Effects of hearing an incorrect stress on word naming in Dutch by Francophones

Michaux, M.-C.[1], Caspers, J.[2], Van Heuven, V.[2], Hiligsmann, Ph.[1]

[1]IL&C, Université catholique de Louvain, [2] LUCL, Leiden University

marie-catherine.michaux@uclouvain.be, j.caspers@hum.leidenuniv.nl, v.j.j.p.van.heuven@hum.leidenuniv.nl, philippe.hiligsmann@uclouvain.be

ABSTRACT

In this paper, we investigate the effect of Dutch stress misplacements on the perception and subsequent production by Francophone learners of Dutch in a word naming task. The results suggest that Francophones experience a strong bias towards the final syllable when perceiving Dutch words and producing Dutch stress. Moreover, the results suggest that Francophones are less sensitive to misstressing than natives.

Keywords: Stress, production, perception, Dutch, French

1. INTRODUCTION

Dutch and French native speakers do not use stress in the same way. In Dutch, stress is a lexically distinctive property of words. Contrary to French, the position of Dutch stress is variable and largely constrained by lexical morpho-phonological rules [1]. Moreover, stress information is crucial for word recognition. Research [2, 3] has shown that moving stress to an incorrect position truly harms recognition by native listeners so that words are recognized less often and more slowly. Crucially, it has been shown that a forward shift (*PIloot 'pilot') has a more disruptive effect in two-syllable words than a backward shift (*toeVAL 'chance', canonical stress (i.e. dictionary form) underlined, realised stress in capitals). In three-syllable words, a wrong medial stress position seems to impede recognition most: as a result, *kaPItein 'captain' and *caVIa 'guinea pig' trigger slower responses and lower recognition rates than *KApitein and *caviA.

In French, stress is not a lexical, but a post-lexical or phrasal property as it always has to fall on the last syllable of potentially stressable domains called 'clitic groups' (CG). Those consist of a content word and all its clitics [4]. When stressed, the domain is called 'Accentual Phrase' (AP). However, not every last syllable of a CG needs to be marked by a prominence. A CG-final word can be left unaccented when followed by another CG, both merging into a bigger AP, as stated in (1):

(1) (la belle)CG (maison)CG
    (la belle maiSON)AP
    'the beautiful house'

Rather than being contrastive as in Dutch, it has a demarcative function: primary stress always falls on the last syllable of word groups. The beginning of an AP can also be marked by an optional initial stress on the first content word [5]:

(2) la BELLE maiSON

A small-scale experiment [6] has shown that when confronted with (mis)stressed Dutch words in gating and word naming tasks, Dutch listeners suffer twice as much from stress errors than Francophone learners. The latter group seems to rely more on segmentals than suprasegmentals and shows less sensitivity towards incorrect stress. Yet the potentially disturbing impact of the direction of the shift (forward as in stimuli *KApitein and *kaPItein or backward as in *paGIna and *paginA) on L2-processing of stimuli has been left unanswered so far and the possible influence of L1-transfer on stress perception and production is still unclear.

The current paper focusses on a word naming experiment carried out with Francophone learners of Dutch ("FR group"). Such a task implies that listeners hear a (mis)stressed isolated word that they have to speak out as quickly as possible. As a result, it is possible to measure the effect of (mis)stressings of the stimulus on production (what syllable do the participants stress in their response after hearing a (mis)stressed word?) as well as perception (how much time does it take to process the stimulus and to respond?). The hypotheses are the following: (1) in their production (i.e. responses), the FR group might tend to stress the last syllable as a result of L1-transfer, independently of the potentially incorrect stress in the stimuli. (2) There might also be a bias when hearing a final stress: this pattern might be repeated more often and might be processed most quickly compared to other stress positions. (3) Finally, it is hypothesized that the first syllable will have a special status: as in [7, 8], main stress on the first syllable is expected to be underrepresented in the learners' production while potentially being processed as quickly as a final prominence, as those two patterns also exist in French. Indeed, it has been shown that French initial prominence is mentally represented in French listeners just as final standard prominence is [9]. As a result, stress on the second syllable in an isolated stimulus (thus being an AP by itself) is expected to be the most difficult position to

process as it is the pattern that is most distant from French.

2. METHOD

2.1. Participants

60 Francophone (FR) learners of Dutch and 60 native control speakers (both mean age 19.7) took part in the test. The FR group had been studying Dutch as a foreign language since the mean age of 9.7.

2.2. Materials

36 trisyllabic words were used in the word naming task. The words had an initial (*pagina* 'page'), a medial (*collega* 'colleague') or a final (*formulier* 'form') canonical stress position ("canonical SP", i.e. the dictionary form). Every stimulus was recorded by two male speakers with stress realised on the first, second and third syllable (*PAgina*, *paGIna*, *pagiNA*, 'page'). Each word thus had one canonical SP, but three different realised stress patterns ('realised SP') two of which are incorrect.

2.3. Procedure

Every participant heard all 36 stimuli in one of the realised SP conditions and had to produce them as promptly as possible. The stimulus and the response got recorded with a Tascam-07 MKII recorder and a Sennheiser PC131 head-set microphone. The stress position in the response was determined perceptually by two trained annotators, who indicated which syllable(s) they perceived as stressed (syll. 1, 2 or 3 or multiple prominences). Reaction times were extracted in *Praat*. All statistics were carried out in SPSS (v.22) using mixed-model designs (GLMM). The independent variables are the participant L1 and the canonical and realised SP of the stimuli. The different target variables are presented in section 3.

3. RESULTS

3.1. Preferred stress position in responses

First of all (Figure 1), the FR-group seems to produce final stress (syll. 3) more often (46%) than a medial (14%) or an initial one (7%), confirming hypothesis 1 and the tendency found in [8]. The natives stressed every position equally often (30%), suggesting that they corrected the stress position if it was misplaced in the stimulus (e.g. *paGIna* or *pagiNA* accurately corrected into *PAgina*). In about 6% of the cases, the FR-group produced multiple prominences on syll. 1-3. A combined prominence

on the first and last syllable is possible in French (see example 2).

Figure 1: percentage realised stress position or multiple stress in FR and control responses
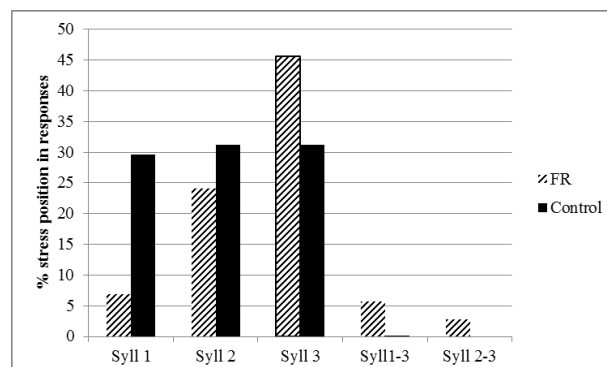
3.2. Correctness of stress position in responses

The FR scores are much lower (35%) than those of the native control group (94%). The first GLMM carried out on the correctness of the stress position in the FR responses shows several tendencies: there is a significant effect of canonical SP ($F_{(2, 3,975)} = 18.9$ p <.001) and realised SP ($F_{(2, 1,931)} = 4.5$ (p <.05)) as well as an interaction between both factors ($F_{(4, 1,931)} = 61.2$, p <.001).

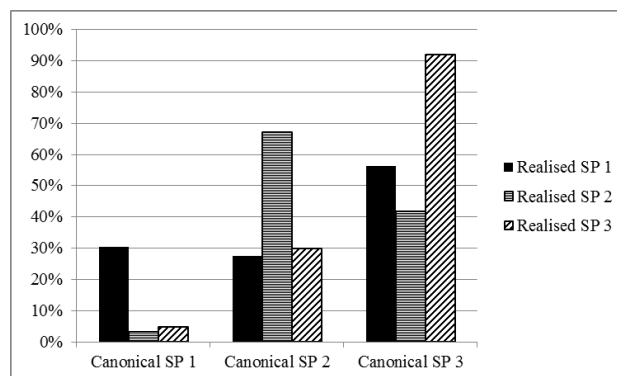Figure 2: Mean correct stress position in response per canonical and realised SP (FR data)

Figure 2 shows that, as predicted (hypotheses 1 and 2), there is a general bias towards the 3rd syllable, as stimuli with a canonical SP or a realised SP on the 3rd syllable initiate correct responses more often. Moreover, hearing a correct stimulus (i.e. the canonical and realised SPs concur) always triggers more correct responses than incorrect ones (SP1: 30%, SP2: 67%, SP3: 92%). Yet, if the stimulus is incorrectly stressed, a different picture emerges: both for canonical SP 1 and 2, the position of incorrect realised stress does not seem to matter: *paGIna*, *pagiNa* trigger only 3 and 5% of correctly stressed answers ($t_{(1,931)} = 0.891$, n.s., Bonferroni). The same holds for forward and backward shifts as in *COLlega* and *colleGA* where

correctness in both cases amounts to 30% ($t_{(1,931)}$ = -0.592), n.s., Bonf.). When a final stress is expected (canonical SP3), an incorrectly realised stress on the 2nd syllable causes more errors (42% correct) than a realised initial SP ($t_{(1,931)}$ = -8.309, p < .001).

None of the factors has an effect on the control group responses.

3.3. Echoing versus modifying the stress pattern

The following analysis tackles the question of repetition/correction behaviour. Do the participants simply echo the presented stress pattern or do they modify it when repeating the stimulus? The dependent variable in the GLMM is the echoing or not echoing of the stimulus. First of all, the control group only repeats the stimulus when it is correctly stressed (i.e. when the canonical and realised SPs concur, 33% of the cases) and no other factor influences their correction behaviour.

In contrast, the FR-group modifies the presented stress in 52% of the cases. The GLMM analysis shows an effect of canonical SP ($F_{(2,1.931)}$ = 5.2, p <.05) and realised SP ($F_{(2,1.931)}$ = 174.9, p<.001) on the repetition/echoing behaviour as well as a significant interaction between both factors ($F_{(4,1.931)}$ = 30.315, p<.001). Pairwise contrastive analyses show that the FR-group tends to echo the stimulus most often when canonical and realised stress concur, i.e. when the input form is correct (see 3.2.). Moreover, as predicted by hypothesis 2, realised stress on the 3rd syllable in the stimulus is always echoed more often (78%) than realised stress on the 2nd (53%) or on the 1st (24%, all pairwise contrasts significant at p < .05 with Bonferroni correction).

A crucial question is what syllable gets stressed when the FR-group does not repeat the heard pattern and whether or not they correct the stress properly (see Table 1 A-B-C). The grey-shaded cells are cases of accurate corrections (e.g. *pagiNA accurately corrected into PAgina).

Table 1: Stressed syllables in FR-non repetition responses for canonical SP 1 per realised SP (A. PAgina-*paGIna-*pagiNA, B.*COLlega-colLEga-*colleGA, C.*FORmulier-*forMUlier, formuLIER)

			Stressed syllable(s) in response, % and (n)				
			Syll 1	Syll 2	Syll 3	Syll 1-3	Total
Canon. SP 1	Realised SP	1		7 (9)	73 (95)	21 (27)	100 (131)
		2	8 (7)		86 (71)	6 (5)	100 (83)
		3	25 (11)	59 (26)		16 (7)	100 (44)
	A. Total		7 (18)	14 (35)	64 (166)	15 (39)	100 (258)
Canon. SP 2	Realised SP	1		38 (58)	49 (75)	13 (20)	100 (153)
		2	2 (1)		93 (41)	5 (2)	100 (44)
		3	3 (2)	88 (67)		9 (7)	100 (76)
	B. Total		1 (3)	46 (125)	43 (116)	11 (29)	100 (273)
Canon. SP 3	Realised SP	1		8 (14)	69 (122)	24 (42)	100 (178)
		2	3 (3)		88 (90)	9 (9)	100 (102)
		3	0 (0)	64 (9)		36 (5)	100 (14)
	C. Total		1 (3)	8 (23)	72 (212)	19 (56)	100 (294)

Corrections are most often accurate when canonical stress falls on the 3rd syllable (Table 1C, 72%), then on the 2nd (46%, Table 1B) and finally on the 1st syllable (7%, Table 1A). For every combination of canonical and realised SP, the preferred modification is the 3rd syllable (e.g. *pagiNA is produced in 86% of the cases after hearing *paGIna, Table 1A). Interestingly, the double prominence (Syll 1-3) also seems to provide an attractive modification option as it is used in 11–19% of the cases (*e.g. PAgiNA) in all conditions.

3.4. Reaction times

The RT analysis provides valuable information on the processing costs of the stimuli. A GLMM on the RTs shows that the natives' mean RTs (289 ms) are significantly shorter than the learners' (509 ms) ($F_{(1, 4.288)}$ = 74.3, p<.001). In both language groups, there is a significant interaction between canonical and realised SP (FR-group: $F_{(4,1.922)}$ = 3.1, p<.05; control group: $F_{(4,1.142)}$ = 34.0, p<.001).

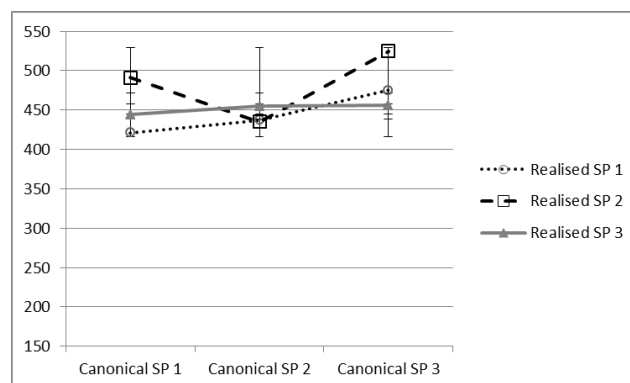Figure 3: Mean reaction times (in ms) per canonical and realised SP in the FR-data

Figure 3 shows that for the FR-group and following the predictions of hypothesis 3, processing a realised SP 1 takes as much time as a realised SP3 (e.g. *FORmulier versus formuLIER, pairwise contrast ($t_{(1,931)}$=-0.627, n.s.)). More importantly, it does not seem to matter whether the initial or final stress position is correct or not (all contrasts n.s.). However, it is noteworthy that a correct medially stressed stimulus (colLEga) is processed as quickly as the incorrect version of the same word (*COLlega or *colleGA). Moreover, an incorrectly realised SP2 (*paGIna, *forMUlier) is systematically processed more slowly than the other realised SPs (all contrasts p<.001), supporting [3].

In comparison to the FR-data, the native group (see Figure 4) seems to be considerably more sensitive to misstressing, in line with [3]. In the control group, correct cases lead to the shortest RTs (PAgina: 162ms, colLEga: 173 ms, formuLIER:

203ms). In contrast, an incorrect stress on the 2nd syllable (*paGIna*, *forMUlier*) triggers the slowest RTs (up to three times slower than correct medial stress) and slower than incorrect initial and final stress.

Figure 4: Mean reaction times (in ms) per canonical and realised SP in the control data
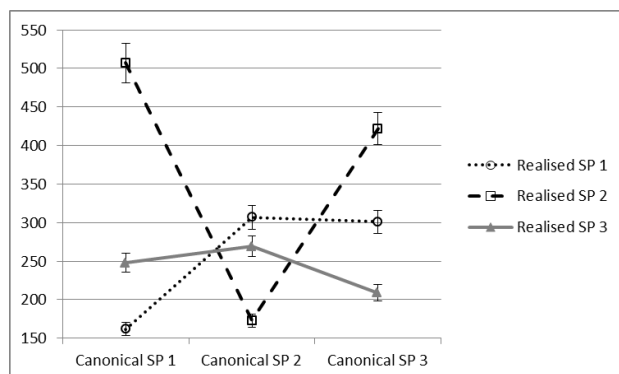
Interestingly, the disruptive effect of an incorrect medial stress is found in both language groups, even though incorrect stressing has much stronger effects on the natives.

4. DISCUSSION AND CONCLUSION

First of all, it seems safe to conclude that the word naming task was a real challenge for the Francophone learners as the correctness scores averaged out to 35% (vs. 94% for the control group). Moreover, when it comes to reaction times, native Dutch listeners seem to be a lot more sensitive to misstressing than Francophones, as suggested by [6].

The analysis of the stress position in the responses showed that correctness of the response was higher when the stress position of the stimulus was correct too, especially if the expected stress was final. This might be due to transfer from French. Interestingly, in most of the cases the direction of the stress shift in the stimulus did not influence the amount of FR mistakes. In other words, it did not seem to matter whether the participants got presented with *paGIna* or *pagiNA*, or *COLlega* or *colleGA*. However, the results suggest that in some cases (e.g. with canonical SP 3 as in *formulier*), an incorrect medial stress (e.g. *forMUlier*) is more disruptive than an initial stress (e.g. *FORmulier*).

The analysis of the correction/repetition behaviour revealed that correct stimuli or word final stresses tended to be echoed more often. This suggests that learners have developed intuitions on Dutch stress but also that they get easily influenced by their familiar L1 final pattern. When modifying the heard stress in their responses, the FR-participants most often found the 3rd or the 2nd syllable the most attractive alternatives. This may show a combination of learner strategies: on the one hand, they tend to fall back on L1-patterns. On the other hand, the medial stress position is the most typically Germanic, which the learners eagerly try to apply.

The reaction time investigation provides interesting insights into the potential mismatch between production and perception of stress. The FR-data shows that the learners did process a perceived initial stress as quickly as a final one. An initial stress is thus easily processed – as it is also found in French. However, and as shown in earlier studies ([7, 8]), the FR participants hardly ever stressed it themselves in their responses, unless in combination with a final stress as in *PAgiNA* (as in L1 French). Interestingly, a correct stimulus did not necessarily trigger quicker RTs.

Similarly, an incorrect medial stress seems to cause the longest RTs. This is all the more noteworthy as the production data showed that the 2nd syllable is stressed in 25% of the cases. In other words, processing a medial stress has very high time costs, but producing it is an easy task. This might be due to the fact that the trochee (i.e. medial stress) is not a pattern that is often found in French and has to be learned consciously. It seems that learners realise that this unnatural pattern is Germanic and that they should try to reproduce it. At the same time, this realisation happens at the expense of reaction time.

Both the Francophones and the natives process an incorrect medial stress more slowly than other realised SPs, even though the Francophones show less sensitivity towards misstressings than the natives. For the natives, an explanation has been suggested by [3, 10, 11]: hearing a strong initial syllable triggers the search of a lexical item. If the first syllable remains unstressed (in cases of an incorrect medial stress as in *paGIna*), no lexical activation process is triggered, which might cause the confusion and delay when hearing the medial stress. The fact that the Francophones show a mild version of the same tendency does not necessarily mean that it is due to the same underlying strategies. It might as well be that a medial stress is so peculiar to them that this has an effect on the processing costs. Further research will be needed to address this question in depth.

5. REFERENCES

[1] Trommelen, M., & Zonneveld, W. (1989). *Klemtoon en metrische fonologie*. Muiderberg: Coutinho.

[2] Heuven, V., van. (1985). Perception of stress pattern and word recognition: recognition of Dutch words with incorrect stress pattern. *Journal of the Acoustical Society of America,* 78.

[3] Leyden, K., van, & Heuven, V. J., van. (1996). Lexical stress and spoken word recognition: Dutch versus English. In: Dikken, M., den, Cremers, C. (eds). *Linguistics in the Netherlands 1996*. Amsterdam: John Benjamins, 159-170.

[4] Garde, P. (1968). *L'accent*. Paris: Presses Universitaires de France.

[5] Di Cristo, A. (2011). Une approche intégrative des relations de l'accentuation au phrasé prosodique du français. *French Language Studies*, 21, 73-96.

[6] Dalen, J., van. (1992). *Het belang van klemtoonmarkering voor woordherkenning in talen met een distinctieve versus demarcatieve klemtoon; een contrastieve studie van het Nederlands tegenover het Frans,* thesis, Universiteit Leiden.

[7] Michaux, M.-C., & Caspers, J. (2013). The production of Dutch word stress by Francophone learners. In: Mertens, P., Simon, A.C. (eds.), *Proceedings of the Prosody-Discourse Interface Conference 2013 (IDP 2013)*, Leuven, 89-94.

[8] Michaux, M.-C., Brognaux, S., & Christodoulides, G. (2014). The production and perception of L1 and L2 Dutch stress. In: Campbell, N., Gibbon, D.,Hirst, D. (eds), *Proceedings of Speech Prosody 7*, Dublin, 462-466.

[9] Aguilera, M., El Yagoubi, R., Espesser, R., & Astésano, C. (2014). Event-Related Investigation of Initial Accent Processing in French. In: Campbell, N., Gibbon, D., Hirst, D. (eds), *Proceedings of Speech Prosody 7*, Dublin, 383-387.

[10] Cutler, A., & Norris, D. (1988). The role of strong syllables in segmentation for lexical access. *Journal of Experimental Psychology: Human Perception and Performance,* 14, 113-121.

[11] Cutler, A. (2012). *Native Listening. Language Experience and the Recognition of Spoken Words*. Cambridge, MA: MIT Press.