Interaction of Grammatical Form and Intonation: Two Experiments on Dutch Imperatives

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1. Introduction

One of the more intriguing and elusive semantic contrasts in Modern Dutch is that between the bare verb stem and the infinitive, as they are used in imperative sentences: e.g., *Rook niet!* 'Smoke not = Don't smoke' or *Loop door!* 'Walk on = Walk through (e.g., to the rear of the bus)', versus *Niet roken!* 'Not (to) smoke = No smoking!' or *Doorlopen!* '(To) through-walk = Walk on'. Kirsner, van Heuven, and Caspers (1998: 135–6) argued that the verb stem (henceforth STM) would communicate GREATER IMPERATIVE FORCE than INF. Nevertheless, their experimental subjects did not judge STM as significantly 'stronger' than INF. Given that STM remains the only acceptable option in truly hierarchical command situations (such as the armed forces (*Geef acht!* 'Attention!' rather than **Acht geven!)* and given that it is also the only option for cursing (*Val dood!* 'Drop dead!' rather than **Doodvallen!*), Kirsner at al. provisionally concluded that the fault lay with their stimulus sentences rather than with their hypothesis.

Faced with STM's wide range of uses, including conditionals such as *Hang de was buiten en het gaat regenen* 'Hang the laundry outside and it starts raining!', Proeme (1984: 245) characterized the form as urging the addressee to regard himself as fulfilling the role with respect to the lexical verb which, in a normal declarative sentence, would be referred to by the grammatical subject. This meaning is less precise than 'command' or 'condition' but is consistent with both. Building on Proeme (1984: 245), Blom (1987) argues that while STM (i) places the activity in a personal perspective and (ii) characterizes it as something to be imagined and not necessarily undertaken (as in the laundry-sentence above), INF (i) does NOT place the activity in a personal perspective, but (ii) characterizes it as one of a series of actions comprising a standardized procedure, and (iii) explicitly portrays the activity as an ACTION TO BE UNDERTAKEN and NOT just imagined. The STM/INF contrast is thus multi-dimensional. The personal aspect of STM versus

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the impersonal aspect of INF led Kirsner et al. (1998) to hypothesize that STM would be directer than INF, thus have more immediate impact, and communicate the more forceful command.

But a reading of Paardekooper (1951) and Duinhoven (1984) shows that the matter is not simple. Paardekooper discusses several cases in which there is no obvious difference between the two forms, but does indicate (1951: 100–101) that STM is better suited for the speaker's own 'first-hand' commands while INF is better suited for 'second-hand commands', where the speaker merely passes on a message from someone else. Crucially, Duinhoven (1951: 156) argues that STM and INF are actually NEUTRAL with respect to any speech act of commanding and suggests that it is INTONATION (not specified any more precisely than that) which is responsible for the imperative messages associated with these forms. But then the question arises as to precisely how 'intonation' is to be understood.

In this contribution we therefore study the effect of speech melody on the interpretation of STM and INF. We will report two experiments. In the first we ask how the degree of authority (a continuous, paralinguistic variable) operationalised prosodically in terms of mean pitch and size of pitch movement) influences the interpretation of STM versus INF sentences. In the second experiment we examined the relative compatibility with STM and INF of two categorically different accent-lending pitch configurations, viz. the 'pointed hat' versus the 'chanted call'.

2. First experiment: command melody and grammatical form

We have not been able to find any solid evidence for a prosodic category associated with commands. We are therefore inclined to believe that Duinhoven's claim with regard to the existence of imperative intonation refers to the paralinguistic use of vocal pitch (and presumably loudness and rate of speech as well) on the part of the speaker so as to project an image of authority. Typically, paralinguistic use of prosodic parameters (such as pitch) does not involve a contrast between two discrete categories (such as statement versus question, or plus versus minus accent) but a scalar continuum. For instance, a person may pretend to be friendly or unfriendly to any intermediate degree.

A command, then, will be more forceful as the speaker projects an image of greater strength and superiority. One way to do this is to lower one's voice. Ethologically, low pitched sounds are characteristic of large individuals and communicate dominance of the speaker (Ohala 1982). Conversely, high-pitched vocalisations, such as produced by small creatures (and infants), are interpreted as a sign of weakness, helplessness or subservience. A second melodic parameter that may bear on the authority of one's voice is the size of the pitch changes on accented

syllables. Relatively flat pitch patterns (i.e., small rises and falls on the accented syllables) tend to communicate lack of interest and/or reluctance on the part of the speaker to make choices as to what is and what is not communicatively important. Near-monotony is therefore a poor means of getting one's interlocutor's attention and/or respect. Large pitch movements, on the other hand, tend to be interpreted as a sign of confidence on the part of the speaker (cf. van Bezooijen 1988, and references given there). However, there is an upper limit to the size of pitch movements; once the threshold is crossed, the speaker will sound exaggerated or even hysterical, which, of course, is not conducive to the projection of authority.

In view of these considerations we decided to exploit mean pitch and size of the pitch changes on accented syllables so as to create a paralinguistic continuum arguably ranging from superiority/authority on the one extreme to helplessness/ dispair on the other. The various pitch patterns will then be transposed onto the syntactically different STM and INF structures, so that we can experimentally determine how choice of melody and of syntactic structure interact in the signalling of a forceful command.

2.1 *Stimulus materials*

The sentences in (1–2) were recorded on digital audio tape by a male native speaker of Dutch using a Sennheiser MKH unidirectional condenser microphone and a sound-proofed recording booth. Each sentence was read with two rise-fall pitch accents, indicated by small capitals in (1–2).

(1) a. *Doe het* RAAM *dicht als het* REgent!
'Close the window shut if it rains'
b. *Het* RAAM *dichtdoen als het* REgent!
'The window to-shut.close if it rains'

(2) a. *Werk* DOOR *als de* BEL *gaat!*
'Work on if the bell rings'
b. *DOORwerken als de* BEL *gaat!*
'To-on.work if the bel rings'

The signals were downsampled (16 kHz, 16 bits) and stored on computer disk. Using a high resolution waveform editor, recombinations of parts of both syntactic structures were made such that the resulting utterances contained identical speech material as much as possible. For instance, the sentence-initial word *Doe* was spliced on to the INF-sentence, while editing out the infinitive *doen* in order to transform the INF-structure into the corresponding STM-imperative. Fundamental

frequency (F_0), the acoustic correlate of vocal pitch, was extracted from the signal using an autocorrelation method, and interactively stylized using the PRAAT speech processing software (Boersma and Weenink, 1996). Twenty-five intonationally different examplars were then generated for each of the four utterances, using high-quality PSOLA analysis and resynthesis (see Rietveld and van Heuven 1997, and references given there).

While maintaining the original F_0 downtrend, both rise-fall accents were replaced by standardised movements with excursion sizes of 1, 4, 7, 10 and 13 semitones. The entire F_0 contours were then shifted up and down such that the terminal F_0 was equal to 0, 4, 8, 12 or 16 semitones relative to 50 Hz (the lowest frequency a male voice can produce without breaking into a creak; a semitone is a difference between two frequencies of 6%). The 5 (terminal pitches) × 5 (excursion sizes) = 25 intonation contours are (partly) illustrated in figure 1.

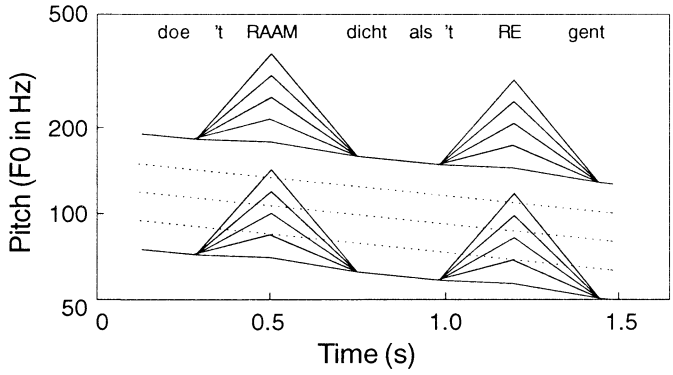

Figure 1. *Illustration of 15 (out of the possible 25) combinations of terminal F_0-levels and excursion sizes.*

The 100 test utterances (4 lexico-syntactically different sentences × 25 intonation contours) were recorded on DAT in random order, preceded by 10 practice items (selected at random from the set of 100). Stimuli were separated by a 3–s period of silence; a short beep was recorded after every tenth item. Forty-four native Dutch subjects (first year students of linguistics at Leiden University) listened to the tape being played to them over good-quality loudspeakers in a quiet, medium-sized amphitheater. Listeners were issued response sheets on wich they indicated, for each utterance on the tape, to what extent they considered it suited as a strict order.

Subjects responed by ticking (forced choice) a value along a 9–point scale running between 1 ('completely unsuitable as a strict order') and 9 ('perfectly suitable as a strict order'), with 5 representing neutrality.

2.2 *Results*

To determine to what extent the subjects agreed with each other in assigning Imperativity scores to the stimuli, we first computed Cronbach's Alpha. An Alpha of 0 indicates no agreement between subjects, while a score of 1 indicates perfect agreement. The result obtained (.97) suggests that our Imperativity scale was a reliable measuring instrument.

Table 1 summarizes the results of a repeated measures analysis of variance of the Imperativity judgements. We shall limit our discussion here (and in the following sections) to significant main effects and interactions ($\alpha = 0.05$) that explain at least 0.5% of the variance ($\omega^2 \geq 0.5\%$). Pitch Level, Excursion, and Sentence are significant main effects, but surprisingly, and against our hypothesis, Grammatical Form is not. Grammatical Form is only significant in its interaction with other factors. We will discuss significant first-order interactions between Grammatical Form and Pitch Level, Grammatical Form and Sentence, and between Pitch Level and Excursion.

Table 1. *Summary of analysis of variance on the Imperativity scale: Main factors and second order interactions*

Factor/Interact.	df_1, df_2	F	p	ω^2
Sentence	1,43	16.5	<.001	0.5%
Gramm. Form	1,43	.01	n.s.	
Pitch Level	4,172	42.2	<.001	10.3%
Excursion	4,172	3.2	=.016	0.5%
Sent × Level	4,172	2.5	=.046	0.1%
Sent × Exc.	4,172	4.2	=.004	0.1%
Gram × Level	4,172	15.4	<.001	0.7%
Gram × Sent.	1,43	18.5	<.001	0.5%
Gram × Exc.	4,172	4.3	=.004	0.1%
Level × Exc.	26,688	6.5	<.001	0.9%
Total explained variance				13.7%

2.2.1 *'Command intonation'*

Figure 2 plots mean Imperativity scale values broken down by pitch level and excursion size, accumulated over the two lexically different sentences. The data generally accord with the discussion above: The higher the average pitch level, the less the utterance sounds like a command (main effect of Pitch Level). Very small excursions are incompatible with commands. Larger excursions work better (main effect of Excursion size), but only at low to moderate terminal pitch levels (Level × Excursion interaction).

2.2.2 *Grammatical form and pitch level*

We are now in a position to study the effect of the paralinguistic continuum (our interpretation of what Duinhoven 1984 meant by intonation) on the degree of Imperativity judged to be communicated by STM and INF. Figure 3 plots the mean Imperativity scores for both sentences combined, broken down by grammatical form and pitch level.

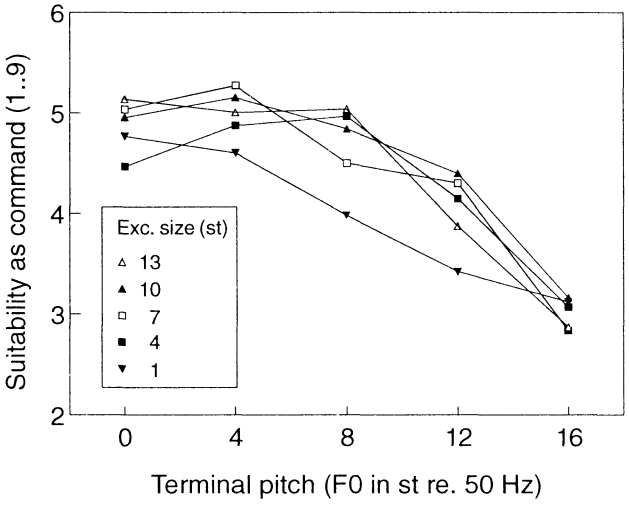

Figure 2. *Mean Imperativity scale values broken down by pitch level and excursion size*

Now to the extent that STM ranks higher than INF at the lower and medium pitch levels (more suited for communicating commands; Pitch Level × Grammatical Form interaction), there is some support for the hypothesis that STM is the stronger imperative. But the reversal of STM and INF at higher pitch levels, less

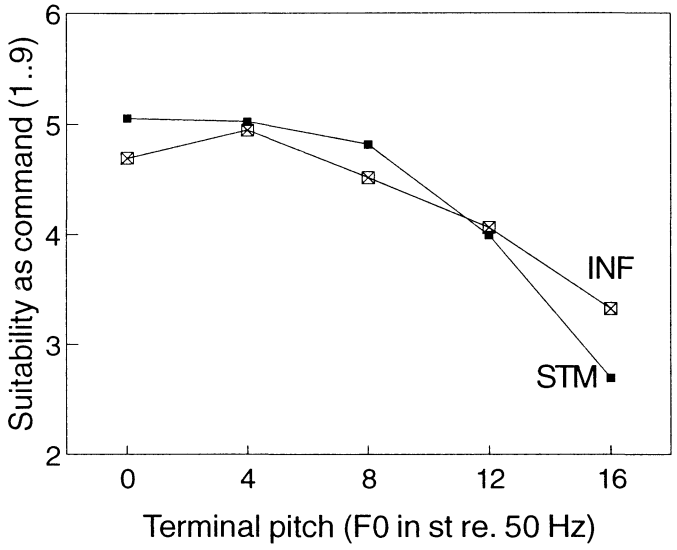

Figure 3. *Mean Imperativity scale values broken down by pitch level and grammatical form*

suited for communicating commands, calls this interpretation into question. If STM were inherently a more forceful command than INF, with the greater imperativity 'built into it', there should be no such reversal. The stronger STM would resist the decay in imperativity brought about by high pitch more strongly than the weaker INF, and we would simply have two parallel descending curves, with the STM curve higher than the INF curve. At any given level on the Imperativity scale, STM would reach that level at a lower pitch level than INF.

Inspection of figure 3 reveals that while STM ranks higher in Imperativity than INF at the initial low pitch levels, it decays faster and and more pronouncedly than INF as the pitch increases, so that INF still preserves some degree of imperative force even when STM has lost it almost entirely. 'Intonation' (here: pitch level) can 'push around' STM much more than INF.

The greater influence of pitch level on the interpretation of STM rather than INF is revealed by a trend analysis of the data of figure 3 (cf. Keppel 1991:142–161). Planned comparisons show that the Imperativity scores for both STM and INF exhibit significant linear and quadratic trends, but no cubic or quartic trends. Furthermore, the trends for STM are significantly greater than those for INF. (STM

values fall farther than INF values as a function of pitch level and exhibit a greater curvature.) The trends for STM account for more than twice as much of the variance in the Imperativity scores as those for INF; see table 2).

Table 2. *Trend analysis for effect of pitch level on Imperativity for STM and INF*

	Verb Stem Imperative (STM)		Infinitivus pro Imperativo (INF)	
TREND	Significance	ω^2	Significance	ω^2
Linear	F(1,43)=56.08, p<.001	26.3%	F(1,43)=26.31, p<.001	12.5%
Quadratic	F(1,43)=75.33, p<.001	5.7%	F(1,43)=27.30, p<.001	2.8%
Total variance explained		32.0%		15.3%

2.2.3 *Interim discussion*

Although the data came out differently than we expected from our own selective interpretation of Proeme (1984) and Blom (1987), these two articles provide the explanation for figure 3. Consider table 3.

Table 3. *Comparison of semantic components of STM and INF*

	STM	INF
1. RELATION TO HEARER	Personal/direct	Impersonal/indirect
2. CHARACTERIZATION OF EVENT	To be imagined	Action to be undertaken
3. STATUS OF ACTIVITY	[Unspecified]	Part of standard procedure

The crucial point is that, along the second dimension, viz. characterization of event, the meaning signaled by STM is less PRECISE than that signaled by INF, so that its interpretation will necessarily depend more on contextual factors such as the paralinguistic ones of pitch level and excursion size considered here. Now when these factors point overwhelmingly towards the 'command' interpretation (e.g. at low pitch levels), so that there is in effect no difference between STM and INF on dimension 2, the contrast on dimension 1 can become salient. Here, all other things being equal, the greater directness of STM might be expected to lead to its favoring for 'command' messages. When, however, paralinguistic factors disfavor a 'command' interpretation of both STM and INF, INF — having 'command' built-in as part of its meaning along dimension 2 — should retain more Imperativity than INF, which is exactly what we see in figure 3 at high pitch levels. The problem factor is the third dimension above. When all other things are NOT equal, when something in the context suggests that we are dealing with a component of a standardized

procedure rather than a single, isolated activity, then INF might be favored where we would not have expected it to be. And here the lexical meaning of the verb may be expected to come into play.

2.3 *Grammatical form and Sentence*

Figure 4 below displays the interaction of sentence with grammatical form listed in Table 1 above. For the *doorwerken*-sentences, planned comparisons indicate that INF (mean: 4.6) is rated as significantly more commanding than STM (mean: 4.3); p=.002. For the *dichtdoen*-sentences, INF (mean: 4.0) is rated as significantly less commanding than the STM (mean: 4.3) ; p=.008. The STM *Werk...door!* is not judged as signficantly more commanding than STM *Doe...dicht!*, but the INF *Doorwerken!* IS judged as significantly more commanding than INF *Dichtdoen!* (p<.001). Why?

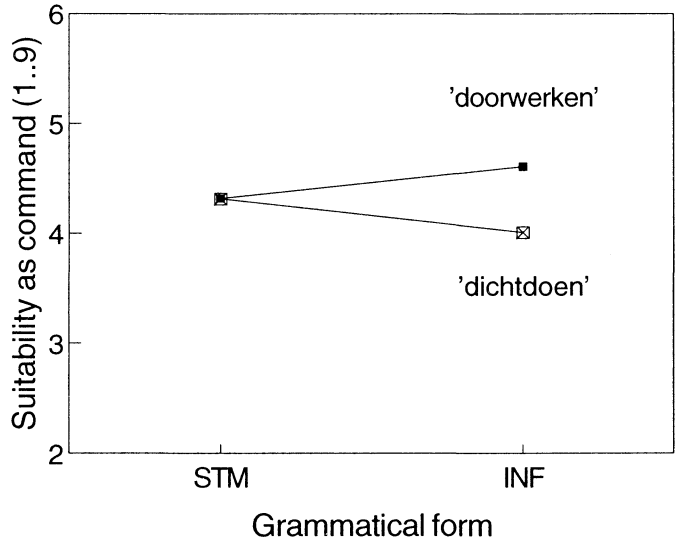

Figure 4. *Interaction of Grammatical Form with Lexicon*

We would hypothesize that the reason for these differences is that the *door-werken*-sentences ('Keep on working when the bell rings') evoke an elementary or

secondary school environment more than a domestic one, and that the reverse is true for the *dichtdoen*-sentences ('Close the window if it rains'). The speaker in the school situation might be more of an authority figure (a teacher administering a test to a group of pupils) than in the non-school situation. Accordingly, it is not unreasonable that the INF *Doorwerken*! (addressing no one specifically and, hence, by default, everyone, as in a phrase like *Iedereen binnenblijven* 'Everyone stay inside') might be rated as more forceful in that situation than the STM *Werk door!* In contrast, in the non-school situation evoked by the *dichtdoen*-sentences, the opposite might hold. If one keeps in mind Blom's discussion (1987: 185) of the contrast between the personal advice *Rook niet!* and the public ordinance *Niet roken!*, one could argue that the more personally directed *Doe het raam dicht als het regent*, said to one person, would seem more urgent, less general than *Het raam dichtdoen als het regent.*

Figure 5A-B plots the mean Imperativity scores as a function of Pitch Level and Grammatical Form for each of the two lexically differet sentences. While the above considerations might explain the choice of STM over INF or INF over STM at low pitch levels, it will be seen in both figures that, when Imperativity decays, it is the more precise INF form which ends up ranking higher than STM.

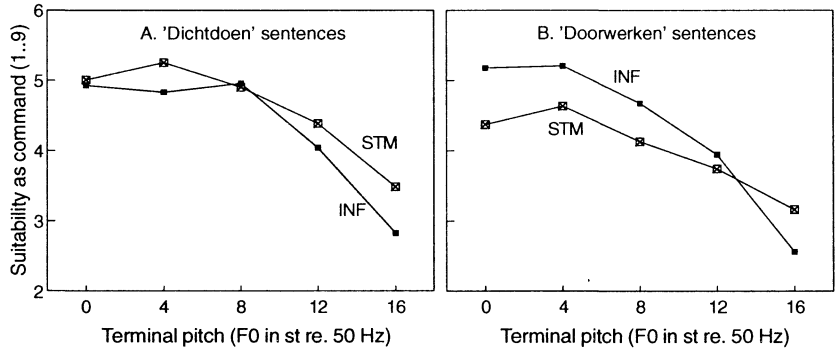

Figure 5. *Imperativity scores broken down by pitch level and grammatical form for the 'Dichtdoen' (panel A) and 'Doorwerken' (panel B) sentences.*

3. Second experiment: STM versus INF and 1&A versus 1E

This second experiment focusses not on the (alleged) overall greater strength of STM over INF as imperative markers, but rather targets the third semantic component listed in Table 3 above, namely Blom's (1987) claim that INF explicitly characterizes the activity as part of some standard procedure. Paardekooper's (1951) assertion that INF is better suited than STM for communicating 'second-hand commands', originating from someone other than the speaker, seems to us to be describing the very same phenomen. If one child in a family summons the other children by saying *Binnenkomen en je huiswerk maken!* 'To inside-come and your homework to-make!', the use of INF characterizes the acts of coming inside and doing one's homework as part of a series of events comprising some larger behavioral unit (e.g. an 'end of the afternoon before dinner procedure'). The key aspect of both Blom's and Paardekooper's characterization of INF versus STM is REPETITION, hence relative FAMILIARITY. If an activity is part of a standard procedure, it is likely to be repeated and the command to do it will be familiar. If a command is a second-hand command, then it is also litterally being repeated. The question which then arises is whether this difference in semantic nuance between STM and INF might have intonational consequences.

Previous research has shown that commands are preferred when spoken with a pitch accent that focusses the hearer's attention on a new, unexpected referent (Kirsner et al. 1998: figure 1B, 2B), i.e., accent type 1&A (or: H*L). This accent type, often referred to as the pointed hat, consists of a full rise immediately followed by a full fall. Note that the 1&A accent is the prototypical, unmarked pitch accent in Dutch, which can be used in almost any situation (Caspers and van Heuven 1995; Caspers, van Heuven and van Zwol 1997). There is also a different, highly marked, configuration 1E or 'chanted call', which consists of a full rise on the last accented syllable of an Intonational Phrase, followed by a half fall on the next syllable (after which the pitch remains steady at a level intermediate between high and low). Keijsper (1984) argues that 1E signals the abstract meaning 'the information given here is superfluous'. This meaning is highly compatible with uses of 1E expressing irritation, frustration or impatience on the part of the speaker for having to repeat the same utterance over and over again. Extending this reasoning to the problem of first-hand commands versus second-hand commands (passed on to the listener on behalf of a higher authority), it seems to us that 1E should be (relatively) more compatible with INF than with STM, since the abstract meaning of superfluousness is synergetic with the (implied) repetitive character of the second-hand command. In contrast 1E should be antagonistic (more so than 1&A) to the idea of a novel, out of the blue, first-hand command as signalled by STM.

We therefore generated STM and INF commands with 1&A as well as with 1E accent-lending pitch configurations, and had listeners indicate the degree of compatibility between the verbal contents of the command and its speech melody.

3.1 *Stimulus materials*

The sentences (3–4) were spoken by a male native speaker of Dutch (for details see experiment 1), once with 1&A configurations on the accents, and once with 1E configurations.

(3) *MaRIJke! Doe de DEUR dicht!*
'Mary! Make the door shut!

MaRIJke! De DEUR dicht doen!
'Mary! The door shut to-make!'

(4) *PEter! Hang je JAS op!*
'Peter! Hang your coat up!'

PEter! Je JAS ophangen!
'Peter! Your coat to-up.hang!'

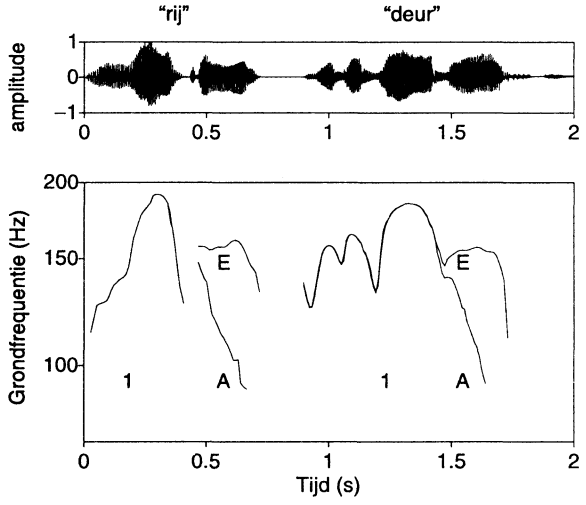

Figure 6. *F_0 tracings of pointed hat and chanted call for one sample sentence*

Through digital waveform editing the preboundary syllables carrying the E-fall were substituted for their counterparts carrying the falls A (Figure 6). This procedure yielded four stimulus types: The original (i) STM and (ii) INF sentences with 1&A configurations and the derived (iii) STM and (iv) INF sentences with the preboundary syllables replaced by those excerpted from the corresponding 1E utterances. The resulting 2 (STM/INF) × 2 (1&A/1E) × 2 (Marijke/Peter) = 8

stimulus types were recorded on DAT in two random orders and played to 62 native Dutch listeners. These decided, for each utterance on the tape, how felicitous they considered the combination of the verbal contents of the command and its melody. Listeners indicated their judgments by ticking a number along a 9–point scale ranging from 1 'extremely poor combination of contents and melody' to 9 'excellent combination of contents and melody', with 5 indicating neutrality.

3.2 *Results*

We know from previous work that the 1&A configuration is generally the preferred accent in Dutch, in any situation (see above). Moreover, the 1&A accent should be especially favoured in the STM-sentences as these present the commands as an unexpected event. Inspection of the listeners' responses revealed that indeed 1&A was generally the preferred pattern, not only for STM but also for INF commands. The statistical analysis therefore concentrated on the preference of 1E relative to that of the unmarked accent 1&A. For reasons we fail to understand, a (small) minority of nine listeners preferred the marked 1E accent even when the command was given in the STM-form. We eliminated these abnormal listeners from the data set, limiting the analysis to the remaining 53 subjects, who all shared the intuition that 1&A is the preferred melody for STM. Note that the crucial responses to INF-utterances did not play a role in this selection. Cronbach's Alpha was .87 after elimination of the abnormal listeners.

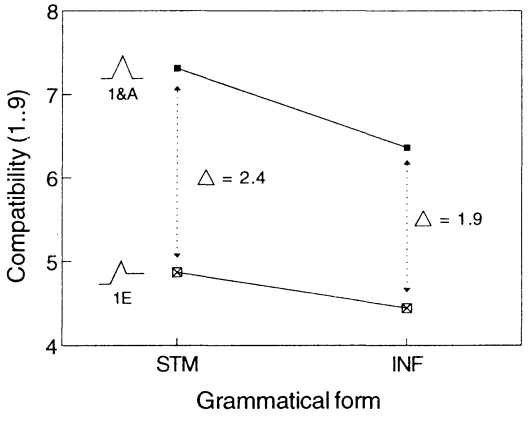

Figure 7. *Judged content-prosody compatibility broken down by grammatical form and accent type*

Figure 7 above plots the compatibility judgements broken down by imperative form and melody. The results show that the pointed hat 1&A is by far the preferred type (relative to the chanted call 1E) for both types of imperatives, with a difference of 2 full points on the compatibility scale. Crucially, however, replacing the pointed hat by the chanted call is judged MORE detrimental with STM commands (a loss of 2.4 points) than with INF commands (a loss of 1.9 points): a difference of 0.5 point. Therefore, the 1E accent is indeed relatively more compatible with the 'second-hand imperative' than 1&A, which in turn is relatively more compatible with the first-hand imperative. Table 4 below summarizes the results of a repeated measures analysis of variance of the compatibility scores.

Table 4. *Summary of analysis of variance on the Compatibility scale*

Factor/Interaction	Significance	% Expl. variance (ω^2)
Sentence	F(1,52)= 30.89, p<.001	1.7%
Grammatical Form	F(1,52)= 36.89, p<.001	2.7%
Accent	F(1,52)= 64.89, p<.001	27.4%
Sentence × Accent	F(1,52)= 55.83, p<.001	3.4%
Sent × Gram	F(1,52)= 7.74, p=.008	0.3%
Gram. × Accent.	F(1,52)= 13.98, p<.001	0.4%
Total explained variance		35.9%

Though space limitations preclude full examination of the results here, we note that the (predicted) interaction between grammatical form and accent which we have just discussed is significant at the .001 level.

4. Conclusion

We have presented here two experimental studies of the semantic opposition between the verbal stem imperative STM and the infinitivus pro imperativo INF. Specifically, we examined their interaction with two different aspects of Dutch intonation: the paralinguistic features of pitch level and excursion size and the symbolic or linguistic aspect of accentual contour. The first experiment disconfirmed our original hypothesis that STM would be a stronger imperative than INF (Kirsner et al. 1998), but confirmed the characterizations of these forms given by Blom (1987) and Proeme (1984). 'Imperative force' is not the relevant dimension for

describing the STM/INF opposition. Rather, the meaning of STM is simply less precise than that of INF in both dimension 2 (Characterization of event) and dimension 3 (Status of activity) in Table 3. It is this difference in relative precision that explains the greater sensitivity of the Imperativity judgements of STM to such external factors as the speaker's pitch level.

The data from the second experiment, in which INF was judged (by comparison with STM) to be less incompatible, hence relatively more compatible, with the chant contour 1E than with the pointed hat contour 1&A supported the association of INF with 'second-hand' commands and of STM with 'first-hand' commands suggested by the discussions of Paardekooper (1951) and Blom (1987).

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