contour, fall 1 and fall 2. The results of the perception experiment are illustrated in Figures 5 and 6.

![Figure 5. Perception of fall 1 nuclear accent.](image1)

![Figure 6. Perception of fall 2 nuclear accent.](image2)

Early fall 1 was almost invariably associated with statement intonation (91%). Utterances with the late fall 2 still gave a rather high percent of «statement» responses (40%).

**CONCLUSION**

Yes-no questions and non-final clauses can be intoned in various ways. Though cues to utterance type may be said to be spread over the whole intonation contour, the actual identification of utterance type is to the largest extent determined by the type of nuclear accent. In the course of the experiments reported here no obligatory prosodic features were established for either non-finality or interrogativity, though it is possible to speak of clear preferences in the production and perception of different utterance types. Some prosodic characteristics can also be said to be incompatible with certain utterance types. Thus, y-n questions are never realised with a «jagged» pre-nuclear pattern typical of non-final clauses, with the stressed syllables clearly marked out by melodic peaks (1A); at the same time non-final clauses have other possibilities in intoning the pre-nuclear part.

Conversely, non-final clauses are very unlikely to have a high (raised) level pre-nuclear pattern commonly realised in yes-no questions, and again, this pattern is by far not the only one possible in questions. Half-fall has a strong association with non-finality, incompleteness and appears to be unacceptable for the expression of interrogativity.

Timing of the nuclear accent has also been found to influence the perception of utterance type: early rise 1 is less likely to occur in questions; late rise 2 is preferred in questions, though it proves to be quite acceptable in non-final clauses as well.

Early fall 1 is not acceptable for the expression of non-finality and highly unlikely to be associated with interrogativity, almost invariably eliciting «statement» responses.

Late fall 2, conversely, cannot be unambiguously associated with one specific utterance type - it can almost with equal degrees of possibility occur both in statements (commands) and yes-no questions. Its association with non-finality is rather weak (6% in our perception experiment), but not impossible.

**REFERENCES**