Moving beyond innate features: a unified account of natural and unnatural classes[1]

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It is widely known that some sound patterns involve "unnatural classes" (e.g., Sanskrit /r u k i/), but it is *not* widely known how widespread unnatural classes are. Goals of this talk are to overview a crosslinguistic **survey** of natural (and unnatural) classes, **discuss predictions** of innate and emergent features, **test predictions** with survey data, and **sketch an account** based on the results.

(1) A crosslinguistic survey of *phonologically active classes*:
- i.e., group of sounds which, to the exclusion of all others:
  - undergo a phonological process,
  - trigger a phonological process, or
  - exemplify a static distributional restriction.
- Sources: grammars of 561 languages (all the grammars on the shelf)
- Database: about 17,000 sound patterns
- Data for this study: 6077 distinct target or trigger classes

(2) Ability of three feature systems to characterize 6077 phonologically active classes as "natural classes" (with a conjunction of distinctive features):

Feature System	Natural classes	
Preliminaries (Jakobson, Fant & Halle 1956)	3640	59.90%
SPE (Chomsky & Halle 1968)	4313	70.97%
Unified Feature Theory (Clements & Hume 1995)	3872	63.72%
ANY SYSTEM	4579	75.35%

(3) If features are not innate:
- They must emerge in language acquisition, language change, etc., instead of emerging in biological evolution.
- Emergent features would need to be accounted for in terms of language change, social and cognitive factors, and phonetic facts, *including* the phonetic facts innate features are grounded in.

[1]References are in the paper-intensive version: http://www.ling.ohio-state.edu/~mielke/papers/Mielke_diss.pdf

(4) **Natural and unnatural classes:** Innate features predict a well-defined boundary between natural and unnatural. Emergent features predict a smooth transition.

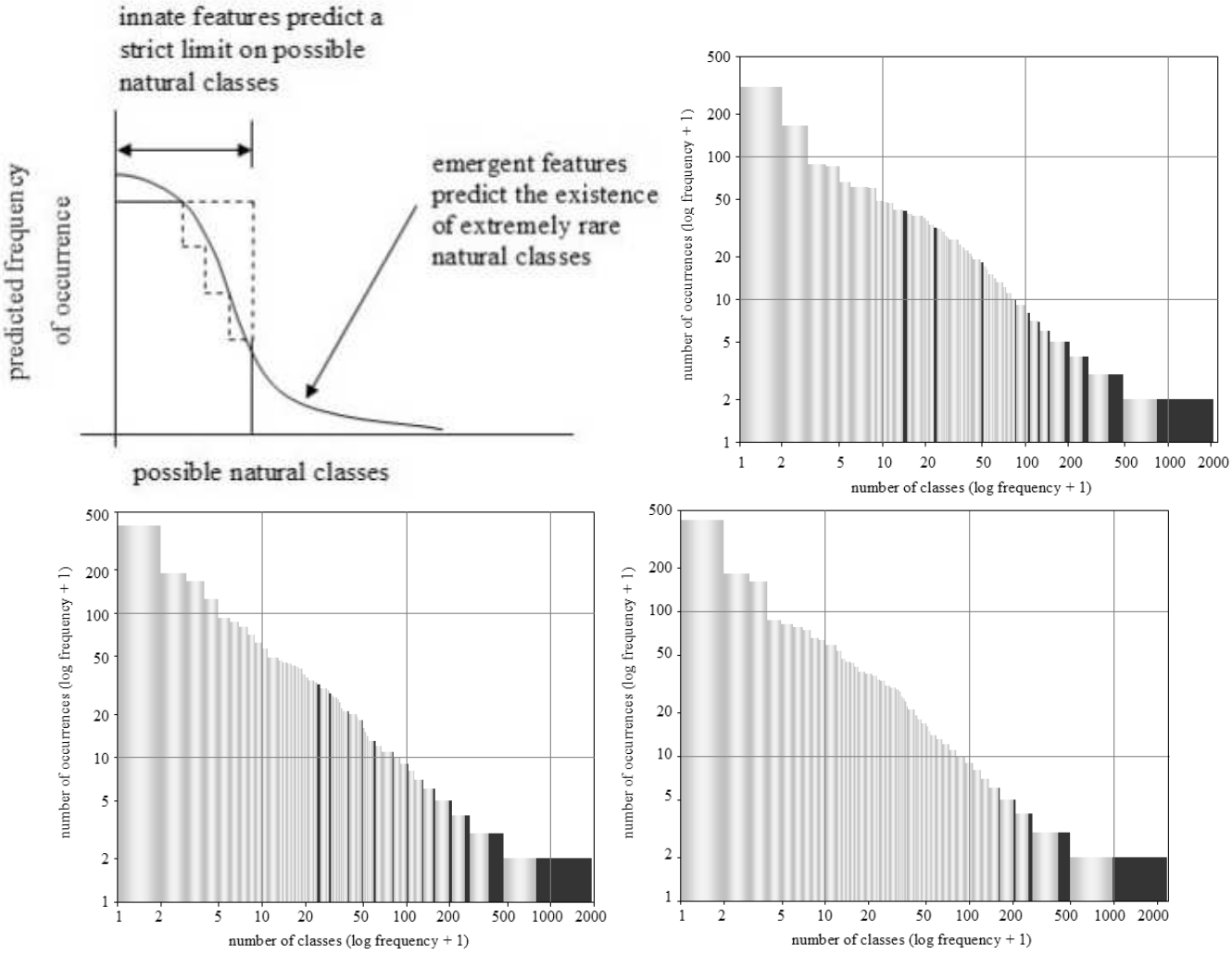

Figure 1: Clockwise from top left: Predicted distributions of natural and unnatural classes, *Preliminaries* results, *SPE* results, Unified Feature Theory results. Light bars are natural classes, dark bars are unnatural classes.

(5) **Complex classes:** If unnatural classes are composed of smaller natural classes, innate features predict the most common components to be the most common classes.

- For example, consonants (including liquids) are not a natural class in *Preliminaries*. But...
- Treating them as complex classes requires rare feature specifications.
- The most common unnatural class, [cons, oral] $\vee$ [non-vocalic], occurs 40 times, but its components occur only 6 and 23 times, respectively.

(6) Common complex class components and their frequencies as natural classes:

	As component		As natural class		
	Rank	n	Rank	n	Class
Preliminaries	#1	150	#32	23	[non-vocalic]
	#2	123	#18	36	[consonantal, vocalic]
	#3	98	#2	164	[nasal]
SPE	#1	51	#245	2	[+coronal, –tense]
	#2	41	#156	4	[+lateral]
	#3	34	#245	2	[+vocalic, –lateral]
UFT	#1	203	#55	11	[+open1]
	#2	63	#322	1	[+nasal, Labial]
	#3	60	#5	91	[+SYLLABIC, Labial]

(7) Treating unnatural classes as complex classes simply involves patching together whatever classes are necessary to fix a hole in the theory's coverage. *Any class can be represented this way!* Innate features have no account for why many of them are more common than most possible *natural* classes.

(8) **Ambivalent segments:** Emergent features predict (correctly) that segments with relatively unpredictable phonological patterning (like [l]) are those which are also relatively ambiguous phonetically:

	[+continuant]		[–continuant]	
/z̪ z ʐ ʒ ʑ ʝ/ etc.	41	87.2%	6	12.8%
/l̪ l ɭ ʎ/ etc.	36	52.9%	32	47.1%
/n̪ n ɳ ɲ/ etc.	17	44.7%	21	55.3%
/d̪ d ɖ ɟ/ etc.	1	2.3%	43	97.7%

Among classes which are natural *only* with the use of [+/–continuant], canonical [+cont] and [–cont] sounds are most consistent in their phonological patterning.

(9) **Emergent Feature Theory: Natural class behavior can be accounted for without innate features.**

(10) Reason #1 to expect natural classes without innate features: **Sound change**

- Some recurrent classes can be accounted for directly from sound change.
- For example, if phonetic vowel nasalization affects all vowels, and this effect is reinterpreted as phonology, the resulting alternation would likely affect the class of vowels and the class of nasals.

(11) Reason #2 to expect natural classes w/o innate features: **Generalization**

- Generalization is a general cognitive process by which observations about a stimulus are applied to similar stimuli.
- The "wrong" generalization may lead to an accidental extension of a class, presumably to some phonetically-coherent set.
- The result is likely to be a phonetically natural class.

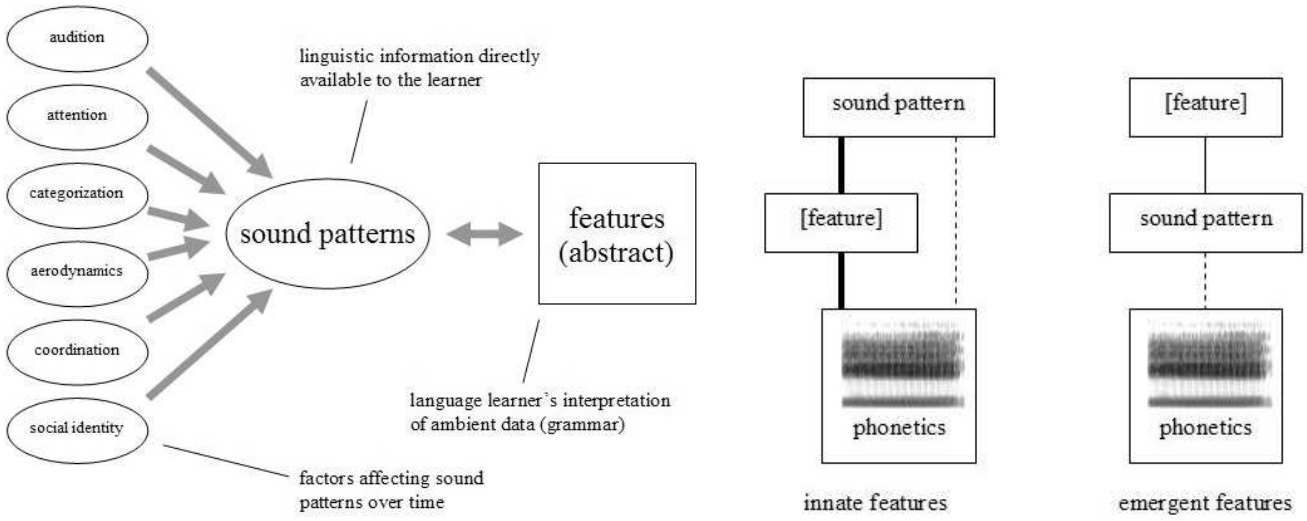

Figure 2: Abstract features from concrete external factors (left), relationships between phonetics, features, and sound patterns (right)

(12) Natural and unnatural classes

- In the literature on innate features, unnatural classes are often attributed to such external factors as history, phonetics and social identity.
- I am arguing that *all* classes are attributable to these "external" factors.
- The most common sequences of events lead to what we know as *natural* classes, and less common ones lead to *unnatural* classes.
- Our understanding of external factors (and typology) enables us to predict which classes may be more common than others.

CONCLUSIONS: Although frequently marginalized, "unnatural classes" are actually quite numerous, and part of the reality of language. There is no boundary between natural and unnatural classes, and both may be accounted for by the same independently-motivated external mechanisms. Fortunately, many of the insights of innate feature theory can be recast in Emergent Feature Theory...