On-line interpretation of intonational meaning in L2

Bettina Braun*^ and Lara Tagliapietra*

*Max Planck Institute for Psycholinguistics, Nijmegen

^ University of Konstanz, Germany

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Address for correspondence:

Bettina Braun

University of Konstanz

Department of Linguistics

Fach 186

D-78457 Konstanz

Phone: 0049-7531-2386, Fax:??

Bettina.Braun@uni-konstanz.de

Abstract

Despite their relatedness, Dutch and German differ in the interpretation of a particular intonation contour, the hat pattern. In the literature, this contour has been described as neutral for Dutch, and as contrastive for German. A recent study (Braun & Tagliapietra, in press) supports the idea that Dutch listeners interpret this contour neutrally, compared to the contrastive interpretation of a lexically identical utterance realized with a double peak pattern. In particular, this study showed shorter lexical decision latencies to visual targets (e.g., PELIKAAN, *'pelican'*) following a contrastively related prime (e.g., FLAMINGO, *'flamingo'*) *only* when the primes were embedded in sentences with a double peak contour, not in sentences with a hat pattern. The present study replicates Experiment 1a of Braun and Tagliapietra with German learners of Dutch. Highly proficient learners of Dutch differed from Dutch natives in that they showed reliable priming effects for both intonation contours. Thus, the interpretation of intonational meaning in L2 appears to be fast, automatic and driven by the associations learned in the native language.

Introduction

Variation in speech melody (intonation) signals a number of linguistic, extralinguistic, and paralinguistic functions. For instance, high ending utterances often signal continuations or questions, while low ending utterances signal finality or assertions (Bolinger, 1978, 1989; Pierrehumbert & Hirschberg, 1990; Gussenhoven, 2004; Steedman, 2000). Although these associations have been observed for a variety of languages, the encoding of intonational meaning is language-specific. For instance, several English dialects have high ending statements (Grabe, 2004; van Leyden & van Heuven, 2006), while Hungarian and Southern Italian yes/no-questions end low (Grice, Ladd, & Arvaniti, 2000; Grice, D'Imperio, Savino, & Avesani, 2005; Ladd, 1996).

The prosodic and melodic organization of language is among the first aspects of speech that infants attend to or produce themselves (Lieberman, 1986) and that adults hardly ever acquire in a native-like way (James, 1976; Banjo, 1979; Willems, 1982; Grosser, 1989; Cruz-Ferreira, 1989; Wennerstrom, 1994; Trouvain & Gut, 2007). This deficiency often results in a foreign accent (van Els & de Bot, 1987; Jilka, 2000), a decreased intelligibility (e.g., Munro & Derwing, 1995, Holm, 2007) and may lead to cultural misunderstandings (e.g., Trim, 1988; Holden & Hogan, 1993).

A test case of cross-language differences in interpreting intonational meaning concerns the hat pattern in Dutch and German. It consists of two accents, the first one rising, the second one falling. The pitch between these two accents stays high (Figure 1a). This contour is an instance of an intonational 'false friend' (same form but different function across languages): It has been described as a neutral intonation contour for Dutch (Cohen & 't Hart, 1967; 't Hart, Collier, & Cohen, 1990), but is associated with contrast in German (Büring, 1997; Krifka, 1998; Wunderlich; 1991; Mehlhorn, 2001; Steube, 2001; Braun, 2005, 2006). This difference in the marking of intonational meaning is especially striking, since Dutch and German are genetically very closely related.

We investigated whether German learners of Dutch transfer their native language knowledge of intonational meaning into their L2 or whether they apply the L2 intonational meaning when listening to Dutch. Intuitively, transfer of intonational meaning from German to Dutch is likely to occur because intonation is often not formally taught in second language instruction (Trouvain, Gut, & Barry, 2007), there is usually little awareness for intonational realization, and speakers of typologically close languages, like German and Dutch, may assume a similar mapping from form to function in the two languages.

Several studies have documented that learners fail to encode intonational meaning in a native-like way (e.g. Wennerstrom 1994; Munro & Derwing, 1995; Chun, 2002; Odlin, 2003). Research on the *interpretation* of intonational meaning in one's non-native language, however, is relatively scarce and restricted to off-line tasks (Cruz-Ferreira, 1989; Atoye, 2005; Niioka, Caspers, & van Heuven, 2005; Chen, 2009). Cruz-Ferreira (1989), for instance, asked Portuguese learners of English and English learners of Portuguese to indicate differences in meaning in intonational minimal pairs (e.g., She gave her dog biscuits) and reported three strategies: transfer of L1, usage of universal codes (e.g. high pitch for non-finality, see also Chen, Gussenhoven, & Rietveld, 2004), and choice of the more neutral meaning. Niioka et al. (2005) tested the perception of interrogativity in Dutch by native Dutch speakers and intermediate Japanese learners of Dutch. Their results showed that Japanese speakers attached more weight to rising intonation than native speakers, especially when word order indicated interrogativity. Off-line techniques, however, may not assess on-line processing during speech comprehension. Whether the interpretation of intonational meaning in L2 is *automatically* transferred from L1 knowledge is, therefore, still an open question.

Psycholinguistic experiments in L1 indicate that listeners interpret intonational information as soon as it becomes available. For instance, accented referents are immediately understood as new with respect to the preceding context even before segmental information uniquely identifies them (Dahan, Tanenhaus, & Chambers, 2002; Weber, Braun, & Crocker, 2006; Ito & Speer, 2008). Recently, Braun and Tagliapietra (in press) reported evidence that Dutch listeners ascribe contrastive interpretation to double peak contours (Figure 1b), but interpret sentences with a hat pattern neutrally. They conducted two cross-modal priming experiments. Experiment 1a tested for the recognition of visual targets that were contrastively related to a spoken prime (same semantic and syntactic category, such as PELIKAAN, 'pelican'; prime *flamingo*[1]), Experiment 1b for non-contrastively related targets (ROZE 'pink'). While non-contrastive associates (e.g. PINK) were facilitated regardless of intonation contour, contrastively related targets showed faster recognition only after sentences with a double peak intonation contour. This pattern of results indicates that only sentences with a double peak contour are interpreted as contrastive by Dutch listeners.

(Insert Figure1 about here)

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[1] Visual targets appear in capitals and auditory primes in italics.

In this study we used the same procedure and materials as in Experiment 1a of Braun & Tagliapietra (i.e., contrastive visual targets) to test whether German listeners automatically assign the interpretation of their native language to Dutch sentences or correctly learn the different interpretations in the two languages. If L2 learners automatically transfer their L1 interpretation to L2 sentences, the recognition of contrastively related targets (PELIKAN upon hearing *flamingo*) should be facilitated independent of intonation contour, as both the double peak contour and the hat pattern are described as contrastive. If they correctly apply the intonational meaning of Dutch, Braun and Tagliapietra's findings should be replicated.

Methods

Participants

Forty native speakers of Standard German[2] with very good command of Dutch and unaware of the experimental purposes participated for a small fee. They had not been raised in a bilingual environment. Almost all had received at least one term of formal instruction in classrooms, had had contact with Dutch for over 4 years on average, and had been living in the Netherlands for over 3 years on average. They had good or corrected vision and no self-reported history of hearing problems or speech disorders.

Materials

Materials were identical to Experiment 1a in Braun & Tagliapietra. Thirty-six triplets of Dutch words were selected as experimental items. They consisted of a related prime (e.g., flamingo 'flamingo'), a visual target contrastively related to the prime (e.g., pelikaan 'pelican'), and an unrelated prime (e.g., beroemdheid 'celebrity'). Related and unrelated primes were trisyllabic trochaic words. The mean frequency of the related primes was 8.6 occurrences per million (SD = 11.3) in the CELEX database (Baayen, Piepenbrock, & Gulikers, 1995); unrelated primes had a mean frequency of 10.5., SD = 23.4 (t(35) = 1.5, p > 0.05). Contrastive visual targets were 7.8 letters long on average and had a mean frequency of 19.0 (SD = 54.2). Most of the words were German cognates: 77.8% of the visual targets,

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[2] Participants were almost exclusively from Northern German states (Northrine-Westphalia, Schleswig-Holstein, Lower Saxony, Hesse, Berlin).

44.4% of the related primes, and 80.6% of the unrelated primes (SD = 42.2%, 50.4% and 40.1%, respectively)[3]. Primes and targets are listed in Appendix A.

A Dutch native speaker constructed 36 syntactically and semantically neutral sentences that ended in both a related or unrelated prime. Most of them were subject-verb-object sentences (e.g., 'Our neighbors assembled an antenna'), three had a preverbal preposition phrase (e.g., 'On Saturday I went to the theater'), two had an expletive (i.e., 'There was air-conditioning in the cabin'), and two were passive constructions (e.g., 'The inflammation was caused by a bacteria'). See Braun & Tagliapietra for the full set of sentences.

The 164 filler sentences and six practice sentences were similar to the experimental ones. Fifty-four of the filler items were paired with an existing unrelated word, 92 with an unrelated non-word and 18 with a phonologically related non-word. The six practice sentences were paired with 3 word and 3 non-word visual targets. Filler and practice targets were matched to the experimental targets for number of characters.

We used the same recordings as in Braun and Tagliapietra. Durations of the primes (divided by the respective utterance durations to account for speech rate) did not differ in the double peak and the hat pattern realizations (t(35) = 1.66, p > 0.1 for related primes, t(35) = 0.21, p > 0.8 for unrelated ones. Related primes lasted on average 37.8% of the overall utterance duration, unrelated primes 38.5%[4].

Procedure

The procedure was identical to Braun & Tagliapietra. Four experimental lists were constructed by rotating through the four conditions, crossing intonation (hat pattern vs. double peak) and prime type (related vs. unrelated). Each list also contained all practice and filler items, totaling in 206 trials. Two randomized orders were made for each list, avoiding that two or three subsequent sentences could be interpreted as part of a coherent discourse. Participants were randomly assigned to one of these lists and tested individually in a soundproof booth. They were asked to listen to the sentences and perform a lexical decision task on visual targets presented at the offset of the primes. All responses within 2 seconds after the appearance of the target were recorded. After the experiment, participants were

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[3] Note that these lexical frequencies might not be appropriate for non-native speakers of Dutch as they were estimated from the Dutch word form dictionary (CELEX). Moreover, cognates might be more frequent in learners than non-cognates, especially for less proficient learners.

asked to provide the German translation of all targets and primes without consulting a dictionary. Participants translated the words correctly in 86.5% of the cases on average (SD = 5.9%, ranging from 72.2% to 98.1%). Furthermore, they provided self-ratings on the frequency with which they read and speak Dutch and about their Dutch reading and speaking skills. The outcome of these ratings is summarized in Appendix B.

Results

From the original 1440 trials, 256 trials for which participants did not know the correct translation of the prime or the target were discarded[5]. Further 92 trials with incorrect responses were excluded from reaction times (henceforth RTs) analyses. Errors were analyzed using binary logistic regression models with participants and items as crossed random factors and *Intonation* (hat pattern or double-peak), and *Prime Type* (related or unrelated) as fixed factors. Lexical frequency and number of character of the target were included as they might affect accuracy. Errors were more frequent for low frequency targets ($\beta = 0.64$, $p < 0.05$) and for targets preceded by unrelated primes ($\beta = 0.48$, $p < 0.05$).

RTs longer than 1800 ms were considered outliers and removed (6 trials). The remaining RTs were log-transformed and analyzed using mixed-effects models with participants and items as crossed random factors, and contrast coding for factors (N = 1088). The crucial predictors were *Intonation* (hat pattern or double-peak) and *Prime Type* (related or unrelated). Further, the model included a number of predictors that have been shown to affect reaction times in lexical decision experiments (i.e., log-lexical frequency, number of characters, reaction time to the preceding trial, position of the trial in the experiment, whether the visual target was a cognate or not and participants' proficiency). Proficiency was entered (a) as individual self ratings or (b) as an on-line, task-dependent measure (averaged number of correct responses for each subject to all 164 filler trials, which covers the correct recognition of existing words and the correct rejection of non-words; this measure ranged from 53.4% to 98.2% (mean: 83.8%, SD: 10%) and was not correlated with any of the four self ratings)

To compare whether German learners of Dutch resembled native Dutch participants, we tested the interaction between *Intonation* and *Prime Type*. The initial model included all predictors and three-way interactions between *Intonation, Prime Type* and the other

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[4] In Braun & Tagliapietra (in press), two pairs contained the same word (as a related and an unrelated prime) and were removed from the analyses. Here, experimental lists were adapted so that participants never heard the same prime twice and all items could be analyzed.

predictors[6]. Non-significant interactions and predictors were removed if this did not deteriorate the fit of the model as estimated by a likelihood-ratio test; the log-likelihood of the full model was 62.6, that of the final model was 54.7 (χ^2 = 15.8, df = 16, p > 0.45). The most parsimonious model was refitted removing data points with residuals larger than 2.5 standard deviations; p-values were estimated as the posterior probability of a Markov Chain Monte Carlo simulation with 10000 runs. Reaction times were faster for targets with a higher lexical frequency (β = -0.03, p < 0.05), fewer characters (β = -0.03, p < 0.01), when the RT to the preceding trial was shorter (β = -0.12, p < 0.00001), and for trials towards the end of the experiment (β = -0.0004, p < 0.001). Crucially, there was an interaction between *Prime Type* and *Proficiency* (β = -0.37, p < 0.005; see Figure 2), and no interaction between *Prime Type* and *Intonation*.

(Insert Figure 2 around here)

For further analyses, the data set was divided into two halves at the median value for proficiency (85%). The resulting data sets were analyzed with the same model, excluding the factor *Proficiency*. Responses for the low proficiency group were only affected by reaction times to the preceding trials (β = 0.13, p = 0.0001), and number of characters of targets (β = 0.03, p < 0.01). For the high proficiency group, responses were faster for targets with a higher lexical frequency (β = -0.03, p < 0.05), fewer characters (β = -0.03, p < 0.005), when the reaction time to the preceding trial was short (β = -0.12, p < 0.0005), and for trials towards the end of the experiment (β = -0.0008, p < 0.001). Importantly, there was a significant main effect of *Prime Type* (β = -0.03, p < 0.05): RTs were 30.9 ms faster after related than after unrelated primes (763.5 ms vs. 794.4 ms).

General Discussion

We tested whether L2 listeners automatically transfer their L1 interpretation of intonational meaning when listening to L2 sentences. German learners of Dutch listened to Dutch sentences with double peak and hat pattern contours. While only the former sentences are contrastive in Dutch, both contours signal contrast in German. Results were affected by learners' proficiency. Less proficient learners did not show a priming effect, whereas priming

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[5] This was done to ensure that participants knew the semantic relation between prime and target.

effects for highly proficient German learners of Dutch were reliable for both intonation contours.

The lack of a priming effect for less proficient learners is not surprising. Although only trials for which participants knew the meaning of both the prime and the target (as evidenced by the off-line translation task) were included in the analyses, these participants might not have necessarily known all the words in the experimental sentences. Assessing proficiency on the basis of the recognition of the filler trials tests the recognition of a large number of words and non-words and provides an independent estimate of the non-native lexicon and L2 understanding. Admittedly, even when knowing the meaning of the prime and the visual target, less proficient learners might have had difficulties with the interpretation of the L2 sentences preventing the observation of reliable associative priming effects. In fact, associative priming effects depend on the comprehension and interpretation of the experimental sentence. (Blutner & Sommer, 1988, Williams, 1988; Tabossi, 1988; Norris, Cutler, McQueen, & Butterfield, 2006; Braun & Tagliapietra, in press). As shown in Figure 2, as proficiency – and the comprehension of the sentence - increases priming effects start to emerge.

Highly proficient German learners of Dutch, indeed, showed reliable priming effects. Contrastively related targets were recognized faster than unrelated primes after sentences with a hat pattern and a double peak contour. The present data confirm and extend the results reported by Braun and Tagliapietra (in press) for native Dutch listeners. In that study, priming effects for contrastively related targets were also observed after sentences with a contrastive meaning, i.e. after sentences with a double peak contour but not after sentences with a non-contrastive hat pattern. Hence, German listeners interpret sentences with a double peak contour and a hat pattern contrastively, whereas Dutch listeners only assign a contrastive interpretation to double peak sentences, but not to ones with a hat pattern.

The differential results support the conclusion drawn by Braun and Tagliapietra (in press) that the facilitation of contrastively related targets is triggered by the contrastive interpretation of the sentences with a double peak contour, rather than the phonetic saliency of this contour compared to the hat pattern. If the saliency of the double peak contour had driven the effect, we would have observed the same or a comparable interaction between *Intonation* and *Prime Type* with German listeners. Therefore, the present results bring further

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[6] Only one proficiency measure was entered at a time and the fit of the models were compared. The statistical outcomes were comparable but the on-line measure resulted in better fitting models than the self-ratings, so the self-ratings will not be discussed further.

evidence to the hypothesis that intonation contours automatically trigger and drive semantic interpretation during sentence comprehension. More specifically, the present results indicate a strong role for native language intonational meaning: Even proficient learners of Dutch do not adopt the Dutch mapping from intonational form to function but rather transfer their native-language interpretation to L2 sentences.

The native-language interpretation of intonational meaning in this experiment may have been boosted by the large number of cognates, which have been shown to be especially sensitive to cross-language influences during bilingual word recognition (e.g., Lemhöfer & Dijkstra, 2004) and are said to be represented differently in the bilingual lexicon (de Groot & Nas,1991; Gollan, Forster, & Frost, 1997).The role of cognates, however, could not be tested in the present study. Also, as German and Dutch are two very closely related languages, many aspects (lexicon, morphology, syntax) need not be explicitly learned but can be transferred from the native to the foreign language. The drawbacks of this strategy are the so-called 'false friends', i.e. words or constructions with the same form but different meanings across languages (e.g., *bellen* means 'to bark' in German but 'to phone' in Dutch). These need to be pointed out and memorized. As already mentioned, second language instruction does not focus strongly on prosody and intonation (Trouvain & Gut, 2007) and although non-native prosody results in a foreign accent, the inappropriate prosody is rarely corrected. This might explain why many non-native speakers are not always aware of 'intonational false friends', such as the interpretation of the hat pattern in German and Dutch.

To conclude, previous linguistic and psycholinguistic research suggests that speakers tend to transfer their prosodic knowledge from L1 to L2. The present data furthermore indicate that the processing of intonational meaning occurs automatically and depends on the prosodic system of the native language.

References

Atoye, R. O. (2005). Non-native perception and interpretation of English intonation. *Nordic Journal of African Studies,* 14(1), 26–42.

Baayen, R. H.; Piepenbrock, R.; Gulikers, L. (1995). The CELEX lexical database [CD-ROM]. Philadelphia, PA: Linguistic Data Consortium, University of Pennsylvania.

Baayen, R. H. (2008) Analyzing Linguistic Data. *A Practical Introduction to Statistics Using R*. Cambridge University Press.

Banjo, A. (1979). Beyond intelligibility in Nigerian English. In E. Ubahakwe (Ed.), *Varieties and Functions of English in Nigeria*. Ibadan: African University Press.

Barr, D. J. (2008). Analyzing 'visual world' eyetracking data using multilevel logistic regression. *Journal of Memory and Language*, 59, 457 – 474.

Bolinger, D. (1978). Intonation across languages. In: Greenberg, J. (ed.) *Universals of Human Language, vol II : Phonology*. (pp. 471 – 524). Palo Alto, CA: Stanford University Press.

Bolinger, D. (1989). *Intonation and its Uses*. Palo Alto, CA: Stanford University Press.

Braun, B. (2005). *Production and Perception of Thematic Contrast in German*. Oxford, UK: Peter Lang Publishing.

Braun, B. (2006). Phonetics and phonology of thematic contrast in German. *Language and Speech,* 49, 451-493.

Braun & Lemhöfer (in preparation). Segmental and suprasegmental features in English word stress as produced by English and Dutch speakers.

Braun, B. & Tagliapietra, L. (in press). The role of contrastive intonation contours in the retrieval of contextual alternatives. *Language and Cognitive Processes.*

Büring, D. (1997). *The meaning of Topic and Focus—the 59th Street Bridge Accent*. London: Routhledge.

Chen, A. (2009). Perception of paralinguistic intonational meaning in a second language. *Language Learning*, 59(2).

Chen, A., Gussenhoven, C., & Rietveld, A. (2004). Language-specificity in perception of paralinguistic intonational meaning. *Language and Speech,* 47(4), 311-350.

Chun, D.M. (2002) *Discourse intonation in L2, From theory and research to practice*. Amsterdam: John Benjamins.

Cohen, A. & 't Hart, J. (1967). On the anatomy of intonation. *Lingua,* 19, 177-192.

Costa A, Caramazza A, & Sebastian-Galles N. (2000). The cognate facilitation effect: implications for models of lexical access. Journal of Experimental Psychology: Learning, Memory and Cognition 26, 1283-1296.

Cruz-Ferreira, M. (1989), Non-native interpretive strategies for intonational meaning: an experimental study. In. James, A. & Leather, J. (eds), *Sound patterns in second language acquisition*, (103-120), Dordrecht: Foris.

De Groot, A. M. B., & Nas, G. L. (1991). Lexical representation of cognates and noncognates in compound bilinguals. *Journal of Memory & Language*, **30**, 90-123.

van Els, T. V., & de Bot, K. D. (1987). The role of intonation in foreign accent. *Modern Language Journal*, 71 (2), 147 – 155.

Gollan, T. H., Forster, K. I., & Frost, R. (1997). Translation priming with different scripts: Masked priming with cognates and noncognates in Hebrew–English bilinguals. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **23**, 1122-1139.

Grabe, E. (2004). Intonational variation in urban dialects of English spoken in the British Isles. In P. Gilles, & J. Peters, (eds.), *Regional Variation in Intonation*. (pp. 9-31). Tübingen: Linguistische Arbeiten.

Grice, M., Ladd, D.R., & Arvaniti, A. (2000). On the place of phrase accents in intonational phonology. *Phonology*, 17(2), 143-185.

Grice, M., D'Imperio, M., Savino, M., & Avesani, C. (2005). Strategies for intonation labelling across varieties of Italian. In. S-A. Jun (Ed.) *Prosodic Typology: the Phonology of Intontaion and Phrasing*. (pp. 362-389). Oxford: Oxford Univerity Press.

Grosser, W. (1989). *Akzentuierung und Intonation im englischen L2-Erwerb österreichischer Lerner [Accentuation and Intonation in English L2 acquisition by Austrian Learners]*. Habilitationsschrift University of Salzburg, Austria.

Gumperz, J. J. (1977). The conversational analysis of interethnic communication. In E. Rosa (Ed.) *Interethnic Communication.* (pp. 233-245). Atlanta, Georgia: University of Gerogia Press.

Gussenhoven, C. (2004). *Tone and Intonation*. Cambridge: Cambridge University Press.

't Hart, J.; Collier, R.; Cohen, A. (1990). *A Perceptual Study of Intonation: An Experimental-phonetic Approach to Speech Melody*. Cambridge Studies in Speech Science and Communication. Cambridge, UK: Cambridge University Press.

Herry, N., & Hirst, D. (2002). Subjective and objective evaluation of the prosody of English spoken by French speakers: the contribution of computer assisted learning. In:

Proceedings of the first International Conference on Speech Prosody, Aix-en-Provence, Fance, pp. 383-387.

Holden, K., & Hogan, J. (1993). The emotive impact of foreign intonation: an experiment in switching English and Russian intonation. *Language and Speech,* 36, 167 – 188.

Holm, S. (2007). The relative contributions of intonation and duration to intelligibility in Norwegian as a second language. In J. Trouvain & W. J. Barry (Eds.), *Proceedings of the XVIth International Congress of the Phonetic Sciences.* Saarbrücken, Germany (pp. 1653 – 1656). Dudweiler: Pierrot.

Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of Memory and Language*, 59, 434-446.

James, A.R. (1976). Dialektaler Transfer in der Prosodie. Auswirkungen des Schwäbischen in der englischen Intonation. [Effects of Swabian on English intonation] *Linguistik und Didaktik* 28, 261-272.

Jilka, M. (2000). *The Contribution of Intonation to the Perception of Foreign Accent.* Unpublished doctoral dissertation, Institut für Maschinelle Sprachverarbeitung, Stuttgart, Germany.

Krifka, M. (1998). Scope inversion under the rise-fall contour in German. *Linguistic Inquiry*, 29(1), 75 – 112.

Lemhöfer, K.M.L., & Dijkstra, A.F.J. (2004). Recognizing cognates and interlingual homographs: Effects of code similarity in language specific and generalized lexical decision. *Memory and Cognition, 32* (4), 533-550.

Ladd, D. R. (1996). *Intonational Phonology.* Cambridge: Cambridge University Press.

Lieberman, P.(1986). The acquisition of intonation by infants: Physiology and neural control. In: C. John-Lewis (Ed.), *Intonation in Discourse.* (pp 239-257). London: Croom-Helm.

Mehlhorn, G. (2001). Produktion und Perzeption von Hutkonturen im Deutschen [Production and perception of hat patterns in German]. *Linguistische Arbeitsberichte*, 77, 31 – 57.

Munro, M. J., & Derwing, T. M. (1995). Foreign accent, comprehensibility, and intelligibility in the speech of second language learners. *Language Learning*, 45, 73-97.

Norris, D.; Cutler, A.; McQueen. J.; Butterfield, S. (2006). Phonological and conceptual activation in speech comprehension. *Cognitive Psychology,* 53, 146-193.

Odlin, T. (2003) Cross-linguistic influence. In: C. Doughty and M. Long (eds.), *Handbook on Second Language Acquisition*, (pp. 436- 486). Oxford: Blackwell.

Pierrehumbert, J., & Hirschberg, J. (1990). The meaning of intonational contours in the interpretation of discourse. In: P. Cohen, J. Morgan & M. Pollack (eds.), *Intentions in Communication*, (pp. 271-311). Cambridge, MA: MIT Press.

Schartz, G. & Głogowska (2004). Acoustic tools for students' production of English long (tense) vowels. In: W. Sobkowiak and E. Waniek-Klimcyak (Eds). Dydaktyka Fonetyki Jezyka Obcego *Zeszyt Naukowy Instytutu Neofilologii* 3, Wydawnictwo PWSZ w Koninie, 80-85.

Steedman, M. (2000). Information structure and the syntax-phonology interface. *Linguistic Inquiry,* 31, 649-689.

Steube, A. (2001). Grammatik und Pragmatik von Hutkonturen (Grammar and pragmatics of hat patterns). *Linguistische Arbeitsberichte*, 77, 7 – 29.

Tabossi, P. (1988). Accessing lexical ambiguity in different types of sentential contexts. *Journal of Memory and Language,* 27, 324-340.

Trim, J. (1988). Some contrastive intonated features of British English and German. In J. Klegraf & D. Nehls (Eds.), *Essays on the English Language and Applied Linguistics on the Occasion of Gerhard Nickel's 60th Birthday* (pp. 235 – 249). Heidelberg: Julius Groos.

Trouvain, J., & Gut, U. (Eds.), (2007). *Non-Native Prosody: Phonetic Description and Teaching Experience.* Berlin, New York: Mouton de Gruyter.

Trouvain, J., Gut, U. & Barry, W.J. (2007). Bridging research on phonetic descriptions with knowledge from teaching practice – The case of prosody in non-native speech. In: Trouvain, J. & Gut, U. (Eds). pp 3-21.

Van Leyden, K; & van Heuven, V. J. (2006). On the prosody of Orkney and Shetland dialects. *Phonetica, 63, 149-174.*

Wennerstrom, A. (1994). Intonational meaning in English discourse: A study of non-native speakers. *Applied Linguistics,* 15 (4), 399 – 420.

Willems, N. J. (1982). *English Intonation from a Dutch Point of View*. Dordrecht: Foris Publications.

Williams, J. N. (1988) Constraints upon semantic activation during sentence comprehension. *Language and Cognitive Processes,* 3, 165-206.

Wunderlich, D. (1991). Intonation and contrast. *Journal of Semantics*, 8**,** 239 – 251.

Appendix A

Unrelated prime	Related prime	Visual target
trapeze 'trapeze'	antenne 'antenna'	schotel 'dish'
verwonding 'injury'	bacterie 'bacteria'	virus 'virus'
centrale 'head office'	cabine 'cabin'	kamer 'room'
spaghetti 'spaghetti'	confetti 'confetti'	serpentine 'paper streamer'
gefluister 'whispering'	examen 'exam'	proefwerk 'test'
beroemdheid 'celebrity'	flamingo 'flamingo'	pelikaan 'pelican'
kabouter 'gnome'	gorilla 'gorilla'	chimpansee 'chimpanzee'
insigne 'badge'	horloge 'wrist watch'	klok 'clock'
risotto 'risotto'	jenever 'alcoholic drink'	brandewijn 'brandy'
papiertje 'piece of paper'	kalender ' calender'	rooster 'schedule'
andijvie 'endive'	kamille 'camomile'	lavendel 'lavender'
koala 'koala'	kanarie 'canary'	parkiet 'parakeet'
taveerne 'tavern'	kazerne 'barracks'	sporthal 'gymnasium'
terrine 'tureen'	lagune 'lagoon'	rivier 'river'
gebergte 'mountain range'	Lyceum 'secondary school'	mavo 'lower general secondary education'
savanne 'savanna'	manege 'stables'	boerderij 'farm house'
fanfare 'brass band'	marine 'marines'	luchtmacht 'air force'
noordoosten 'north east'	museum 'museum'	archief 'archive'
toeriste 'tourist'	oase ' oasis'	luchtspiegeling 'illusion'
kastanje 'chestnut'	pantoffel' 'slipper'	slippers 'flip-flop'
verklaring 'explanationt'	placebo 'placebo'	medicijn 'medicin'

politie 'police'	provincie 'Province'	gemeente 'community'
piano 'piano'	punaise 'drawing pin'	spijker 'nail'
kalkoentje 'little turkey'	pyjama 'pyjama'	nachthemd 'nightgown'
pagode 'pagoda'	ruine 'ruin'	bunker 'bunker'
karate 'karate'	safari 'safari'	trektocht 'hiking tour'
cadeautje 'small present'	salaris 'salary'	subsidie 'subsidy'
komkommer 'cucumber'	sardine 'sardine'	zalm 'salmon'
sukade 'candied peel'	spinazie 'spinach'	kool 'cabbage'
verlengsnoer 'extension lead'	suede 'suede'	zijde 'silk'
orakel 'oracle'	theater 'theater'	bioscoop 'film theatre'
tomaten 'tomatoes'	vanille 'vanille'	kaneel 'cinnamon'
projectgroep 'project group'	elite 'elite'	burgers 'citizens'
veranda 'veranda'	douane 'customs'	marechaussee 'military police'

Appendix B

Self-ratings	Mean	sd
Frequency of reading Dutch (1 very often, 6 very rarely)	1.72	1.25
Frequency of speaking Dutch (1 very often, 6 very rarely)	1.54	0.99
Dutch reading skill (1 very proficient, 6 very inproficient)	1.80	0.66
Dutch speaking skill (1 very proficient, 6 very inproficient)	2.35	0.80

Figures

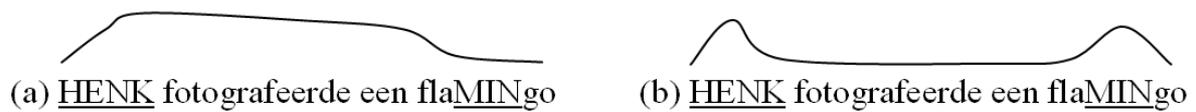(a) <u>HENK</u> fotografeerde een fla<u>MIN</u>go   (b) <u>HENK</u> fotografeerde een fla<u>MIN</u>go

Figure 1.Stylized examples of the hat pattern (a) and the double-peak contour (b) in Dutch.
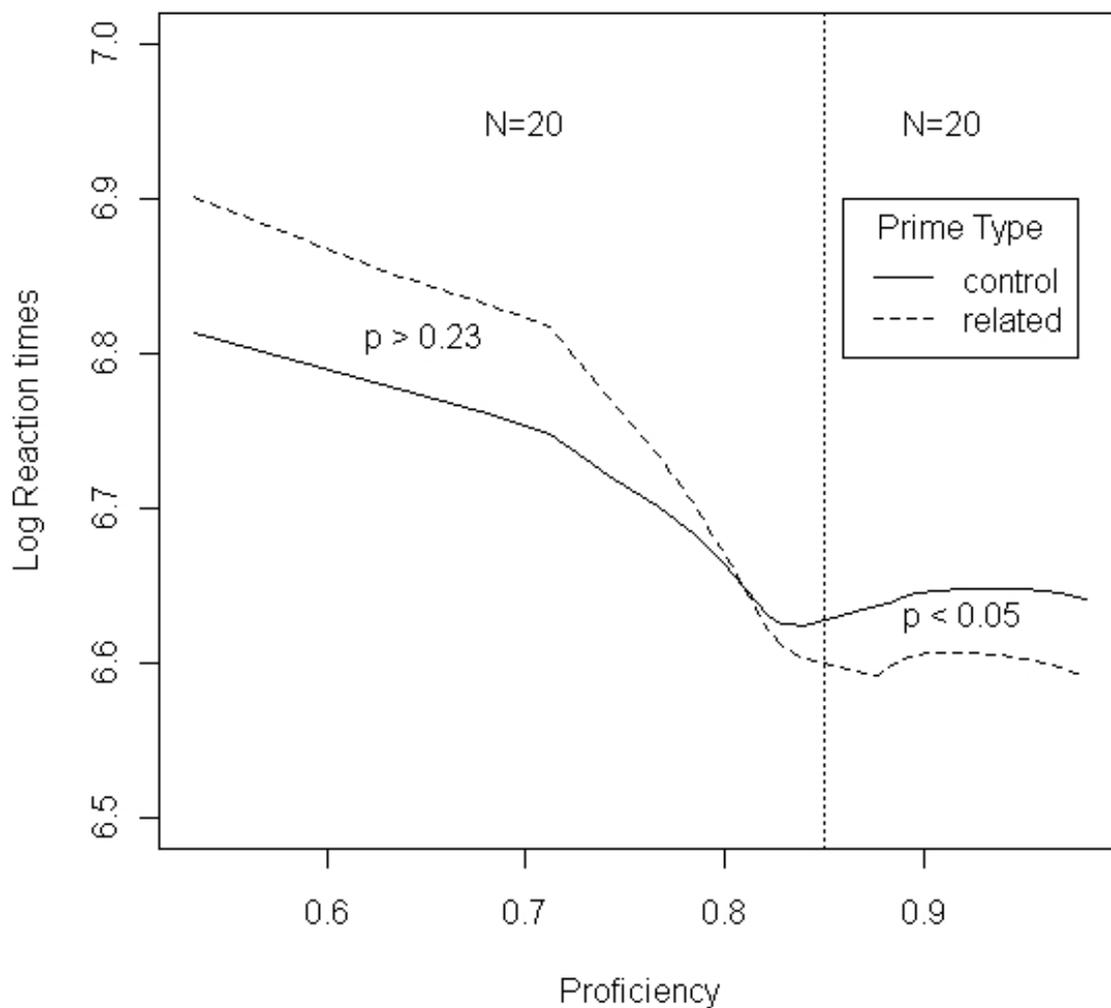Accented words are highlighted with underlined capitals.

Figure 2. Interaction between Prime Type and Proficiency. Log reaction times are plotted
against proficiency scores for responses after control (solid line) and related primes (dotted
line). The vertical cut-off line divides particpants with high and low proficiency scores.