

**Implicative organization in grammar systems:
Word structure, paradigm organization and learnability**

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Speakers of languages with complex morphology and multiple inflection classes confront a large learning task whose solution raises fundamental questions about the structure of words, and the organization of morphological systems. This task receives a general formulation as the Paradigm Cell Filling Problem (PCFP) in Ackerman et al. (2009):

PARADIGM CELL FILLING PROBLEM: Given exposure to an inflected wordform of a novel lexeme, what licenses reliable inferences about the other wordforms in its inflectional family?

The essential challenge, as formulated in the PCFP, is not new, and proposed answers to it have a similar profile (Paul 1891, Hockett 1967, Paunonen 1976, Bybee 1985, Anttila 1989, Wurzel 1989, see also Fertig 2013, 2016): analogical inferences from (incomplete sets of) forms belonging to known inflectional patterns permit reasonable guesses concerning likely candidates for unknown forms. Descriptive observations about the implicational organization of morphological systems have been reconceptualized and quantified in renascent word and pattern approaches to morphological analysis (see the detailed overview and description in Blevins 2016).

The calculation of informativity concerning combinations of patterned ingredients and meanings associated with them attested in individual languages, such as Finnish or Fur, has been the main object of Information-Theoretic measures in these new word-based formal models. The Low Conditional Entropy Conjecture – LCEC (Ackerman and Malouf 2013) represents a cross-linguistic hypothesis concerning complex morphological systems: morphological systems seem to display organization in terms of low conditional entropies, reflecting high predictability between known words and their unknown variants. In effect, the LCEC is a way of solving the PCFP, providing learners with cues to facilitate good guesses about previously unencountered words. Given the huge variability in the cross-linguistic shapes of words and their patterns of relatedness, the LCEC, by hypothesis, reflects a strategy by which language change is guided by learnability considerations.

The learnability problem identified by descriptivists is confirmed and quantified by recent research revealing that the inflectional stimuli that learners experience is highly skewed and incomplete: following Zipfian distributions, small numbers of inflected words are heard frequently providing partial paradigm information, while increasing the corpus size does not provide exposure to the “missing” words from the complete paradigm, but merely reinforces the distributions found in smaller samples. (Bonami and Beniamine 2015, Sims (2015) and Blevins, Milin and Ramscar (to appear)). Chan

(2008) and Yang (2010, 2016) utilize this type of result to argue against the plausibility of the class of word and pattern models. Following Bonami and Beniamine 2015, Ramscar and Blevins 2015 and Blevins 2016, we argue, on the contrary, that these results suggest the necessity for complex morphological systems to be organized in line with word-based models that are centrally concerned with quantifying conditional entropy in morphological organization: the learning paradox raised by Zipfian distributions of stimuli points to the necessity of something like the LCEC and correlatively, for the type of word-based morphological model within which it operates.

Given this, we explore empirical data that confirm and/or challenge the LCEC, suggesting that both help to refine the possible scope of the conjecture and the nature of its extensions to data beyond those analyzed in Ackerman and Malouf 2006, Ackerman et. al. 2009, Bonami and Luis 2013, Ackerman and Malouf 2013, 2016, Bonami 2014, Bonami and Beniamine 2015, Sims 2015, Stump and Finkel 2015, Blevins 2016, among others.