Morpheme stripping in the lexicon and in the sublexicon

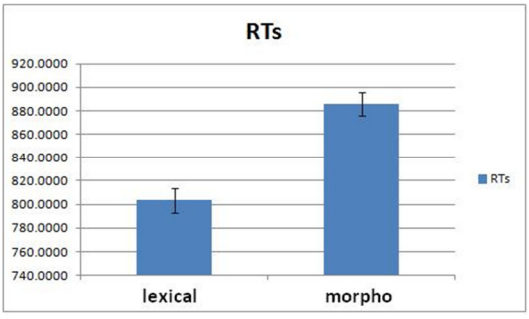
Luca Cilibrasi, Vesna Stojanovik, Patricia Riddell
School of Psychology and Clinical Language Sciences, University of Reading

The storage (and processing) of inflected verbs is a strongly debated issue in psycholinguistics. Some authors suggest that inflected verbs are stored as units (i.e. with the bound morpheme) in the lexicon (Stemberger & MacWhinney, 1986, Bertram at al, 2000), and bring as evidence the presence of strong frequency effects in lexical decision tasks with inflected verbs. Other authors suggest that inflected verbs are decomposed in stems and affixes in perception and generated by the application of a rule in production, for instance +ed, +s in English (Pinker & Ullman, 2001), and bring as evidence phenomena such as hyper-regularizations. Some authors go further in this direction as suggest that a morpheme stripping process takes place sublexically, at least in reading (Grainger & Ziegler, 2011). A set of 3 experiments was conducted in order to investigate these phenomena.

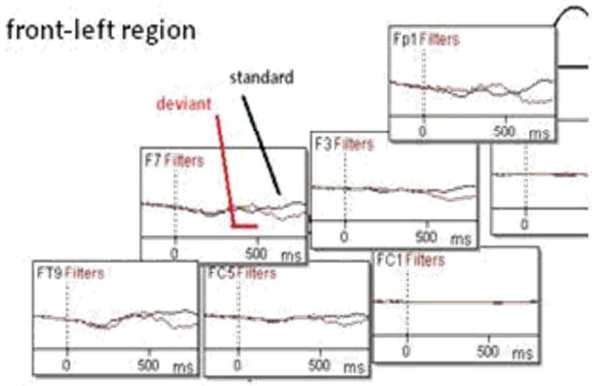
In the first experiment 20 subjects native speakers of English were asked to discriminate elements belonging to lexical and morphosyntactic minimal pairs. Minimal pairs are pairs of words that differ in only one phoneme. In the morphosyntactic condition the contrast was generated by bound morphemes, for instance “asked” vs “asks”. In the lexical condition minimal pairs were carefully chosen so that 1) the difference was always in final position, in order to be comparable to the morphosyntactic condition; 2) the contrast was always generated by morphemes that are potentially morphological in English, i.e. /z/ & /d/ or /t/ & /s/, for instance “slight” vs “slice”, “tact” vs “tax”, “right” vs “rice”. All words in this task were monosyllabic. Words were presented aurally, with the “same/different” paradigm. The task consisted of 80 trials.

Lexical minimal pairs	Morphosyntactic minimal pairs
/ɑːskt/ - /ɑːskts/ (i.e. asked vs asks)	/slaɪt/ - /slaɪs/ (i.e. slight vs slice)
/keəd/ - /keəz/ (i.e. cared vs cares)	/nəʊd/ - /nəʊz/ (i.e. node vs nose)
/laikt/ - /laiks/ (i.e. likes vs liked)	/tækt/ - /tæks/ (i.e. tact vs tax)

Reaction times in the discrimination of elements belonging to the two types of pairs were compared. Lexical minimal pairs were faster to be discriminated than morphosyntactic minimal pairs, $t(19) = -11.985$, $p < .001$. This result underlines bigger complexity in the morphosyntactic condition, suggesting that costly processing is needed to compare bound morphemes. We also conducted item based correlations (between average RT for a specific word and frequency of that word in the British National Corpus). The correlation for the lexical condition was not significant $r = 0.26$, $p > .05$, but the morphosyntactic one was significant, $r = -0.37$, $p = .03$ (but non significant with Bonferroni correction), suggesting the coexistence of morpheme stripping effects (Pinker & Ulman, 2001) and frequency effects (Stemberger & MacWhinney, 1986).

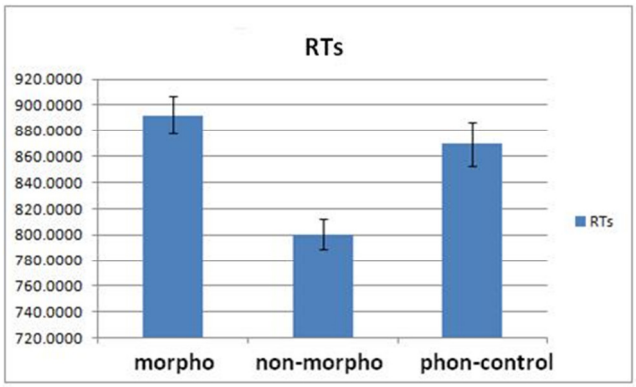


In the second experiment 22 right handed subjects native speakers of English were tested using Electroencephalography (EEG), 32 electrodes cap, in a Mismatch Negativity (MMN) task composed of four conditions: lexical minimal pair *frequent*, lexical minimal pair *infrequent*, morphosyntactic minimal pair *frequent*, morphosyntactic minimal pair *infrequent*. Subjects listened 80% of the time to the word ending in /d/ and 20% of the time



to the word ending in /z/. We analysed brain activity following the presentation of the phoneme /z/ (since this was the crucial disambiguating point in the task). Interaction was not significant posteriorly, suggesting that the effect is driven by frontal circuits. MMN was generated only in the morphosyntactic condition (see picture above), with no relation to frequency, $F(147,3) = 107.357$, $p < .001$.

In the third experiment we investigated morpheme stripping effects in the sublexicon. In English regular verbs ending in /l/ "take" the /d/ ending when inflected in the past and the ending /z/ when inflected in the third person present. Although morphological in other contexts, /t/ and /s/ do not bring grammatical information when following /l/. We compared then the discrimination of non words ending in /ld/ vs /lz/ and non words ending in /lt/ vs /lt/. All non words were phonotactically legal, as calculated with the Vitevich & Luce (2004) calculator. A third condition was added to



control for voicing effects. The task was conducted on 20 native speakers of English and contained 180 trials. The 3 by 1 ANOVA is highly significant, $F(15,2) = 17.7$, $p < .001$. Pairwise comparisons show that elements with potential morphological information take more time than non-morphological elements to be discriminated, Mean Diff = 103.232, $p <$ .001, and a marginally significant larger amount of time than the phonological control condition, Mean Diff = 29.591, $p = .063$. Item based correlations were run between RTs and rhyme likelihood, coda likelihood, and positional segment frequency. Only the last one was significant, $r = -.26$, $p = .044$ (but non significant with Bonferroni correction).

In conclusion, with the first experiment we reported evidence of morpheme stripping effects with RTs, in experiment 2 we reported physiological evidence (brain correlates) of similar effects, and in experiment 3 we reported evidence of morpheme stripping effects in the sublexicon. Further, with experiment 3 we also showed that stripping is not blind but synergic to the analysis of the stem, and also, with the experiments 1 and 3, we reported the presence of frequency effects, that however do not undermine the evidence for morpheme stripping.