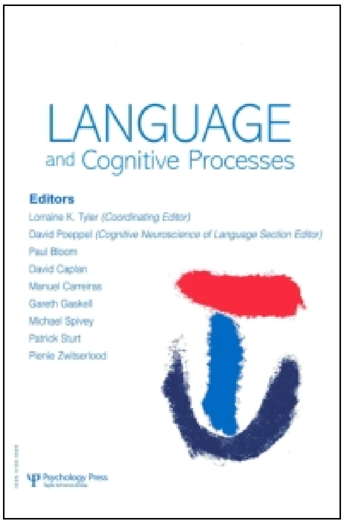

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On-line interpretation of intonational meaning in L2

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On-line interpretation of intonational meaning in L2

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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 supports the idea that Dutch listeners interpret this contour neutrally, compared to the contrastive interpretation of a lexically identical utterance realised 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 contrastive double peak contour, not in sentences with a neutral hat pattern. The present study replicates Experiment 1a of Braun and Tagliapietra (2009) 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.

Keywords: L2; Intonational meaning; Cross-modal associative priming; Contrast; Hat pattern.

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; Gussenhoven, 2004; Pierrehumbert & Hirschberg, 1990). Although these associations have been observed for many languages, the encoding of intonational meaning is

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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, D'Imperio, Savino, & Avesani, 2005; Grice, Ladd, & Arvaniti, 2000).

The prosodic and melodic organisation 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 (e.g., Banjo, 1979; Cruz-Ferreira, 1989; Grosser, 1989; James, 1976; Wennerstrom, 1994; Willems, 1982; articles in Trouvain & Gut, 2007). This deficiency often results in a foreign accent (Jilka, 2000; van Els & de Bot, 1987), a decreased intelligibility (e.g., Holm, 2007; Munro & Derwing, 1995), and may lead to cultural misunderstandings (e.g., Holden & Hogan, 1993; Trim, 1988).

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, and a high pitch between the two (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 (e.g., Braun, 2005, 2006; Büring, 1997; Krifka, 1998; Mehlhorn, 2001; Steube, 2001; Wunderlich, 1991). This difference in the marking of intonational meaning is especially striking, since Dutch and German are two closely related Western Germanic languages.

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 (e.g., Trouvain, Gut, & Barry, 2007), there is usually little awareness for intonational realisation, and speakers of typologically close languages, such as German and Dutch, may assume a similar mapping from form to function in the two languages.

Several studies have documented that second-language learners fail to encode intonational meaning in a native-like way (e.g., Chun, 2002; Munro & Derwing, 1995; Odlin, 2003; Wennerstrom, 1994). Research on the interpretation of intonational meaning in one's non-native language, however, is relatively scarce and restricted to off-line tasks (Atoye, 2005; Chen, 2009; Cruz-Ferreira, 1989; Niioka, Caspers, & van Heuven, 2005).

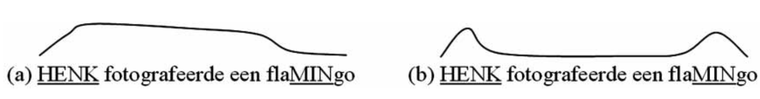

Figure 1. Stylised examples of the hat pattern (a) and the double peak contour (b) in Dutch. Accented syllables are marked with underlined capitals 390 × 46 mm (72 × 72 DPI).

Cruz-Ferreira (1989), for instance, asked Portuguese learners of English and English learners of Portuguese to indicate meaning differences in intonational minimal pairs (e.g., She gave her dog biscuits—in which either the dog or the person gets biscuits) and reported three strategies: transfer of L1, usage of universal codes (e.g., high pitch for nonfinality, 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 in the condition in which order indicated interrogativity. In this study, we test the immediate integration of intonational meaning during L2 speech comprehension.

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; Ito & Speer, 2008; Weber, Braun, & Crocker, 2006). Recently, Braun and Tagliapietra (2009) 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 containing sentence final, accented primes. Experiment 1a tested for the recognition of visual targets that were contrastively related to the spoken prime (same semantic and syntactic category, such as PELIKAAN, "pelican"; prime *flamingo*[1]), Experiment 1b for noncontrastively related targets (ROZE "pink"). While noncontrastive 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.

In this study, we used the same procedure and materials as in Experiment 1a of Braun and Tagliapietra (2009) (i.e., contrastive visual targets) to test whether German listeners automatically assign the interpretation of their native language to Dutch sentences or correctly acquired the non-native mapping. If L2 learners automatically transfer their L1 interpretation to L2 sentences, the recognition of contrastively related targets (PELIKAAN 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 (2009) findings should be replicated.

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

METHODS

Participants

Forty native speakers of Standard German[2] who used Dutch on a daily basis but had not been raised in a bilingual environment volunteered for the study. They were unaware of the experimental purposes and received a small fee. Almost all had received at least one term of formal instruction in classrooms, had contact with Dutch for over 4 years on average, and had been living in the Netherlands for over 3 years on average. German was still their dominant language. 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 and Tagliapietra (2009). 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 words stressed on the second syllable. Mean frequency of related and unrelated primes did not differ. 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, $SD = 23.4$, $t(35) = 1.5$, $p > .05$. 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, 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 1.

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 neighbours assembled an antenna"), three had a preverbal preposition phrase (e.g., "On Saturday I went to the theatre"), 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 and Tagliapietra (2009) or http://ling.uni-konstanz.de/pages/home/braun/forschung.html for the full set of sentences.

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

[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.

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 nonword, and 18 with a phonologically related nonword. The six practice sentences were paired with 3 words and 3 nonwords 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 (2009). 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 realisations: $t(35) = 1.66$, $p > .1$ for related primes; $t(35) = 0.21$, $p > .8$ 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 and Tagliapietra (2009). 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, totalling in 206 trials. Two randomised 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 sentence-final primes. All responses within 2 seconds after the appearance of the target were recorded. After the experiment, participants were 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 summarised in Appendix 2.

RESULTS

From the original 1440 experimental 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

[4] In Braun and Tagliapietra (2009), 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 analysed.

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

reaction times (henceforth RT) analyses. Errors were analysed 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 ($\beta = .64$, $p < .05$) and for targets preceded by unrelated primes ($\beta = .48$, $p < .05$).

RTs longer than 1800 ms were considered outliers and removed (6 trials). The remaining RTs were log-transformed and analysed using mixed-effect models with participants and items as crossed random factors (Baayen, 2008; Barr, 2008), and contrast coding for factors ($N = 1088$). The crucial predictors were *Intonation* (hat pattern or double peak) and *Prime Type* (related or unrelated). Furthermore, we included predictors that affect RTs 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 online, 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 nonwords; 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).[6]

To compare whether German learners of Dutch resembled native Dutch participants, we specifically 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 predictors. Nonsignificant 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 ($\chi^2 = 15.8$, df $= 16$, $p > .45$). 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 10,000 runs. Reaction times were faster for targets with a higher lexical frequency ($\beta = -.03$, $p < .05$), fewer characters ($\beta = -.03$, $p < .01$), when the RT to the preceding trial was shorter ($\beta = -.12$, $p < .00001$), and for trials towards the end of the experiment ($\beta = -.0004$, $p < .001$). Crucially, there was an interaction between *Prime Type* and *Proficiency* ($\beta = -.37$, $p < .005$; see Figure 2), but no interaction between *Prime Type* and *Intonation*.

[6] Only one proficiency measure was entered at a time and the fit of the models was compared. The statistical outcomes of these models were comparable. As the on-line proficiency measure resulted in a better fitting model, this will be reported in this paper.

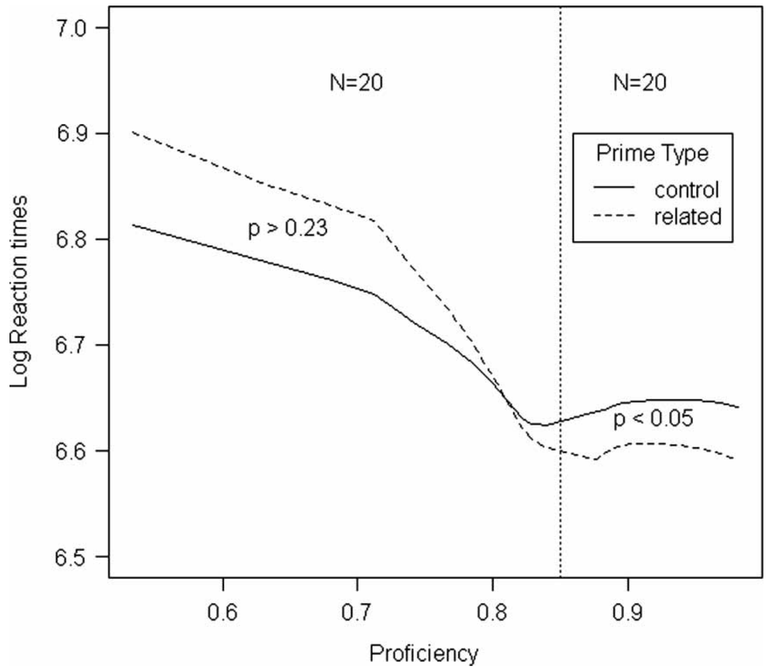

Figure 2. Interaction between *Prime Type* and *Proficiency.* Log reaction times are plotted against proficiency scores for responses after control (solid line) and related primes (dotted line); the cutoff line divides participants with low and high proficiency scores; 205 × 204 mm (72 × 72 DPI).

For further analyses, the data-set was divided into two halves at the median value for proficiency (85%). These data-sets were analysed with the same model, as before excluding the factor *Proficiency.* The high proficiency group showed a reliable priming effect ($\beta = -.03$, $p < .05$); RTs were 30.9 ms faster after related than after unrelated primes (763.5 ms vs. 794.4 ms). For the low proficiency group, there was no priming effect ($p > .25$).[7]

GENERAL DISCUSSION

We tested whether L2 listeners automatically transfer their L1 interpretation of intonational meaning when listening to L2 sentences. German learners of

[7] Further factors influencing RTs in the high proficiency group were lexical frequency ($\beta = -.03$, $p < .05$), number of characters ($\beta = -.03$, $p < .005$), reaction time to the preceding trial ($\beta = -.12$, $p < .0005$), and position of the trial in the experiment ($\beta = -.0008$, $p < .001$). Response times for the low proficiency group were only affected by reaction times to the preceding trial ($\beta = .13$, $p = .0001$), and by the number of character of targets ($\beta = .03$, $p < .01$).

Dutch listened to Dutch sentences with double peak and hat pattern contours. While only the former are contrastive in Dutch, both signal contrast in German. Results were affected by learners' proficiency. Less proficient learners did not show a priming effect, whereas priming 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 trials with unknown primes or targets (as evidenced by the translation task) were removed, these participants might not have necessarily known all the words in the experimental sentences. 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; Braun & Tagliapietra, 2009; Norris, Cutler, McQueen, & Butterfield, 2006; Tabossi, 1988; Williams, 1988). Assessing proficiency on the basis of the recognition of the filler trials tests the recognition of a large number of words and nonwords and provides an independent estimate of the non-native lexicon and L2 understanding. 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 recognised 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 (2009) for native Dutch listeners. In that study, priming effects for contrastively related targets were only observed after sentences with a contrastive meaning, i.e., after sentences with a double peak contour but not after sentences with a noncontrastive 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.

The differential results support Braun and Tagliapietra's (2009) conclusion upon which 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 evidence to the hypothesis that intonation contours automatically trigger and drive semantic interpretation during sentence comprehension. More specifically, 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 supposed to be represented differently in the bilingual lexicon (e.g., 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, and syntax) need not be explicitly learned but can be transferred from the native to the foreign language. One drawback of this strategy are 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 memorised. As already mentioned, second-language instruction does not focus strongly on prosody and intonation (Trouvain et al., 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.

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APPENDIX 1

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 2

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