

# Linguistic and Extra-linguistic Determinants of Accentuation in Dutch

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## Abstract

In this paper we discuss the influence of semantically unexpected information on the prosodic realization of contrast. For this purpose, we examine the interplay between unexpectedness and various discourse factors that have been claimed to enhance the accentuation of contrastive information: contrast direction, syntactic status, and discourse distance. We conducted a production experiment in Dutch in which speakers described scenes consisting of moving fruits with unnatural colors. We found that a general cognitive factor such as the unexpectedness of a property has a strong impact on the intonational marking of contrast, over and above the influence of the immediate discourse context.

## 1. Introduction

The nature of contrastive information and its correlates on the prosodic level are intensively discussed in research on information structure in language processing. Nevertheless, the definition of contrast still remains controversial. From a general point of view, contrast always involves the presence of an alternative set. In other words, the semantics of contrast reflects *the selection* of elements from a limited set of similar yet different items. According to its informativity in the discourse, semantic contrast can be packaged as contrastive *focus* (the most informative part of an utterance) or as contrastive *topic* (less informative presupposed part) on the information structural level. Hence, contrastive *focus* refers to *the choice* of an element from an alternative set. Consider the sentence: “Peter bought a red car.” The NP “red car” can be introduced as narrow focus (i.e. adding new information and providing an answer to a wh-question). Focus in Dutch occurs in the rightmost sentence position in the default case, and is associated with a nuclear pitch accent. Contrastive focus realized with a corresponding pitch accent in a default nuclear position can hardly be distinguished from a non-contrastive focus (buying a car but not a boat vs. simply buying a car). By moving the nuclear accent to “red”, prosody establishes focus in a non-default position and favors the perception of contrastiveness.

Even though, intuitively, contrastive focus can be regarded as being an organizing principle of communication, its existence has been questioned in the literature. According to [2], contrastive and non-contrastive focus can not be attributed to distinct categories because (i) contrastive focus does not exist, and (ii) every focus is perceived as establishing contrast due to its semantics (i.e. the speaker in the example above contrasts “car” to anything else what Peter might have bought and what is red). Contrastive interpretation arises not through prosodic prominence (nuclear accents are syntactically unrestricted), but through semantic “unpredictability” (i.e. words which are most unpredictable in the context). In contrast, [3] attributes contrastive focus to an

accent distribution which is not predicted by the Nuclear Stress Rule (the main accent in a sentence is syntactically bound to a single constituent, in Dutch the rightmost element). The correlation between prosodic unpredictability and perception of contrast has been attested for Dutch [4]: it is the non-default position, and not a particular phonological type of pitch accent, which leads to a contrastive interpretation. This result is inconsistent with previous assumptions about the mere contrastive meaning of the L+H\* pitch accent [6] and about the phonetic correlates of contrastive accents [1].

Based on theoretical and empirical evidence for a correlation between unpredictability and perception of contrast, we investigate the impact of semantic unpredictability on the prosodic marking of contrast in Dutch. For this purpose, we adopted the experimental paradigm from [8] which allows us to collect semi-spontaneous speech data dealing with the accentual correlates of contrasted noun phrases. However, we modified the experimental conditions by adding semantic unpredictability to the properties denoted by a modifier and by changing the target referents.

According to [8], the accentual marking of contrast is influenced by discourse factors in Dutch. The occurrence of contrastive information in a backward position (i.e. when the contrasting item precedes the target NP) and in nuclear position within the sentence boundary enhances its likelihood to be introduced with a single pitch accent on the matching word. However, the correspondence between a single pitch accent and a contrasted element is stronger for adjectives, while for contrasted nouns both single and double pitch accents are equally preferred. The results suggest that the accentuation of contrasted elements differs within the NP.

These accentual dissimilarities have been attributed to the inherent contrastive function of noun modifiers in general [7]. They all are assumed to establish a contrastive relation to a comparison class, with scalar adjectives involving stronger contrastive effects than non-scalar one like color. However, eye tracking studies on German have shown that modifiers are perceived as evoking contrast only when introduced with a contrastive L+H\* pitch accent [10]. In the absence of such a pitch accent their contrastive interpretation is disfavored. This suggests that contrastive interpretation does not arise from the presence of a modifier *per se*. Prosody alone can trigger the perception of contrast in Dutch as well [9]: accents on contrastive information are judged as the most prominent.

Previous studies [e.g., 5] define *semantic abnormality* as a property of words whose occurrence in a particular context is unusual. They provide evidence for a correlation between semantics and prosody: semantically unexpected words are more likely to bear an accent.

In our study we draw a distinction between two aspects of prominence on the perception level: (i) *prominence* due to contrast, i.e. an item is prominent if it establishes a contrast relation to another typical item in the discourse context; (ii)

*salience* due to what we will call “semantic unexpectedness”, i.e. an item is prominent if it evokes contrast with its typical representation in memory. We aim to examine how these cognitive types of contrastiveness interact and become manifest on the prosodic level.

## 2. Experiment

### 2.1. Participants & Procedure

Ten native speakers of Dutch (age 22-35; 7 female) were paid for participation in a production experiment. They were seated in front of a computer screen in a soundproof recording studio, and were asked to describe various consecutive scenes consisting of moving pairs of fruits (cherries, bananas, lemons, and raspberries) with varying unnatural colors (blue, grey, etc.). In each scene, three consecutive actions were displayed, such that one pair of fruits moved towards another one, touched it and returned to its original position. An example of a scene is shown in Figure 1, where numbers mark the consecutive starting point of a movement, and arrows its direction.

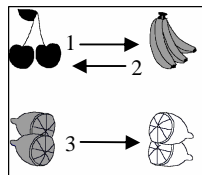


Figure 1: *Experimental scene with three consecutive actions.*

The participants had to produce sentences with a fixed SVO word order such as “The green cherries touch the grey bananas on the screen” (Dutch – “De groene kersen raken de grijze bananen op het beeldscherm”). We decided to ask for a prepositional phrase at the end of the sentence, because break tones may enhance the prominence of nuclear pitch accents on nouns in object position. The experiment lasted for approximately 15 minutes (including a short trial session).

### 2.2. Materials

As already mentioned, we modified the experiment in [8] with the purpose of exploring the impact of semantic unexpectedness on the prosodic realization of contrast. The geometrical figures in the original experiment were replaced by fruits with unnatural colors (e.g. *red* lemons). It is this inappropriateness of a property functioning as a modifier of a particular referent that we define as semantic unexpectedness.

Target sentences describe the third action in a scene and establish a contrast relation between nouns or adjectives within or across the sentence boundary. Target NPs are underlined, and contrasted elements are italicized.

#### (1) Noun contrasted across the sentence boundary

- a) *previous sentence*: The grey *bananas* touch the green cherries on the screen.
- b) *target sentence*: The grey *lemons* touch the blue lemons on the screen.

#### (2) Adjective contrasted within the sentence boundary

The *grey lemons* touch the *blue* lemons on the screen.

We tested how various discourse factors determine the accentuation of contrast. Experimental conditions are listed in Table 1 (abbreviations: A for adjective, N for noun).

condition	sub-condition	contrast on A or N
direction of contrast	forward backward	A or N within
syntactic status	subject object	A or N across
discourse distance	within sentence across sentence	A or N within/ across
conflict cases (double contrast)	within and across	AN where A within, N across N within, A across

Table 1: *Experimental conditions and contrastive relations.*

In a forward-looking contrast relation, target NPs precede the contrasted item (e.g. the *grey lemons* in (2)), as opposed to backward-looking NPs which come at the sentence end (e.g. the *blue lemons* in (2)). Regarding syntactic status, subject or object NPs are contrasted with elements across the sentence boundary, i.e. items in the previous sentence with the same syntactic status (e.g. the *grey lemons* vs. the *grey bananas* in (1) for contrast on the subject). Moreover, depending on discourse distance, contrast can hold within (e.g. the *grey lemons* vs. the *blue lemons* in (2)), or across the sentence boundary (e.g. the *grey lemons* vs. the *grey bananas* in (1)). Finally, in addition to single contrasts (where only one element of the target NP is contrasted), conflict cases were included where one NP element was contrasted within, and the other across the sentence boundary (e.g. target NP the *grey lemons* is contrasted with the *grey bananas* within, and with the *blue lemons* across the sentence in (1)). Depending on the NP element being contrasted (i.e. adjective or noun), contrastiveness and semantic unexpectedness may either coincide or conflict. In the case of *adjectives*, unexpectedness and contrast coincide; therefore we expect an enhancement of their prosodic correlates. In NPs with contrasted *nouns*, however, unexpectedness causes salience of the adjective, whereas contrastive focus leads to prominence on the noun. The cognitive salience caused by unexpectedness may be more important than prominence based on contrast in the context; therefore unexpectedness should have a stronger impact on accentuation.

### 2.3. Analysis

From all 240 target sentences which were cut out from the collected material, 16 (6.6%) were excluded from the analysis due to hesitations, corrections, and errors. Target NPs were analyzed in their sentence context because contrastiveness is assumed to be coded in the whole pitch contour [4]. Two intonation experts (the first author and one independent intonation researcher) performed an auditory analysis of the target sentences. The labelers judged the *prosodic prominence* of the elements within the NP, i.e., noted the item that stood out perceptually due to its accentuation. Three observations led us to choose for such analysis: (i) deaccentuation was highly uncommon for repeated words (1.1% of all NPs); (ii) prominence judgments are reliable cues for perception of contrast and intonation [9]; (iii) accents on contrastive information are perceptually most prominent [4].

## 2.4. Results

Mean percentages Accentuation (accent on adjective vs. on noun vs. on both) were calculated in each of the four major sets of conditions: 1) contrast direction, 2) syntactic status of contrasted element, 3) discourse distance between contrasted elements, and 4) double contrasts. See Table 3 for actual percentages (based on participant means) in all (sub-) conditions.

		Contrast on:		Accent on (in %):		
		A/N	condition	adjective	noun	both
contrast direction	A	forward	85 (7.6)	10 (6.7)	5 (5.0)	
		backward	95 (5.0)	0 (0.0)	5 (5.0)	
	N	forward	65 (13.0)	15 (10.7)	20 (11.1)	
		backward	60 (12.5)	30 (11.1)	10 (6.7)	
syntactic status	A	subject	85 (7.6)	0 (0.0)	15 (7.6)	
		object	85 (7.6)	5 (5.0)	10 (6.6)	
	N	subject	25 (8.3)	40 (12.5)	35 (13.0)	
		object	15 (10.7)	65 (15)	20 (11.1)	
discourse distance	A	within	95 (5.0)	0 (0.0)	5 (5.0)	
		across	85 (7.6)	5 (5.0)	10 (6.7)	
	N	within	60 (12.5)	30 (11.1)	10 (6.7)	
		across	15 (10.7)	65 (15.0)	20 (11.1)	
double contrast	A	subject	75 (13.4)	20 (13.3)	5 (5.0)	
		in object	90 (6.7)	0 (0.0)	10 (6.7)	
	N	subject	75 (13.4)	10 (10.0)	15 (10.7)	
		in object	60 (12.5)	35 (13.0)	5 (5.0)	

Table 3: Percentages (plus SE) of marking of contrast in all (sub-)conditions in each of the four major conditions.

We conducted Repeated Measures ANOVAs for the four major condition sets separately, each with three within-subjects factors: *Accented Element* (Accent on Adjective vs. Noun vs. Both); *Contrasted Element* (Adjective vs. Noun), together with one of the following factors that are unique to a given condition set: *Direction* (Forward vs. Backward), *Syntactic Status* (Subject vs. Object), *Discourse Distance* (Within Sentence vs. Across Sentences), and *Double Contrast* (Subject Within vs. Object Within).

*Contrast Direction.* The factor *Direction* did not give rise to significant (interaction) effects. There was a main effect of *Accented Element* ( $F(2,18)=50.81, p<0.001$ ), indicating that in general there were significantly more accents on the adjective (76.25%;  $SE=4.7$ ) than on the noun (13.75%;  $SE=3.9$ ) or on both elements (10.0%;  $SE=4.1$ ); the number of accents on noun or both elements did not differ significantly. This effect was qualified by an interaction between *Accented Element* and *Contrasted Element* ( $F(2,18)=10.87, p<0.005$ ). Post-hoc tests showed that adjectives differed from nouns with respect to every type of accentuation: 90% ( $SE=4.1$ ) vs. 62.5% ( $SE=7.7$ ), for single accents on the adjectives; 5% ( $SE=3.3$ ) vs. 22.5% ( $SE=5.8$ ), for single accents on the nouns; and 5% ( $SE=3.3$ ) vs. 15% ( $SE=5.5$ ), for accents on both elements.

*Syntactic Status.* The factor *Grammatical Role* does not have a significant effect on the prosodic marking of contrast, either alone or in interaction. As in the previous condition set, we did find a main effect of *Accented Element* ( $F(2,18)=5.25, p<0.05$ ), as a result of there being significantly more accents on the adjectives (52.5%;  $SE=4.9$ ) than on other elements (nouns: 27.5%,  $SE=6.7$ ; both: 20.0%;  $SE=6.5$ ; final two

conditions do not differ). Again, there was an interaction between *Accented Element* and *Contrasted Element* ( $F(2,18)=21.39, p<0.001$ ), due to significant differences between contrasted adjectives on the one hand, and contrasted nouns on the other hand in terms of percentage single accents on the adjective (85.0%,  $SE=6.7$  vs. 20.0%,  $SE=7.3$ ), on the noun (2.5%,  $SE=2.5$  vs. 52.5%,  $SE=12.6$ ); there was no statistically reliable difference between contrasted adjectives and contrasted nouns (12.5%,  $SE=5.6$  vs. 27.5%,  $SE=9.5$ ;  $p>.10$ ). This pattern of interaction indicates that the preference for accenting adjectives is not present, and indeed, is reversed, where contrasted nouns are concerned.

*Discourse distance.* Here we found a significant three-way interaction of *Accented Element* x *Contrasted Element* x *Discourse Distance* ( $F(2,18)=3.62, p=0.05$ ). Follow-up analyses showed a main effect of *Accented Element* (and no interaction with *Discourse Distance*) for all items where contrast was realized between *adjectives*, regardless of whether this contrast was within or across sentences ( $F(2,18)=73.98, p<0.001$ ), reflecting a general preference for putting a single accent on the adjectives (adjectives: 90.0%,  $SE=5.5$  vs. nouns: 2.5%,  $SE=2.5$  vs. both: 7.5%,  $SE=5.3$ ). When *nouns* were contrasted, however, we did find a significant interaction between *Accented Element* and *Discourse Distance* ( $F(2,18)=7.27, p<0.01$ ), showing that adjectives are preferentially accented when nouns are contrasted *within* a sentence (adjectives: 60.0%,  $SE=12.5$  vs. nouns: 30.0%,  $SE=11.1$  vs. both: 10.0%,  $SE=6.7$ ), but not when the contrast goes across sentence boundaries (adjectives: 15.0%,  $SE=10.7$  vs. nouns: 65.0%,  $SE=15.0$  vs. both: 20.0%,  $SE=11.1$ ); thus, we found the same reversal of the adjective accentuation preference as in the previous set of analyses (i.e., regarding *Syntactic Status*).

In the final set of *Double Contrast* conditions, only *Accented Element* had a significant effect ( $F(2,18)=24.38, p<0.001$ ), again reflecting a strong preference for accenting the adjective in all sub-conditions (adjectives: 75.0%,  $SE=7.5$  vs. nouns: 16.25%,  $SE=5.6$  vs. both: 8.75%,  $SE=4.6$ ; the final two conditions did not differ significantly).

In summary, then, we found consistent evidence for a strong preference to place single accents on the *adjective* of the contrasted NP, regardless of whether it is adjectives or nouns that are contrasted, and regardless of manipulations of discourse factors that have been shown to produce significant effects in earlier research [8]. The only exceptions are the cases where nouns are contrasted across sentence boundaries. Here, participants prefer to accent the nouns instead of the adjectives. In the next section we will discuss these findings in more detail.

## 3. Discussion & Conclusion

We expected to find that semantic unexpectedness is signaled in prosody and leads to: (1) an increase of the amount of single pitch accents on contrasted *adjectives* because in their domain, contrast and unexpectedness coincide and evoke accentuation; (2) a decrease of the amount of single accents on contrasted *nouns* because both prominence strategies are in conflict: prominence due to contrast causes accentuation of the noun, whereas salience due to unexpectedness triggers accentuation of the adjective. And indeed, we found that adjectives were realized most often as the single prosodic prominent item in the NP regardless of the domain of contrast and the effect of discourse factors. This provides evidence for

our assumption that cognitive salience due to unexpectedness may overrule contextual factors. The typicality of representation in memory turned out to be superior to discourse prominence.

However, one might argue that our findings are brought about by the adjectives being varied more frequently in our experiment than the nouns, which might have led the participants to interpret them as inherently contrastive. However, a plastic language like Dutch [9], which varies intonation in order to express information structure, i.e. contrastive focus is introduced prosodically by a matching accent. Furthermore, the variation in colors is almost identical between our experiment and the original one, where no intrinsic contrastive interpretation of modifiers was found [8]. From this it follows that the overall highest prosodic prominence of adjectives must be accounted for by the only modified condition in our experiment, namely by semantic unexpectedness.

This assumption is further supported by the fact that, unlike what was found in [8], none of the discourse factors tested had a significant influence on the accentuation of contrastive information, except for discourse distance. Together with the lack of a correlation between prosodic prominence and matching contrasted word, we can infer that (i) it is not discourse factors but semantic unexpectedness that accounts for the accentuation pattern in the experiment, and (ii) unexpectedness is a cognitive phenomenon and remains unaffected by discourse. Those conditions provide further evidence for the salience of unexpectedness: As for *contrast direction*, adjectives are the single prosodically prominent items regardless of which NP element is contrasted, even though nouns are less frequently realized with a non-matching accent on the adjective. Hence, the accentual marking of unexpected information overrules that of contrast. However, in one of the *syntactic status* conditions, contrast does not seem to be overruled by unexpectedness; contrasted nouns appear most often as the single prosodically prominent item, whereas non-contrastive adjectives become less prominent even when they are semantically unexpected. The lack of an impact of unexpectedness on the realization of contrastive nouns in subject and object position only appears when contrast is established across the sentence boundary. Moreover, the only discourse factor that turned out to be significant, *discourse distance*, revealed that contrast across the sentence boundary leads to more frequent single prominence of nouns. However, it is adjectives that bear a single prosodic prominence in all other conditions (i.e. all adjectives regardless of discourse distance, and nouns within the sentence). The single accents on nouns are contrary to the preference for double accents on nouns in [8].

Because of the imperfect correlation between contrast, unexpectedness and prosody, we went back to the experimental stimuli to investigate the distribution of colors and fruits over all scenes that contained noun contrast. Most of the prominent nouns always appeared in scenes with contrast across the sentence, where three out of the four had an identical (but semantically unexpected) color which was mentioned in all three consecutive actions. We suppose that it may be the consecutive repetition of unexpected information which reduces its prosodic prominence in the context in favor of the accentuation of contrast. On the other hand, nouns contrasted within the sentence are not the most prominent because salient adjectives were mentioned within the target sentence only once. Thus, contrast within the sentence does

not rule out the prosodic prominence of unexpected repeated information.

Our findings suggest that the correlation between semantic unexpectedness and intonation is affected by discourse distance and repetition. Concerning discourse distance, unexpected information has the strongest impact within the sentence, i.e., irrespective of contrast domain, adjectives are most prominent. Across the sentence, however, unexpectedness effects decrease, whereas contrast effects become stronger, because cognitive salience is weakened. Our experimental results do not allow us to infer a general principle of cognition which rules out discourse phenomena, such that only unexpectedness is reflected in prosody. Repetition of unexpected information, for instance, does not evoke an increase of its typicality in memory or expectedness in the context; on the contrary, cognitively salient information becomes integrated in the discourse. In so doing, the strong prosodic prominence of unexpectedness may be weakened by both repetition and long discourse distance and result in an increase of accentual prominence due to contrast. We aim to elaborate further on this relation in a future experiment.

In summary, we provided experimental evidence for the interaction of linguistic and more general, extra-linguistic cognitive information in the prosodic realization of contrast. This relation can be best shown as a trade-off: extra-linguistic information may hinder the prosodic marking of information-structural categories such as contrast because it is most salient in the recent context. However, if the unexpected information is repeated, it becomes subordinated to the linguistic principles of discourse organization reflected also in prosody.

#### 4. References

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