



Hat Contour in Dutch: Form and Function

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Abstract

The hat contour is an intonation pattern which starts with a rise and ends in a fall. Although most researchers agree that it consists of a rise and fall, there is little consensus about the actual phonological form of this contour. Consequently, theories about the meaning of the hat pattern are very diverse as well.

The current research attempts at gaining a better understanding of the relationship between the form and meaning of one specific hat contour in Dutch: Something we will refer to as the *early-fall hat contour*. We will test the hypothesis that an early fall encodes the presupposition that there are true alternatives to the asserted proposition.

An online rating experiment was set up in which stimuli were manipulated for the timing of the fall (early fall vs. late fall) and the availability of alternative propositions. The results show that as predicted, an early-fall is less acceptable when all alternatives are ruled out than a late fall. Moreover, an early fall is preferred when there are true alternatives, which interprets as an effect of *Maximize Presupposition*. The effects are very small however, suggesting that more research is needed to understand these effects better.

Index Terms: alternative propositions, hat contour, intonational meaning, maximize presupposition

1. Introduction

The hat contour in German and Dutch refers to an intonation pattern which starts with a rise, stays high and eventually falls, thus forming an apparent hat shape in the pitch trajectory. A lot has been written about the hat contour, but over the years very little consensus has been reached about its exact form and meaning. Part of the problem lies in the fact that there is no established and uniform phonetic/phonological form that corresponds to a hat pattern: Different researchers refer to different phonetic/phonological forms when discussing the hat pattern, or in some cases do not even mention which hat pattern is looked into. This creates problems for arriving at a uniform meaning or function for the hat contour. There may in fact be multiple different hat contours.

Féry and Peters, for example, have discussed a distinction between different hat contours in German based on differences in the early part of the hat [1, 2]. Different rises encode differences with respect to the topicality of the constituent carrying the rise.

Here, we are instead concerned with differences in the second part of the hat, the fall. We will explore another claim that a sharp early fall encodes that there are true alternatives to the current assertion [3, 4].

As the name already suggests, an early fall refers to the timing of the fall, in this case the fall is timed early within or even slightly before the accented syllable. Compare Figure 1 where the fall is early on the accented syllable with Figure 2 where the fall is late. The sentence used for illustration is a simple subject-verb-object sentence in Dutch *Janneke beschuldigde Benjamin*

“Janneke accused Benjamin”. In case of an early fall (see Figure 1), the fall starts before the accented syllable of the last word, i.e. before the name *Benjamin* (which has word-initial stress). For the late fall (see Figure 2), the fall occurs on the last accented word, i.e. later in the accented syllable.

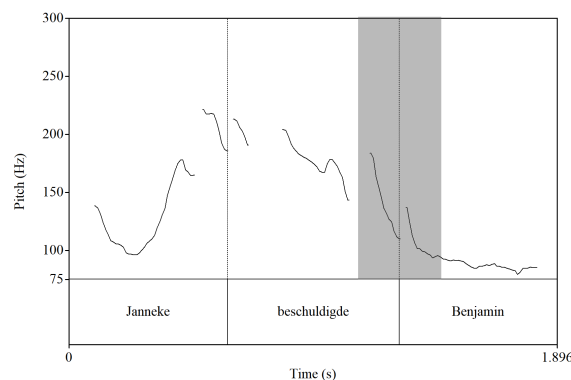


Figure 1: *Early fall Hat contour, the fall is highlighted in the shaded area*

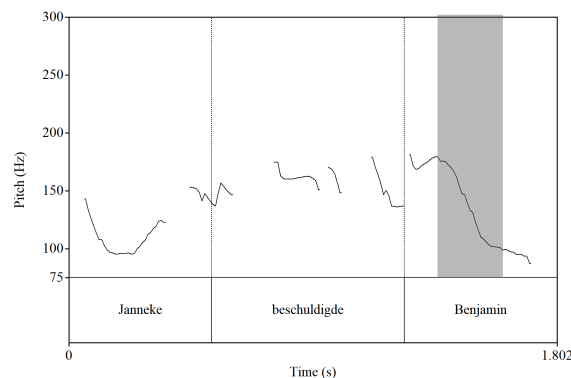


Figure 2: *Late fall Hat contour, the fall is highlighted in the shaded area*

We will argue that the early fall in a hat contour indicates that an alternative proposition must be true besides the proposition under the hat contour.

A distinction between an early vs. late fall was also explored in Caspers [5]. In a rating experiment, subjects were asked to assess different contexts and contours on a ten-point scale. From the results, it was concluded that the early fall sounded more detached, more irritated, more final and less acceptable than the late fall in general. In addition, Caspers found

that the early fall did not go well with new information compared to the late fall. This result supports earlier studies which revealed that the early fall is not compatible with new or unexpected information [6, 7, 8]. Our focus, however, is the effect of the early fall on which alternatives to the present assertion are taken to be true or false by the speaker.

2. Contrastive topics and alternatives

Büring regards the hat-contour as consisting of two phonological units: the initial rise and the final fall [9]. Each phonological element has its own pragmatic/semantic function, the rise indicates the contrastive topic and the fall indicates the focus of the sentence.

In a *wh*-question in which the object is questioned (see Example 2). The answer consequently has focus-marking on the object, indicating that the focus alternatives to the answer are of the form: {*The chefs ate apples, the chefs ate pears, the chefs ate pies...etc.*}.

- (1) What did the chefs eat?
- (2) a. Answer: The chefs ate *x*
b. Answer 1: The chefs ate APPLES-F \

Consider now what happens if the speaker continues with the following statement:

- (3) Answer 2: The /WAITERS-CT ate PEARS-F \
Residual Topic: What did the chefs eat?

Here, the subject is likely accented and followed by a rise, it is marked as a ‘contrastive topic.’ The contrastive-topic marking is similar to focus marking in that it requires the presence of alternatives, but these alternatives don’t play into the focus alternatives of the sentence. According to Büring, they affect the topic-semantic-value, a set of questions that is computed for every utterance which contains a CT-marked constituent. The topic-semantic value has the form: *What did the chefs eat?, What did the waiters eat eat?, ...* Notice how Answer 2 does not directly answer the question *What did the chefs eat*, rather it introduces a new sub-topic: *As for the waiters, they ate pears.*

According to Büring, a sentence with a CT-marked constituent comes with an implicature that at least one question of the topic-semantic value still has to be unresolved. Note that this ‘disputability implicature’ entails that it should be infelicitous if all alternatives to an assertion have already been shown to be false. If the hat-contour, as Büring assumes, requires the presence of CT-marked constituent, this should then entail that one cannot use the hat-contour in contexts in which all alternatives have been claimed to be false already.

As noted in later works [10, 11, 3, 4], this is incompatible with the use of the hat-contour in the final answer of a list of answers like in (5), where we naturally conclude that no question remains open even if the last answer includes the hat-contour. Ludwig [11] resolves the problem by proposing that the hat-contour in fact implies that there has to be a true alternative answer (not just an open one). This analysis too predicts that the hat-contour should be incompatible with a context in which all alternatives are already claimed to be false.

According to Wagner [3, 4], however, not all hat-contours are incompatible with contexts in which there are no true alternatives (as predicted by Ludwig [11]) or possibly true alternatives (as predicted by Büring [12]). It is only hat-contours with a sharp early fall that are.

We will test this hypothesis in a perception experiment, in which we manipulated the intonational contour (early vs. late fall), as well as whether the context makes it clear that all alternatives are false, or that at least one alternative is true.

Example (4) illustrates an example. The context offers a proposition in the form of a yes/no question. The negative polarity item *nein* ‘no’ excludes this proposition, and proposes an alternative instead. In this context, there are arguably only two relevant alternatives. In our experiment, this is reinforced with pictures that illustrate all true alternatives. Since all alternatives are implied to be false, this response should be incompatible with any hat-contour according to Büring [12], but only with an early-fall hat-contour according to Wagner [3, 4].

- (4) Who insulted who? Did Hans insult Pia?
- (5) Ja, und PIA hat HANS beleidigt.
Yes, and Pia has Hans insulted.
‘Yes, and PIA insulted HANS.

3. Methodology

An online experiment was set up in the form of an acceptability judgment task using jsPsych [13]. The participants were presented with a number of carefully manipulated auditory stimuli, after which they were asked to score the stimuli on a scale from 1 to 8 (in which 1 meant completely unnatural and 8 meant completely natural).

3.1. Participants

A total of 32 participants were recruited, all of them are Native speakers of Standard Dutch (as spoken in the Netherlands). They were between 22–68 years of age (m 30.98, SD 10.28). No compensation was provided and participation was entirely on a voluntary base.

3.2. Stimuli

Each stimuli set is manipulated for the following variables: the timing of the fall (early vs. late) and the existence of alternative propositions. An example of such a stimuli set is provided below:

- (6) **Question:** Who had seen who? Had Isabel seen Willem-Jan?
- (7) a. **Ja**, en WILLEM-JAN had ISABEL gezien.
Yes, and Willem-Jan had Isabel seen.
Answer: ‘Yes and Wilem-Jan had seen Isabel.’
b. **Nee**, WILLEM-JAN had ISABEL gezien.
No, Willem-Jan had Isabel seen.
Answer: ‘No, Wilem-Jan had seen Isabel.’

Each question in the experiment is set up in such a way that the subject and object in the question (in this case *Isabel* and *Willem-Jan* respectively) contrast with the subject and object in the answer (in this case *Willem-Jan* and *Isabel* respectively). Thus creating a double contrast which accents the same two elements in the sentence across different stimuli. In addition, no new discourse participants are introduced in the answer, in other words all subjects and objects in the target stimuli are given rather than completely new. This is to accommodate the incompatibility of the (early fall) hat contour with new information as we have seen in the previous literature [6, 7, 8].

Recall from the introduction that the existence or absence of an alternative proposition is crucial to our definition of the hat contour. Crucially, the idea here is that in case of an affirmative answer, there exists an alternative proposition, whereas in case of a negative answer this alternative proposition is absent. For instance, the affirmative answer in (7a) conveys that besides the event “*Willem-Jan had seen Isabel*” another alternative event is true, namely “*Isabel had seen Willem-Jan*”. The negative answer on the other hand (see 7b), conveys that only the situation in which “*Willem-Jan had seen Isabel*” is true and that the alternative event “*Isabel had seen Willem-Jan*” is not true.

Keep in mind that Büring would predict both the affirmative answer as well as the negative answer to be incompatible with a hat contour since there is no disputability: All questions have either been resolved in case of an affirmative answer or there are no true alternatives in case of a negative answer.¹ Ludwig on the other hand predicts that the hat contour, regardless of an early or late fall, should be compatible with affirmative answers but incompatible with negative answers. Finally, similarly to Ludwig, Wagner predicts that both hat contours will be compatible with an affirmative answer, but only an early fall is incompatible with an negative answer.

The timing of the fall is expected to be heavily influenced by the availability of an alternative proposition or not: having a hat contour with an early fall is expected to be significantly more acceptable when there are alternative propositions than when there are none. Within the late fall contours, no difference in context is expected.

Sixteen stimuli sets were created and a total of 64 stimuli were recorded.² The stimuli were recorded in a sound-attenuated booth (16 bit, 44100 Hz) by two native speakers of Dutch. The stimuli are presented in a latin-square design to the participants.

3.3. Procedure

Participants are directed to the experiment via an online link. Each trial starts off with a fixation point, so as to ensure the participant knows exactly when one trial has ended and another one starts. Next, the context is given in written form: the context ensures the phrases sound more natural rather than out of the blue. After that, a screen appears indicating that a question is coming ahead (indicated in red) together with a image showing what has happened (see 3 and 4). At the beginning of the experiment it is explained that the image indicates the actual situation in the real world. This image enforces the existence of alternative propositions since it depicts all the events in the hypothetical world. The arrows indicate who did what to whom. After 1500 milliseconds the participant will hear the question. By providing the subject and object in the question we have introduced these persons and from now on they will be part of the given information structure.

The question trial disappears and the answer trial appears which has a similar layout but now the word ‘answer’ is written in red. Finally, the trial finishes off with an acceptability input screen in which the participant has to indicate how natural the intonation pattern sounds given the answer.

¹Büring does not make a difference between an early fall or late fall hat contour.

²2(early/late fall) * 2(alternatives/no-alternatives) * 16(stimulissets)

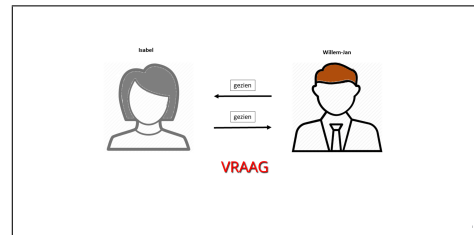


Figure 3: Image depicting the situation with alternatives.

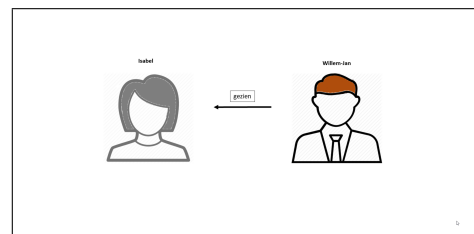


Figure 4: Image depicting the situation without alternatives.

4. Results

As predicted by our hypothesis there seems to be a clear contrast between having alternative propositions or not with regard to the early fall (see Figure 5): The existence of alternative propositions is more acceptable than the absence of alternative propositions. Interestingly, the opposite pattern is observed for the late fall, i.e. the *alternatives* condition is less acceptable than the *no alternatives* condition. This is compatible with the hypothesis about the early fall but not predicted by it, we return to this below.

The data were fitted into a statistical model using cumulative link mixed models analysis (CLMM). The outcome variable was the acceptability score on a Likert scale from 1 to 8. We used this many points on the scale to minimize censoring effects, and we used an even number to avoid that raters impose a three-way interpretation on the scale of the form: *unnatural, neutral/I don't know, natural*. Our assumption is that the scale is monotonous from unnatural to natural. We do not assume that each step is equally spaced, and hence we use cumulative link models to analyze the data.

As main effects, we included *context*, contour *ending* and the interaction between the two. The same variables were entered into the model as random slopes across different participants (*subjectid*) and item sets (*stimuliSet*). As expected, the interaction between context (i.e. *alternatives* vs. *no alternatives*) and endings was highly significant ($z = -3.693$, $SE = 0.3404$, $p < .001$). From this result we concluded that the contour endings led to significantly different responses across the different contexts.

This supports the hypothesis that an early fall should be significantly less acceptable when no alternative propositions are true than when there are such alternatives. Although, this trend is observed in Figure 5, it is not completely clear how significant this difference is. Running another cumulative link mixed models analysis within the group of *early fall* gave some clarity. For the main effect, we took *context* and the same variable was taken as the random slopes across subjects and item sets. From the statistical model, it becomes clear that within the group of contours with an early fall, there is a significant differ-

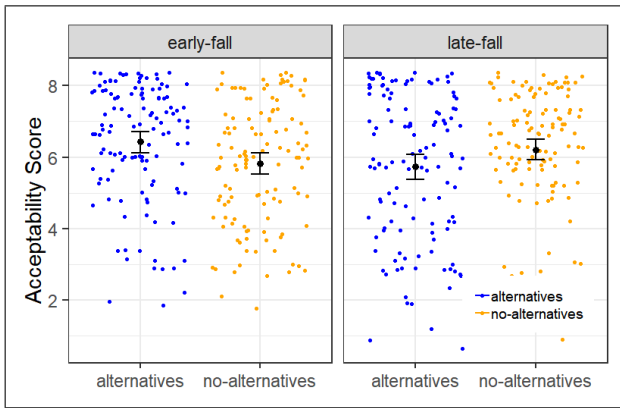


Figure 5: Acceptability score per context, faceted by the timing of the fall and grouped by the availability of alternative propositions

ence across the different context: The *alternatives* condition is significantly more acceptable with an early fall than the *no alternatives* ($z = 2.607$, $SE = 0.3873$, $p < 0.01$). For the late-fall contours on the other hand, no such significant difference was observed ($z = -1.408$, $SE = 0.252$, $p > 0.05$).

5. Discussion

The current research tested the hypothesis that the early fall in a hat contour indicates that an alternative proposition must be true besides the proposition expressed bearing the hat contour. This hypothesis is supported by the results of our online experiment: For the early fall, the *alternatives* condition is significantly more acceptable than the *no-alternatives condition*. No such difference was found for the late fall. We have thus found evidence for the claim that hat contours with early falls require true (or possibly true) alternatives, but not all hat contours, as would be predicted by Bürinig’s disputability implicature [12].

We also found that the early fall appears to be *more* acceptable when there *is* a true alternative. This is compatible with our hypothesis, but is not one of its predictions. We interpret this effect as the result of Maximize Presupposition [14]: if it is possible to mark the presupposition that there is a true alternative, it is preferred to mark it (using the early fall) rather than not mark it (using the late fall).

It is important to note that the effects are rather small: the difference between the *alternatives* and *no alternatives* conditions seems to be no more than 0.5 on a Likert scale from 1-8. This could either be because the hypothesis describes a trend rather than a categorical effect of the meaning of the contour, or it could be that listeners are just easily willing to disregard prosody. Notice also that even though it was predicted that the *no alternatives* condition would be significantly worse than the *alternatives* condition for contours with an early-fall, the *no alternatives* condition is relatively good. In fact, it is as acceptable as the ones with a late-fall. All this suggests that one is dealing with a trend rather than a categorical difference.

Maybe our context could have been more explicit about what the relevant alternatives are. Consider the following example:

- (8) Either Hans insulted Pia or Pia insulted Hans. Did Hans insult Pia?

- (9) #Nein. PIA hat HANS beleidigt.
No. Pia has Hans insulted.
‘No, Pia insulted Hans.’

Here, the word *either* makes it clearer that there are only two relevant alternatives. One potential confound that might have been the cause of these small effect sizes, could be the no-alternative condition not completely excluding all other alternative propositions.

In German there are two ways of answering with a negative answer through the use of contrastive connectives, as shown in Examples (10a) and (10b) below.

- (10) Wer hat wen gesehen? Johan Maria?
who has who seen John Mary
‘Who has seen who? Did John see Mary?’
- a. Nein, sondern Maria hat Johan gesehen.
no, but Mary has John seen.
‘No, but Mary has seen John’
- b. Nein, aber Maria hat Johan gesehen.
no, but Mary has John seen.
‘No, but Mary has seen John’

Intuitively speaking, *aber* seems to be less compatible with an early-fall hat contour than the connective *sondern*. The exact difference between the two connectives is unclear, but they seem to make slightly different relations with the previous context. Without a connective the sentence could receive either of the two meanings related to the contrastive connectives. In the current experiment no contrastive connective was used in the no-alternatives condition. This could potentially explain the small effect sizes. More future research is needed to understand this small but robust effect.³

6. References

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³We also note that since we used the polarity particles *yes* and *no* to manipulate, we can’t rule out that the polarity items themselves may have had an effect. One could try to use a different manipulation for the presence of alternatives instead.

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