

# PERCEPTUAL EXPERIMENTS ON DUTCH INTONATION

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## 1. INTRODUCTION

The study of Dutch intonation as a phonetic problem has led to the discovery of the so-called hat pattern (Cohen and 't Hart 1967). Its characteristics are shown in Figure 1: on the base line of declination are superimposed a rising and a falling pitch movement, both lending prominence to the syllable on which they occur.



Fig. 1. Stylized Hat Pattern.

Explorative analysis of spontaneous speech, undertaken in order to extend the inventory of Dutch intonation patterns, revealed the existence of pitch movements not yet included in the description of spoken Dutch. First, between two prominent syllables a gradually rising pitch showed up instead of the expected declination; this movement was called inclination. Secondly, we found ample confirmation about the existence of a pitch configuration in which only one syllable is prominent and in which the final fall is lacking; moreover, in such cases the prominence lending rise seemed to be located systematically late in the syllable concerned (Collier 1970).

## 2. HYPOTHESIS

It was hypothesized then, that these newly discovered pitch movements might, at least in some configurations, underlie intonation patterns that are, from the listener's standpoint, categorically different from the hat pattern.

The configuration containing inclination was called valley pattern (Figure 2) and the one with the late rise and the lacking final fall was labelled cap pattern (Figure 3).



Fig. 2. Stylized Valley Pattern.

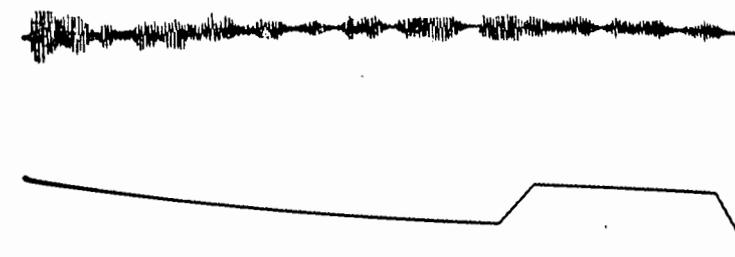


Fig. 3. Stylized Cap Pattern.

Together with the already familiar hat pattern they were incorporated in a series of perceptual experiments in which the degree of intonational difference among the three patterns was explored.

## 3. FIRST EXPERIMENT

In this first experiment use was made of 36 pairs of stimuli in which each of the three patterns was matched either with itself or with one of the other two. The utterances used were all read by the same speaker. Sixteen subjects judged the intonational resemblance of the stimuli within each pair (forced choice). Table 1 presents the results, summed per pattern and averaged over subjects, in percentages of the maximum score (= 96).

TABLE 1

JUDGED AS			
Resembling intended as <i>same</i>		Non-Resembling intended as <i>different</i>	
Cap /Cap	93	Cap /Valley	79
Valley/Valley	96	Valley/Hat	75
Hat /Hat	79	Hat /Cap	92

From these results we learn that the three patterns are indeed perceptually so much distinct that they are not confused in the great majority of the cases.

#### 4. SECOND EXPERIMENT

In this experiment use was made of utterances in natural speech and of stimuli that had been stylized by means of the Intonator (Willems 1966). Each utterance was provided with one of the three patterns. All the stimuli were recorded on Language Master cards (Bell and Howell). The cards were grouped into quartets (*X, A, B, C*) that each contained two intonationally resembling stimuli, viz. *X* and one of the *A-B-C* group. Ten subjects were asked to match the *X*-stimulus with *A, B* and *C* and to indicate which item of the latter group resembled *X*. They were allowed to indicate more than one pair of resembling patterns or no pair at all. They were free to play back the cards as many times as necessary in any desired order.

The results are presented in Table 2. They corroborate those of the first experiment.

TABLE 2

X =	judged as Resembling		No reaction
	when same	when different	
Cap	93	5	2
Valley	83	12	5
Hat	74	14	12

From the results of the first two experiments one may conclude that subjects are capable of noticing intonational differences or resemblances among utterances with different word content, provided that the patterns are stylized versions of the hypothetical basic patterns. The question remains however whether this ability can be called upon when subjects are presented with materials taken from spontaneous speech, in which no such stylization occurs and where the number of intonation patterns to be discriminated is not necessarily limited to three.

#### 5. THIRD EXPERIMENT

In the third experiment the subjects were confronted with a set of twenty utterances from spontaneous speech, pre-selected on the basis of the following criterion: each item in the set should at least have one intonationally resembling counterpart among the others, but it should not necessarily represent one of the three patterns used in the previous experiments. The twenty stimuli were recorded on Language Master

cards and eight subjects were instructed to find resemblances among them, thus building 'less than twenty' piles of cards.

The subjects' groupings were submitted to a hierarchical clustering analysis (Johnson 1967). The outcome of the minimum and the maximum method of this analysis is depicted in Figure 4.

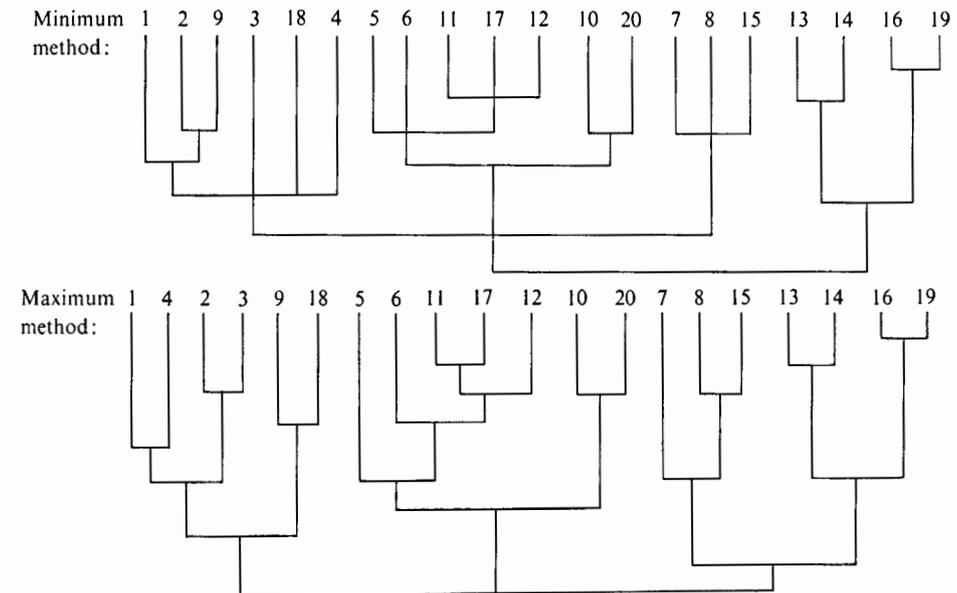


Fig. 4.

The figure shows a division into three groups. To see what may have been the basis for this grouping the fundamental frequency of the twenty utterances was measured. The third group (items Nos. 7, 8, 13, 14, 15, 16, 19) consists of only hat patterns, while the second group (items Nos. 5, 6, 10, 11, 12, 17, 20) appears to contain only cap patterns. As to the first group, it seems as if more than one criterion has influenced the grouping. Indeed, the six utterances in this group share at least one of the following characteristics: small excursion of the pitch movements, inclination, and low pitched prominent syllable. Nos. 1 and 2 are genuine valley patterns, while Nos. 4 and 9 are partial (hybrid) realisations of this pattern. Nos. 3 and 18 are quite different patterns but they show small excursion which is also a feature of some other items in the group.

#### 6. CONCLUSION

The fact that, in the third experiment, the grouping can be traced back to the ability of listeners to discriminate between hat, cap and valley patterns (the latter only to a certain extent), and the agreement between this result and the outcome of the first

two experiments hints at the conclusion that Dutch has at its disposal at least three categorically distinct, equally basic intonation patterns, viz. the hat, the cap and the valley.

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#### DISCUSSION

ROSSI (Aix-en-Provence)

Quel est le rapport de fréquence entre ce que vous appelez 'hat' et ce que vous nommez 'declination'? La variation de ce rapport a-t-elle une incidence sur le comportement des sujets?

COLLIER

Le rapport fréquentiel entre 'declination' et 'hat' n'est pas fixe. Néanmoins, pour la synthèse des patrons intonatifs nous choisissons des intervalles fixes de 5 demi-tons en 100 msec. pour les montées et de 5 demi-tons en 75 msec pour les chutes de  $F_0$ . La variation de ce rapport n'affecte pas le jugement des sujets en ce sens que la reconnaissance de ce patron intonatif comme 'hat' ne dépend pas de ce paramètre. Par contre, dans la troisième expérience, la variation du dit rapport est probablement à la base de la sous-division des 'hat patterns' dans le troisième groupe: les nos. 16 et 19 manifestent des intervalles normaux, les nos. 13 et 14 des intervalles relativement petits et les nos. 7, 8 et 18 des intervalles relativement grands.