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Form or structure?
Morphological processing in second-language English speakers: Evidence from long-lag lexical decision

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Abstract – *Kotzor et al.*

Whether second-language speakers process morphological complexity using native-like strategies has yet to be conclusively established. While some research supports native-like strategies, other evidence suggests a shallower approach with greater reliance on surface similarity. This paper employs a visual lexical decision task with long-lag priming using tri-morphemic stimuli in the three conditions (1) form (*fluently* – *influential*), (2) semantics (*exceptional* – *remarkable*) and (3) morphology (*natural* – *unnatural*), with native English subjects and proficient second-language English speakers whose native language is Bengali. Both groups show robust morphological priming and, while L2 speakers display a form priming effect, this is significantly reduced compared to morphological priming. The results indicate possible differences in the use of sources of information in first- and second-language processing but show that morphological structure does play a role in the latter.

Article – *Kotzor et al.*

1. Background

The role morphological information plays in the speech recognition process is now supported by a large body of research (cf. Amenta & Crepaldi 2012 and Bertram et al. 2011 for reviews) but the precise mechanisms involved in processing morphologically complex items (e.g. *un-happi-ness*) remain controversial. Broadly speaking, recognition of complex words can be achieved by two routes:

(A) looking up a stored lexical representation (as for a monomorphemic word; Butterworth 1983; Seidenberg & Gonnerman 2000)

(B) deconstructing the item into its constituent parts (e.g. *un-*, *happy*, *-ness*), accessing the meaning of each separately and recombining the meanings to achieve comprehension (e.g. Fruchter & Marantz 2015; Taft & Forster 1975)

Some models singularly advocate either Approach A or B. Dual-route models, however, propose that both direct recognition and decomposition play a role (e.g. Baayen et al. 1997; Frauenfelder & Schreuder 1992) and suggest that these routes operate in parallel in first-language (L1) processing. Which route is prioritised depends on factors such as the characteristics of the item in question (e.g. regular vs. irregular inflection; inflection vs. derivation; complexity) and the task being performed.

While experimental results for L1 processing have shown consistent morphological priming effects for items where decomposition occurs, L2 data has frequently shown either no or significantly reduced morphological priming (e.g. Clahsen et al. 2010; Clahsen et al. 2013; Feldman et al. 2009) or, conversely, facilitation of both morphologically related prime–target combinations (e.g. *unhappy – HAPPY*) and pairs which overlap in surface form only (e.g. *increase – CREASE*). The latter set of findings have been taken to indicate greater reliance on surface features in L2 processing (e.g. Duñabeitia et al. 2011; Feldman et al. 2010) and a reduced contribution of morphological structure. Recent behavioural evidence proposes that what appears to be morphological activation may, in fact, be an effect of orthographic overlap (e.g. Heyer & Clahsen 2015) in line with proposals of shallower processing in a second language (Clahsen & Felser 2006, 2018). However, contrasting recent evidence (both behavioural and neurolinguistic; e.g. Bosch et al. 2016; Coughlin & Tremblay 2015; Pliatsikas et al. 2014), has indicated that highly fluent language learners do seem to process complex items in a similar way to L1 speakers. It thus remains unclear whether or to what degree morphological information is used in L2 processing.

The present study investigates potential differences between L1 and L2 processing of morphologically complex words. Unlike most of the current literature, which predominantly employs masked priming (in which primes are presented for very short amounts of time, thus tapping into early automatic processing), a long-lag priming paradigm is used. This method provides a longer period of processing which may allow us to capture possible differences in the time course of L2 processing (e.g. Bosch et al. 2016; McDonald 2006).

Our questions are twofold:

(1) Do patterns of facilitation differ between native and L2 processing and are the results from delayed priming in line with previous masked-priming findings?

(2) Can long-lag priming provide additional insight into the processing of morphologically complex items in L2 processing and enable us to distinguish between surface orthographic effects and true morphological effects?

2. Methodology

We use a visual lexical decision task with delayed priming and trimorphemic derivational items (e.g. *unhelpful – HELPFUL;* see Table 1 for stimulus details) in three conditions: morphologically related pairs (MORPH), semantically related pairs (SEMANTIC) and pairs which overlap in form (FORM). Participants are presented with words on a screen and are asked to decide whether the item is an existing English word (e.g. *active*) or a pseudoword (e.g. *bipple*). The items are preceded by either a related (e.g. *inactive*) or an unrelated (e.g. *tidy*) item to determine whether a related prime activates the target word (*active*) and thus results in shorter response times.

Table 1. Sample stimuli

	Morph 1	Morph 2	Form	Semantics
Prime	unhealthy	inactive	increased	soundless
Target	healthy	active	creased	silent

Unlike in short-lag or masked priming, where the interval between prime and target is very short and participants are often instructed to respond only to the target, in long-lag (delayed) priming, five to seven items are inserted between prime and target and participants respond to every item (both primes and targets; see Figure 1). This method has been shown to isolate morphological facilitation and is not affected by form or semantic overlap in L1 processing (Drews & Zwitserlood 1995).

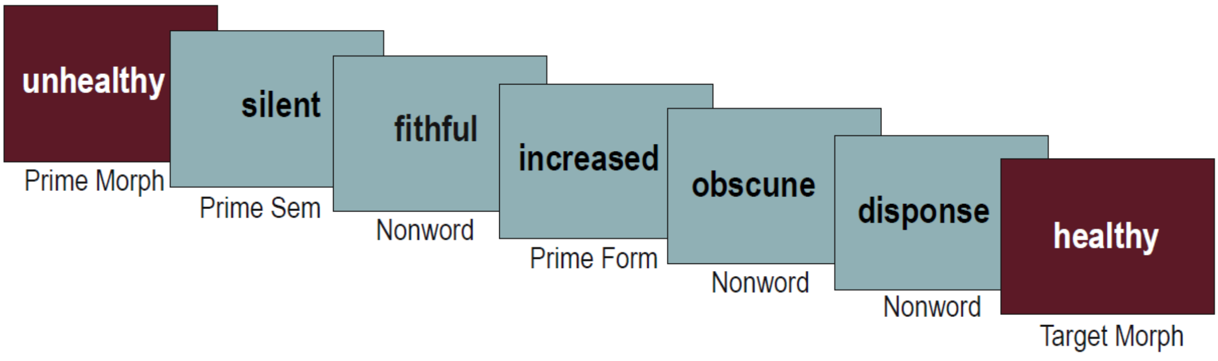

Figure 1. Illustration of long-lag priming

The data was collected in Oxford (UK) and Kolkata (India) and the same hardware was used in both experimental settings. The following participants took part in the study:

- 52 adult native speakers of English (average age: 20.6, 32 female) who were (under)graduate students at the University of Oxford, UK
- 59 Bengali/Hindi native-speaking highly proficient L2 learners of English (average age: 16, all female) in English-medium education at Shri Shikshayatan School, Kolkata, India.

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3. Results

All reaction time (RT) data was transformed to -1000/RT and analysed with two-factor linear mixed model analyses with *Condition* (MORPH vs. FORM vs. SEMANTIC) and *Related* (RELATED vs. UNRELATED) as fixed factors and *Subject* and *Target* as random factors (random intercepts only) in *R* (package: *lme4;* Bates, Maechler, Bolker & Walker 2014) and pairwise comparisons were carried out with *lsmeans*. Error rates were analysed using a generalised linear model (GLM) with *Error* as the dependent variable and *Condition* as a fixed factor.

Reaction times

The L1 dataset shows significant priming only in the MORPH condition ($p < .001$), which is in line with previous experimental findings for L1 long-lag priming, where neither semantic nor form overlap result in facilitation (see Figure 2). In the L2 dataset, however, we observe faster reaction times after related primes in both the MORPH ($p < .001$) and FORM ($p = .010$) conditions, similar to previous experimental findings in L2 morphological priming tasks (see Figure 3). Interestingly, a comparison of the amount of priming observed between the two conditions shows significantly greater priming for the MORPH condition ($p = .028$; see Figure 4).

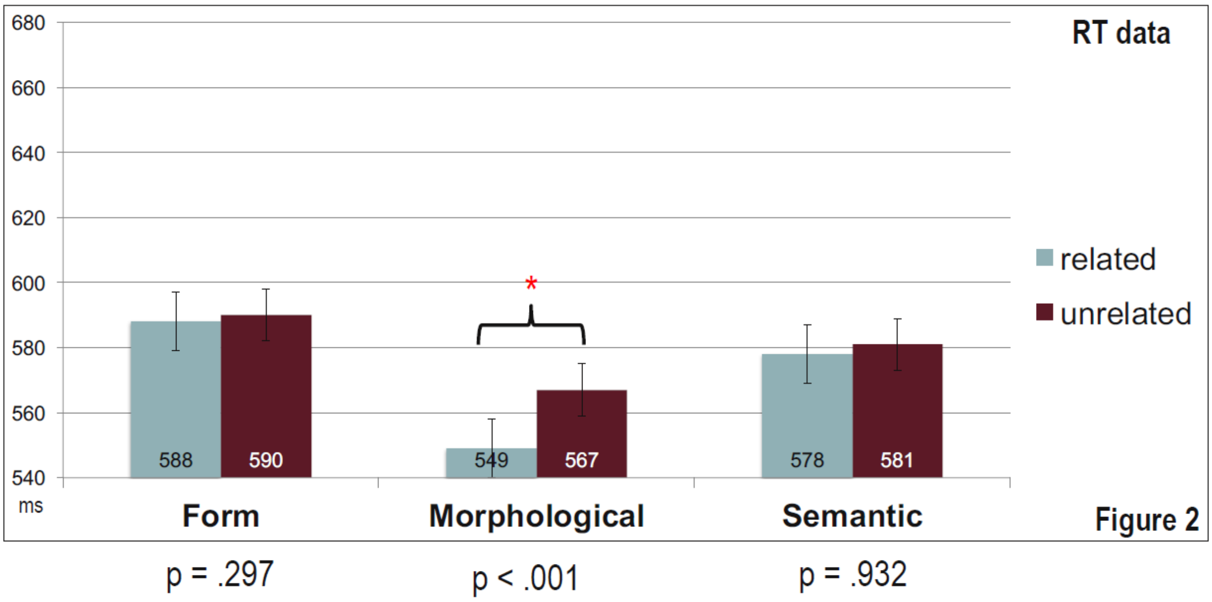

Figure 2. Reaction time results (in ms) for the L1 group

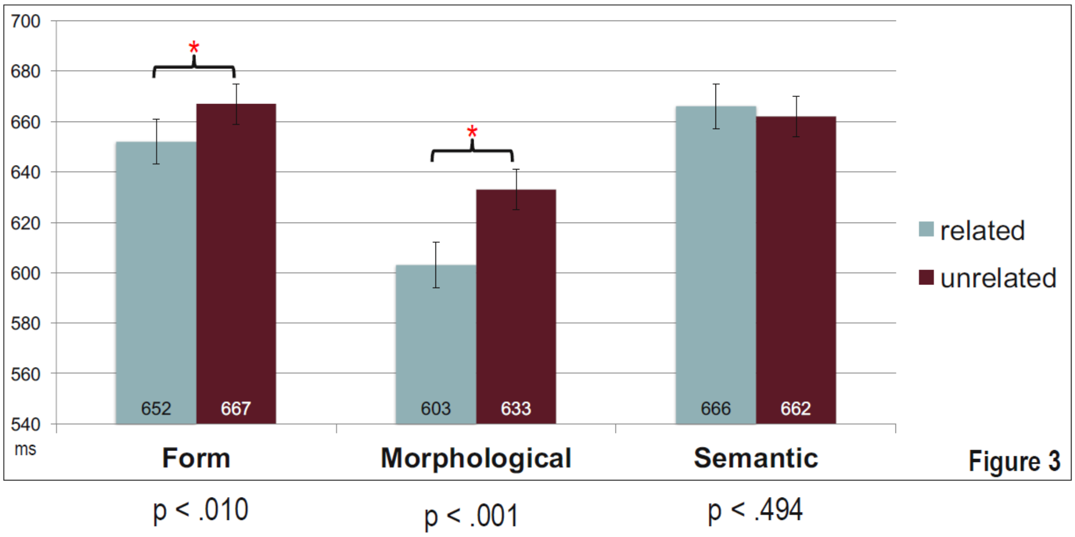

Figure 3. Reaction time results (in ms) for the L2 group

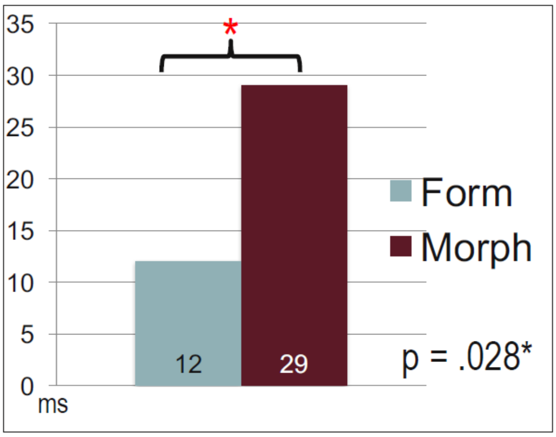

Figure 4. Comparison of degree of priming in the L2 data

Errors

Both the L1 and L2 groups made a significantly greater number of errors in the FORM and SEMANTIC conditions compared to the MORPH condition. However, when comparing errors in the related and unrelated conditions, the L1 group shows significantly fewer errors for related pairs in the morphological condition only, while the L2 group also show this effect for the form condition.

4. Discussion

Overall, the data from the current study provides compelling evidence for morphological facilitation in both L1 and L2 processing (e.g. Coughlin & Tremblay 2015; Gor et al. 2017). The L1 group show a pattern typical for long-lag priming (e.g. Drews & Zwitserlood 1995) with the sole facilitation effects observed in the MORPH condition (in both reaction time and errors). The

L2 learner data shows a different pattern with significantly reduced response times after related primes in both the MORPH and FORM conditions, and the effect of form overlap is also evident in the L2 error data.

The most crucial finding, however, is the significant difference in facilitation between the FORM and MORPH condition in the L2 group. This indicates a differentiation between structural relationships and pure orthographic surface overlap which has not previously been clearly demonstrated. Items which overlap in form but are also structurally related (e.g., *inactive – active*) result in significantly greater facilitation than those which are purely form-related (e.g., *defence – fencing*) even in second-language processing, where form has been suggested to play a more prominent role. It seems that proficient L2 learners utilise morphological structure in the process of accessing their lexicon (e.g. Pliatsikas et al. 2014) but may also use surface overlap to a greater extent than L1 speakers (Clahsen & Felser 2006, 2018; Heyer & Clahsen 2015).

A possible explanation for this pattern is that L2 learners attempt to isolate a stem even in items which are monomorphemic (e.g., *mischief*). If they attempt such an analysis by stripping the apparent prefix *mis*- and thus arrive at the existing stem *chief*, a subsequent related target (e.g. *chiefly*) may be accessed faster despite the absence of any morphological relationship between *mischief* and *chiefly*. As these items are not morphologically related, the recombination process may be unsuccessful, and this may explain reduced activation and thus the difference observed in a long-lag task which allows for sufficient time for both automatic affix stripping and recombination to be carried out (especially in L2 learners, for whom this process has been shown to be delayed, e.g. Gor et al. 2017; McDonald 2006).

5. Conclusion

Contrary to recent proposals (e.g. Heyer & Clahsen, 2015), the results presented here indicate that the facilitation observed in the morphological condition cannot be attributed purely to a surface effect and suggest an independent contribution by the structural information. We are not discounting that L2 learners may rely more strongly on form, possibly at an early stage in processing, and have a tendency to resort to shallower processing (cf. Clahsen & Felser 2018). However, in addition to using form overlap, L2 processing also benefits from shared morphological structure and this information is used during lexical access.

References

Amenta, Simona & Davide Crepaldi. 2012. Morphological processing as we know it: An analytical review of morphological effects in visual word identification. *Frontiers in Psychology* 3. 1–12.

Baayen, R. Harald, Ton Dijkstra & Robert Schreuder. 1997. Singulars and plurals in Dutch: Evidence for a parallel dual route model. *Journal of Memory and Language* 37(1). 94–117.

Bates, Douglas, Martin Maechler, Ben Bolker & Steven Walker. 2014. *lme4: Linear mixed-effects models using Eigen and S4.* R package version 1.1–7. <http://CRAN.Rproject.org/package=lme4>.

Bertram, Raymond, Jukka Hyönä & Matti Laine. 2011. Morphology in language comprehension, production and acquisition. *Language and Cognitive Processes* 26(4–6). 457–481.

Bosch, Sina, Helena Krause & Alina Leminen. 2016. The time-course of morphosyntactic and semantic priming in late bilinguals: A study of German adjectives. *Bilingualism: Language and Cognition* 20(3). 435–456.

Butterworth, Brian. 1983. Lexical representation. In Brian Butterworth (ed.), *Language production*, Vol. 2, *Development, writing and other language processes*, 257–294. London: Academic Press.

Clahsen, Harald & Claudia Felser. 2006. Grammatical processing in language learners. *Applied Psycholinguistics* 27(1). 3–42.

Clahsen, Harald & Claudia Felser. 2018. Some notes on the Shallow Structure Hypothesis. *Studies in Second Language Acquisition* 40(3). 693–706.

Clahsen, Harald, Loay Balkhair, John-Sebastian Schutter & Ian Cunnings. 2013. The time course of morphological processing in a second language. *Second Language Research* 29(1). 7–31.

Clahsen, Harald, Claudia Felser, Kathleen Neubauer, Mikako Sato & Renita Silva. 2010. Morphological structure in native and non-native language processing. *Language Learning* 60(1). 21–43.

Coughlin, Caitlin E. & Annie Tremblay. 2015. Morphological decomposition in native and non-native French speakers. *Bilingualism: Language and Cognition* 18(3). 524–542.

Drews, Etta & Pienie Zwitserlood. 1995. Morphological and orthographic similarity in visual word recognition. *Journal of Experimental Psychology: Human Perception and Performance* 21(5). 1098–1116.

Duñabeitia, John Andoni, Sachiko Kinoshita, Manuel Carreiras & Dennis Norris. 2011. Is morpho-orthographic decomposition purely orthographic? Evidence from masked priming in the same–different task. *Language and Cognitive Processes* 26(4–6). 509–529.

Feldman, Laurie Beth, Patrick A. O'Connor & Fermín Moscoso del Prado Martín. 2009. Early morphological processing is morpho-semantic and not simply morpho-orthographic: A violation of form-then-meaning accounts of word recognition. *Psychonomic Bulletin Review* 16. 684–691.

Feldman, Laurie Beth, Aleksandar Kostic, Dana M. Basnight-Brown, Dušica Filipović & Matthew John Pastizzo. 2010. Morphological facilitation for regular and irregular verb formations in native and non-native speakers: Little evidence for two distinct mechanisms. *Bilingualism: Language and Cognition* 13(2). 119–135.

Frauenfelder, Uli H. & Robert Schreuder. 1992. Constraining psycholinguistic models of morphological processing and representation: The role of productivity. In Geert E. Booij & Jaap van Marle (eds.), *Yearbook of morphology 1991*, 165–183. Dordrecht: Kluwer.

Fruchter, Joseph & Alec Marantz. 2015. Decomposition, lookup, and recombination: MEG evidence for the Full Decomposition model of complex visual word recognition. *Brain and Language* 143. 81–96.

Gor, Kira, Anna Chrabaszcz & Svetlana Cook. 2017. Processing of native and nonnative inflected words: Beyond affix stripping. *Journal of Memory and Language* 93. 315–332.

Heyer, Vera & Harald Clahsen. 2015. Late bilinguals see a *scan* in *scanner* AND in *scandal*: Dissecting formal overlap from morphological priming in the processing of derived words. *Bilingualism: Language and Cognition* 18(3). 543–550.

McDonald, Janet L. 2006. Beyond the critical period: Processing-based explanations for poor grammaticality judgment performance by late second language learners. *Journal of Memory and Language* 55(3). 381–401.

Pliatsikas, Christos, Tom Johnstone & Theodoros Marinis. 2014. fMRI evidence for the involvement of the procedural memory system in morphological processing of a second language. *PLoS ONE* 9(5). e97298.

Seidenberg, Mark S. & Laura M. Gonnerman. 2000. Explaining derivational morphology as the convergence of codes. *Trends in Cognitive Science* 4(9). 353–361.

Taft, Marcus & Kenneth I. Forster. 1975. Lexical storage and retrieval of prefixed words. *Journal of Verbal Learning and Verbal Behaviour* 14(6). 638–647.