

Is this question a question? Final rise as an interrogative marker in Swedish

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Abstract

In Swedish, sentence end is typically marked by a final low. This is also the case for questions, although yes-no questions can be marked by a raised fundamental frequency [2]. In this report, the findings of two types of dialog analysis are presented. Discourse segments marked as questions by evaluators were collected from a corpus of Swedish Map-task dialogs. Prosodic analysis supports the claims that final rise is not a necessary condition for question intonation in Swedish, while yes-no questions can be marked by final rise. Basic syntactic analysis shows that sentence initial finite verbs, interrogative pronouns and adverbs are triggers for perception of questions. Analysis based on the expected response of the segments show that more than half of the utterances perceived as questions by the evaluators are yes-no questions.

1 Introduction

Most text-to-speech (TTS) systems include a module for prosody generation. As it is difficult to extract information on prosody from text, most systems aim for a neutral version [6]. Machine learning methods could be used to model prosody for such purposes, given sufficient amounts of training data with prosodic annotation.

Prosody must also be dealt with in speech recognition; e.g., intonation can be used to predict dialog moves for reducing word error rate in a speech recognition system [8], [9]. Since TTS and speech recognition are part of any dialog system, the need to model and recognize prosody is a major challenge.

In Swedish, sentence end is typically marked by a final low. This is also the case for questions, although yes-no questions can be marked by a raised fundamental frequency [2]. Although rise has not been described as a necessary component of interrogative intonation in Swedish, listeners perceive a final rise as an interrogative signal of feedback seeking [5].

In this report, the findings of two types of dialog analysis are presented:

- Analysis of dialog segments: What types of utterances are perceived as questions?
- Prosodic analysis (acoustic-phonetic): Final rise as an interrogative marker.

2 Data

The material consists of recordings of spontaneous speech (in the form of Map-task dialogs), and transcriptions of these recordings. The four map task dialogs are in Swedish, each with two dialog participants, totally one male and three female speakers. The dialogs consist of about 600 words each. In these dialogs, discourse segments such as questions have been marked up by eight evaluators. The dialogs are part of the Stockholm Corpus of Spoken Swedish, recorded by Helgason [4], and annotation (e.g., transcription, turn-taking, and part-of-speech tagging) was done within the thesis work of Gustafson-Capcová [3].

In a Map-task dialog, one participant has a key to the task, and the other participant must follow her/his instructions. In order to fulfill the task, both participants have to ask questions, and negotiate to reach an agreement.

A total of forty utterances marked by the evaluators as questions were chosen for further study. These utterances were divided into three groups: *group All* consisting of 13 utterances marked by all of the evaluators as questions, *group Maj* with 15 utterances marked by a majority (more than 4), and *group Min* with 12 utterances marked by a minority (less than 4 and more than 1) of the evaluators (see appendix A).

3 Analysis of dialog segments

In Swedish, sentence end is typically marked by a final low, although according to e.g., [2] yes-no questions can be marked by a raised fundamental frequency. In order to investigate this, the utterances were classified according to **question type based on the expected response of each utterance**:

- 1) Yes-no questions: A statement can be transformed into a yes-no question by either moving the finite verb to initial position (e.g., *Vi går rakt på fågeln* ‘We are going straight for the bird’ → *Går vi rakt på fågeln då?* ‘Are we going straight for the bird then?’), or by using question intonation (e.g., *Vi går rakt på nyckeln?* ‘We are going straight for the key?’). According to this definition every utterance where the speaker wants the listener to indicate if it is true or false, is a yes-no question.
- 2) Not yes-no questions. All other utterances, including disjunctive questions (e.g., *Ska jag gå på höger eller vänster sida om simbassängen?* ‘Shall I go to the right or to the left of the swimming pool?’).

The forty utterances were also classified according to **question type based on syntactic properties** in order to investigate the role of syntax in the perception of questions:

- 1) Verb: Questions beginning with a finite verb, e.g., *Har du den också?* ‘Do you have that one too?’
- 2) Wh-questions: Questions beginning with an interrogative pronoun (*vem* ‘who’, *vad* ‘what’) or an interrogative adverb (*när* ‘when’, *var* ‘where’, *hur* ‘how’, *varför* ‘why’)
- 3) Statements: Questions not beginning with a verb or wh-, e.g., *Längs med strandkanten?* ‘Along the beach?’
- 4) Affirmation: typically a one-word interjection with an interrogative tone, e.g., *Jaa?* ‘Yes?’

The classification of utterances into yes-no questions are discussed in section 3.1.1, and question types based on syntactic properties in section 3.1.2.

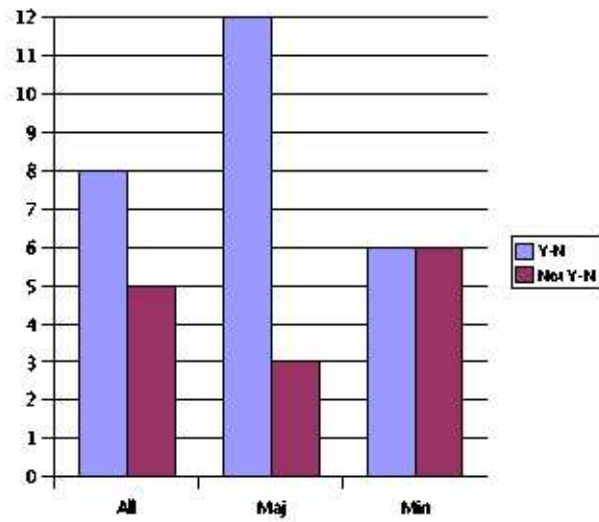


Figure 1: Number of yes-no questions per group (All, Maj, Min)

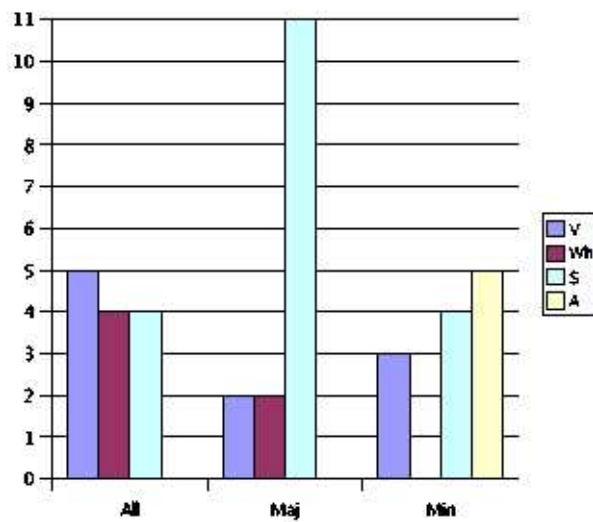


Figure 2: Number of question types Verb, Wh-question, Statement and Affirmation per group (All, Maj, Min)

3.1 What types of utterances are perceived as questions?

3.1.1 Yes-no questions

According to our definition, yes-no questions are all utterances where the speaker wants the listener to indicate if the utterance is true or false. The proportion of yes-no questions per group is presented in figure 1 on page 4. Yes-no questions are common among the utterances perceived as questions by the evaluators: 61.5% of the utterances in group All, and 73.3% in group Maj.

3.1.2 Question type based on syntactic properties

In order to investigate the role of syntax in the perception of questions a basic syntactic analysis was conducted for all the utterances according to the definitions in section 2.

We found that most of the utterances (69.2%) marked as questions by all the evaluators (group All) begin with a question word or a verb. The corresponding number for the group Maj is 26.6%. In the group Min 25.0% of the utterances begin with a finite verb, and there are no wh-questions (see figure 2 on page 4). Thus, it would seem that utterances beginning with interrogative pronouns and adverbs are triggers for perception of questions.

The group Maj contains a large number of statements; 73.3%. Why has most (but not all) of the evaluators marked these statements as questions? We believe that a part of the answer lies in the nature of the Map-task dialog (see section 2 on page 2). In this context, a statement can be a suggestion of truth from one participant, and if so requires a response from the other participant. For example, the statement *Så du går bakom ryggen på sälen då* lit. 'So you are walking (going) behind the back of the seal then' requires a response, and thus is perceived as a question by some of the evaluators.

Another, more easily detected, factor is the presence of what might be question trigger words, such as *då* lit. 'then', *så* lit. 'so', *alltså* lit. 'therefore', *eller* lit. 'or'; 5 statements out of 11 have final trigger words, and of these five, two have initial question trigger words (*då*, *så*).

4 Prosodic analysis

The forty utterances were analyzed using the WAVESURFER speech analysis tool [7]. Each utterance was marked for presence or absence of final rise after examination of waveform, pitch contour and spectrogram (see figures 3, 4, and 5, below).

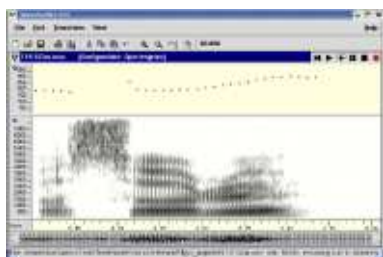


Figure 3: An example of an utterance with final rise (119.153: *va sa du*, ‘what did you say’).

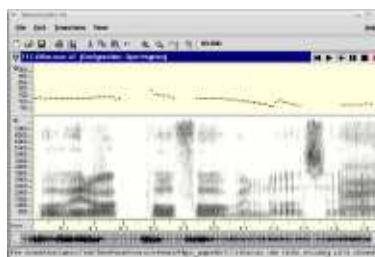


Figure 4: An example of an utterance with uncertain final rise (117.418: *går vi rakt på fågeln då alltså eller*, ‘do we go straight for the bird then or’).

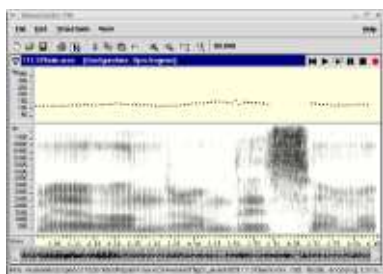


Figure 5: An example of an utterance without final rise (117.379: *men jag undrar om det är samma*, ‘but I wonder if it is the same’).

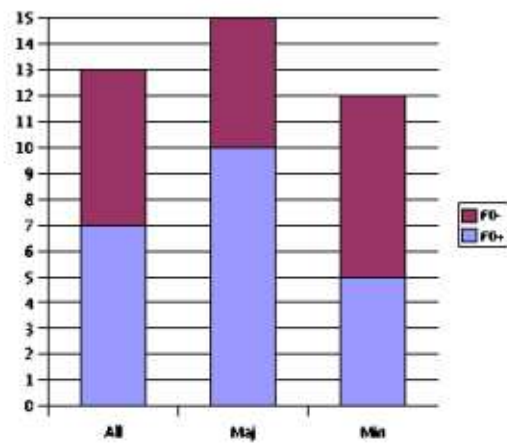


Figure 6: Absence (F0-) and presence (F0+) of F0 rise per group (All, Maj, Min)

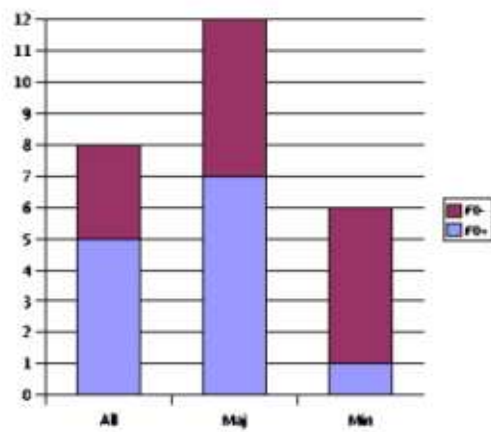


Figure 7: Absence (F0-) and presence (F0+) of F0 rise in yes-no questions per group (All, Maj, Min)

4.1 Final rise as an interrogative marker

4.1.1 Is F0 rise a condition for question intonation?

According to, among others, Elert, 1997 [2], Bruce, 1998 [1], House, 2003 [5], final rise is not a necessary condition for question intonation in Swedish. Our findings support this: most of the evaluators agree that a number of utterances without final F0 rise are questions. Figure 6 on page 7 shows that in the group All, 6 out of 13 utterances do not end in a final rise, and in the group Maj, 5 out of 15 do not.

4.1.2 Final rise in yes-no questions

Although final rise is not a necessary component of interrogative intonation in Swedish, yes-no questions can be marked by a raised fundamental frequency [2]. This claim is supported by our data, which show final rise in the larger part of the yes-no questions (see figure 7 on page 7) in groups All and Maj. Group Min show the opposite: only one yes-no question out of six ends in final rise.

4.1.3 Final rise in question types based on syntactic properties

We are unable to conclude that final rise is linked to syntactic properties of the utterances, due to data sparseness.

From our results, no conclusions can be drawn on the use of final rise in utterances beginning with verbs or in wh-questions. This is also the case for statements. However there is a tendency towards final rise in the utterances marked as questions by most of the evaluators (see figures 8 and 9 on page 9). All but one of the affirmations end in final rise (see figure 10 on page 9) but all instances of this category are found in the group of utterances marked as questions by only one or two of the evaluators.

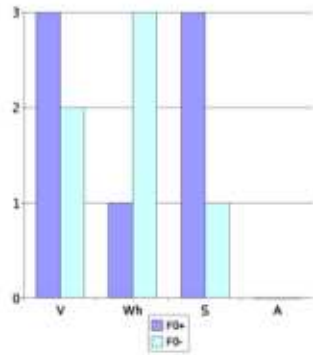


Figure 8: Absence (F0-) and presence (F0+) of F0 rise in question types in group All

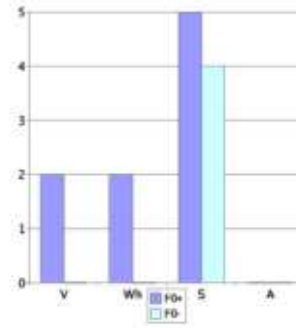


Figure 9: Absence (F0-) and presence (F0+) of F0 rise in question types in group Maj

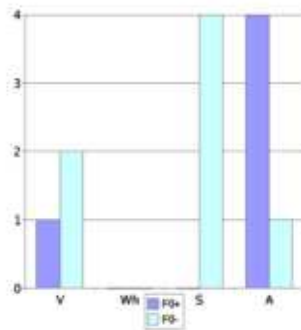


Figure 10: Absence (F0-) and presence (F0+) of F0 rise in question types in group Min

5 Concluding remarks

In this report, the findings of two types of dialog analysis have been presented. The data consists of discourse segments marked as questions by evaluators. These segments have been collected from a corpus of Swedish Map-task dialogs.

We found that yes-no questions are common among the utterances perceived as questions by the evaluators. Basic syntactic analysis shows that most of the utterances marked as questions by all the evaluators begin with a question word or a verb. Question trigger words are common, and it also seems that interrogative pronouns and adverbs are triggers for perception of questions.

The prosodic analysis supports the claim that final rise is not a necessary condition for question intonation in Swedish: a majority of the evaluators agree that a number of utterances without final F0 rise are questions. Although final rise is not a necessary component of interrogative intonation in Swedish, yes-no questions can be marked by a raised fundamental frequency [2]. This claim is supported by our data, which show final rise in the larger part of the yes-no questions. Due to data sparseness, we are unable to conclude whether there is a correlation between the use of final rise and syntactic properties of the utterances.

References

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A Appendix

A.1 Map Task Data: Utterances marked as questions

Group All

The following utterances were considered to be a question by all of the participants in the evaluation:

117.56 har dU DEN också
118.35 nOrdväst
118.92 hur LÅNGT UPP Då
118.251 hur gör jag med KRA*BBERNA* där då
118.436 förstÅR du vad jag meNAR
118.451 ska jag gå MELLAN dom
119.81 (men) dET ser du VA
119.301 du SER deN
119.481 [på nersidan om den] LÄNgS meD STRAndKANteN
119.484 va SA dU
119.520 böjer det UPpåt då
120.421 va gör jag när jag kommer fram till SIMBASSÄNGen
120.488 ska jag gå på hÖGER ELLER *VÄNSTER* sida om
simBAssängEN

Group Majority

The following utterances were considered to be a question by a majority of the evaluators:

117.186 så du går bakom ryggen på sälen då
117.215 du du går igenom krabbflocken Då
117.246 då snuddar du nästan vid en flod där Då
117.290 du går emeLLAN dom
117.418 går vi rakt på fågeln DÅ alltså eller [nej]
117.501 [visst] (vi) går på nyckeln alltså
117.588 lunnefåglarna eller vad dom nu är
118.29 [alltså nord] i sydvästra HÖRNet
119.153 va sa rU
119.421 (ja) i vÄSTLIg riktning då [ja]
119.445 nu förstår jag inte gå RUNt
119.487 längs med strandkanten
119.514 (i) samma kontur som
120.542 är jag precis ute vid kustbANDet här nu
120.8 (men/du/då) vad gör vi nu då

Group Minority

The following utterances were considered to be a question by a minority of the evaluators:

117.379 men jag undrar om det är samma
117.387 (j)aa
117.480 [ta och g] österut
117.581 (gör vi någonting) med endera av dom krokodilena eller
118.19 [ejaa] ja|ha
118.46 det är no bukt där
119.203 jåså du har inte det
119.347 går du ända fram till vattnet där
120.117 jaha
120.219 och då har vi alltså då kräklan på eh
120.345 jaA
120.369 finns då den här golf ...