ABSTRACT BOOKLET

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Effects on speech parsing of vowelless words in the phonology

Across languages, syllabic nuclei are most often vowels, far less often consonants, and least often of all non-continuant obstruents [1].

Listeners use this asymmetry in recognising words in speech. Speech signals are ambiguous and support more words than speakers intend: *bring* contains *ring*, etc. Although word forms matching incoming speech are automatically activated, and such forms temporarily compete with one another [2], embeddings such as *ring* in *bring* cause listeners little problem. This is because residues which are vowelless (the *b* remaining of *bring* minus *ring*) are disfavoured in parsing speech into potential words. Spoken-word recognition experiments in many languages [3-8; see Figure 1] have shown that words are easier to detect in nonsense strings if a whole syllable is left over (*egg* in *mafegg*), but harder to detect if only a consonant remains (*egg* in *fegg*; cf. *ring* in *bring*). This effect appears even where the syllable residue could not be a stand-alone word [6,7], and even in languages that allow underlying vowels to be deleted or devoiced [e.g., 8]; further, 12-month-old infants show an analogous effect in recognising newly heard words [9]. The rule against vowelless residues delivers a powerful payoff for speech recognition, in that it excludes the majority of accidental embeddings (e.g., 73% of all embeddings in English [10]).

Languages which allow words consisting only of consonants, however, form a possible exception to the usefulness of such a constraint. We examined speech processing in two languages exemplifying the hardest case, i.e., where words may consist even of only non-continuant obstruents. In Slovak, four stand-alone closed-class words are single obstruents (e.g., *k* 'to'; 'to the brother' is *k bratovi*). In Tarifit Berber, stand-alone open-class words may consist solely of obstruents, including non-continuant obstruents (e.g., *kb.bd* 'pour out').

In similar word-spotting experiments, listeners of each language heard spoken nonsense words and detected any real words in those items. 40 native Slovak speakers in Nitra, Slovakia, heard words such as *ruka* 'hand' in nonsense strings such as *eruka, truka, oruka, gruka* (where *e* and *t* are meaningless, *o* is the preposition 'about', and *g* is the voice-assimilated form of *k* 'to'; neither *o+ruka* nor *g+ruka* is grammatical). 41 native speakers of Tarifit Berber in Nador, Morocco, heard words such as *fad* 'thirst' in nonsense strings such as *aghfad, eghfad* and *ghfad* (where *agh* and *egh* are meaningless syllables with full and reduced vowels respectively, and *gh* is a meaningless consonant). The listeners' reaction time to spot the words was measured.

Figure 2 shows the results; in both cases the effect observed here differed from that found in other languages (Figure 1). In Slovak, a meaningless consonantal residue (*t* in *truka*) again made word detection very hard, and a meaningless vowel (*e* in *eruka*) made it easy; but a potentially meaningful consonant (*g* in *gruka*) was not significantly more detrimental to word detection than a vowel (meaningful, as in *oruka*, or not, as in *eruka*). For Slovak listeners, the consonants that are words and those that are not words thus differ in status; the real-word consonants form an exception to the rule that vowelless residues are disfavoured in parsing speech into words. In Tarifit Berber, words were detected as easily when appended to a meaningless consonant (*ghfad*) as to a syllable either with a full vowel (*aghfad*) or a reduced vowel (*eghfad*); for Tarifit listeners, therefore, the rule that disfavours vowelless residues apparently does not hold at all.

Prelinguistic infants make use of the vowelless residue rule [9], but our results show that experience with a native phonology modulates how adult listeners apply it. Slovak listeners have learned that certain consonants can be closed-class words, and so should be treated as exceptions to the rule. Tarifit listeners have learned that open-class words can consist of consonants only; for them, the rule is then suspended. Syllabic consonants in the phonology that allow words to be vowelless affect how listeners apply procedures for parsing speech into words.

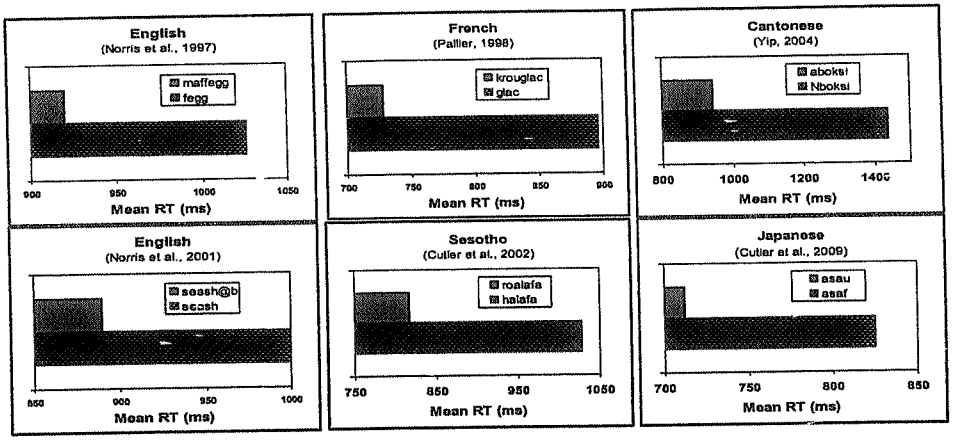

Figure 1. Response time (RT) to detect words (*egg*, *lac*, *boksi*, *sea*, *alafa*, *asa*) appended to contexts with a vowel (grey bars) or without a vowel (black bars), across five languages.

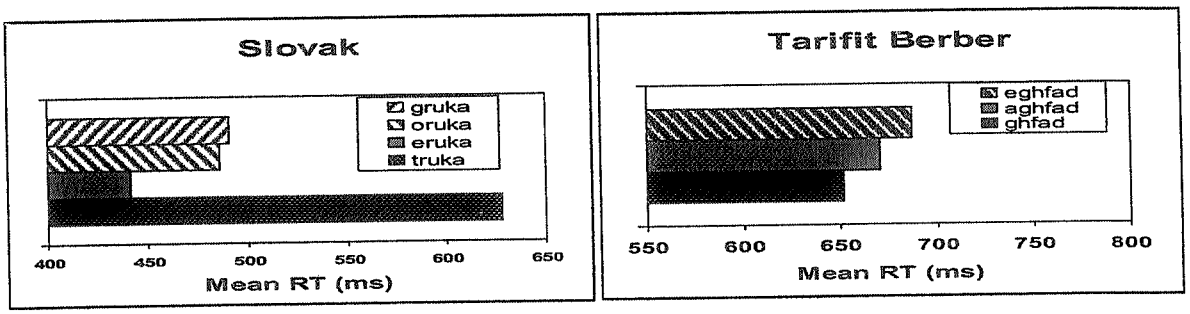

Figure 2. Response time (RT) to detect words in Slovak (left panel; e.g., *ruka* in *gruka*, *oruka*, *eruka*, *truka*) and in Tarifit Berber (right panel; e.g., *fad* in *eghfad*, *aghfad*, *ghfad*).

References

[1] Bell, A. (1978). Syllabic consonants. In J. Greenberg (Ed.), *Universals of human language: Phonology* (Vol. 2, pp. 153-201). Stanford, CA: Stanford University Press.

[2] McQueen, J.M. (2007). Eight questions about spoken-word recognition. In M.G. Gaskell (Ed.) *The Oxford Handbook of Psycholinguistics* (pp. 37-53). Oxford: Oxford University Press.

[3] Norris, D., McQueen, J.M., Cutler, A., & Butterfield, S. (1997). The possible-word constraint in the segmentation of continuous speech. *Cognitive Psychology*, **34**, 191-243.

[4] Pallier, C. (1998). The Possible Word Constraint and language-specific word structure. *Annual Report 1997* (p. 8). Nijmegen: MPI for Psycholinguistics.

[5] Yip, M.C. (2004). Interference effects of possible-word constraints (PWC) in Cantonese speech segmentation. *Psychologia: An International Journal of Psychology in the Orient,* **47**, 169-177.

[6] Norris, D., McQueen, J.M., Cutler, A., Butterfield, S., & Kearns, R. (2001). Language-universal constraints on speech segmentation. *Language and Cognitive Processes*, **16**, 637-660.

[7] Cutler, A., Demuth, K., & McQueen, J.M. (2002). Universality versus language-specificity in listening to running speech. *Psychological Science*, **13**, 258-262.

[8] Cutler, A., Otake, T., & McQueen, J.M. (2009). Vowel devoicing and the perception of spoken Japanese words. *Journal of the Acoustical Society of America,* **125**, 1693-1703.

[9] Johnson, E.K., Jusczyk, P.W., Cutler, A, & Norris, D. (2003). Lexical viability constraints on speech segmentation by infants. *Cognitive Psychology*, **46**, 65-97.

[10] Cutler, A., McQueen, J.M., Jansonius, M., & Bayerl, S. (2002). The lexical statistics of competitor activation in spoken-word recognition. *Proceedings of SST2002,* Melbourne (pp. 40-45).