

Mechanisms, routes and networks

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The Dual Mechanism Model (DMM)

- ▶ According to the dual mechanism hypothesis (Clahsen 1999), the processing of morphology involves two discrete subsystems:
 1. A **combinatorial** system, which processes regular formations.
 2. A **storage-retrieval** system, which processes irregulars.
- ▶ The processing of a regular form like *eating* involves two steps:
 1. **Decomposition** of the form into the stem *eat* and the ending *-ing*,
 2. **Lexical lookup** of the lexical entries for the stem and ending.
- ▶ The processing of an irregular form like *ate* involves a single step:
 1. **Retrieval** of the undecomposable form *eat* from the lexicon.

Priming evidence

- ▶ One source of empirical support for the dual mechanism hypothesis comes from **priming** experiments.
- ▶ These studies can be visual, auditory or cross-modal (both).
- ▶ In a priming experiment, speakers are presented with an initial input, the 'prime' then with a second input, the 'target'.
- ▶ Priming experiments define two basic behavioural measures:
 1. **Response latencies**: The amount of time it takes speakers to recognize the target as a word or to reject it as a nonword.
 2. **Accuracy**: The proportion of correct vs incorrect decisions.
- ▶ Primes can in principle exert either a **facilitatory** or **inhibitory** effect on the processing of the target.

Morphological priming

- ▶ A number of morphological priming effects were initially observed in Stanners et al. (1979) and replicated in subsequent studies:
 1. When the prime and target are **identical** (*walk~walk*), the response time for the target is usually faster than for the prime.
 2. A similar facilitatory effect is found when the target is a **regularly inflected** variant of the prime (*walk~walked*).
 3. The facilitatory effect is weaker when the target is an **irregularly inflected** variant of the prime (*eat~ate*).
- ▶ Advocates of the DMM assume that “The repetition of a word is taken to facilitate access to its lexical entry” and that

“the finding that regular past tense forms consistently produced full priming in all studies is compatible with the view that regular past tense forms are morphologically decomposed.” (Clahsen 1999: 999)

Priming evidence for the Dual Mechanism Model

- ▶ The priming studies summarized in Clahsen (1999) report that:
 1. Regular pairs (*gekauft~kaufe*) exhibit full base priming.
 2. Irregular pairs (*gesehen~sehe*) exhibit partial, priming, which correlates with the frequency of the irregular word form.
- ▶ This contrast is interpreted as evidence that:
 1. Processing of the regular forms involves a **combinatory** subsystem,
 2. Processing of the irregular forms involves lexical **retrieval**.

The role of regularity ...

- ▶ Yet there are two significant confounds in this dichotomy:
 1. Regular patterns typically have a high **type** frequency, since many different items inflect according to regular patterns.
 2. Irregular patterns necessarily have a high **token** frequency, since otherwise they would be assimilated to regular patterns.
- ▶ Hence the contrasts reported in Clahsen (1999) could be attributable to a distinction **either** between regulars and irregulars **or** between high type frequency and high token frequency.
- ▶ How can we isolate the confounded factors in these studies?

... or frequency?

- ▶ There are two potentially disambiguating cases:
 1. **Irregular** patterns with an exceptionally high **type** frequency.
 2. **Regular** patterns with an exceptionally high **token** frequency.
- ▶ The first case is excluded as a contradiction. A **single** pattern with a high type frequency cannot be irregular, since there must be some regularity that makes it the 'same' pattern across different items.
- ▶ In contrast, there **are** many high-frequency regular forms.
- ▶ Like irregulars, these forms exhibit full-form priming effects (Stemberger & MacWhinney 1986; Bybee 1999).

Summary

- ▶ Clahsen (1999: 1052) invokes 'memory traces' to account for the full-form priming effects of high-frequency regulars.
- ▶ However, this explanation undermines the initial logic, in which full-form effects were diagnostic of undecomposable forms.
- ▶ Although frequency and regularity are often confounded, frequency is the more reliable predictor of priming effects.
- ▶ Hence it is distributional contrasts between regulars and irregulars, not 'decomposability' that accounts for priming behavior.

Mechanisms or routes?

The relation between frequency and regularity:

1. Forms with high token frequency exhibit full-form priming effects.
2. All irregulars and some regulars have a high token frequency.
3. Patterns with high type frequency facilitate access to their parts.
4. Any pattern with a high type frequency must exhibit regularities that permit it to be identified as the **same** pattern across different items.
5. No firm conclusions about decomposition follow from these facts.

The Dual Route Race Model (DRRM) (Baayen et al. 1997a,b)

- ▶ The DRRM accommodates the role of frequency by assuming that ‘combinatorial’ and ‘retrieval’ processing strategies do not apply to disjoint domains but **compete** within the same domain:

This experiment clearly demonstrates a solid 59 msec effect of full-form frequency for a completely regular inflectional suffix and, again, negates the linguistic projection of defaultness onto lexical processing. Note that we do not interpret this result to indicate that rule-based processing is absent. Instead, we assume that **lexical access is attempted in parallel both by rule and by rote** (Baayen et al. 1997a), that **on average the parsing route will be the winning route for lower frequency words, and that on average the direct route will be the winning route for higher frequency words.** (Schreuder et al. 1999)

Challenges for the DRRM

- ▶ The DRRM develops a more nuanced treatment of the role of frequency in guiding the interaction between processing strategies.
- ▶ But, like all models of its type, it is not designed to represent:
 1. The **syntagmatic** knowledge that speakers need to know when to interpret an ambiguous ending like *-er* as a comparative marker and when to interpret it as a marker of an agentive nominal,
 2. The **paradigmatic** relations between forms that determines the effects reported in Milin et al. (2009b) and Baayen et al. (2011).
- ▶ There is also no principled basis for determining when which of the competing processing strategies prevails in a particular case.


Dimensions of paradigmatic knowledge

We are only beginning to understand how finely-tuned a speaker's language model is to the distributional patterns in their language:

- ▶ As shown in Milin et al. (2009a), speakers are sensitive to **relative entropy**; the divergence between the frequency distribution of an item's inflectional paradigm and its inflectional class.
- ▶ E.g., the closer the distribution of the forms of PLANINA 'mountain' match the distribution of the second 'feminine' declension, the faster and more accurately speakers recognize forms of PLANINA.

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 2. The **paradigmatic** relations between forms that determines the effects reported in Milin et al. (2009b) and Baayen et al. (2011).
- ▶ For an analysis of these effects, we turn to a **discriminative** model, like the Naive Discriminative Learner model in Baayen et al. (2011).

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