

PHONOLOGICAL THEORY AGORA 2019

MARKEDNESS IN PHONOLOGICAL COGNITION

TUTORIAL

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Goals

- ▶ « What is not agreed, however, is if **markedness and melodic primes are universal properties of language**, and thus a part of UG and innate, **or if they are emergent patterns** based on environmental information gathered by the child. »
 - ▶ Tobias Scheer, p.c.
- ▶ “Would you consider ... taking on the **classical position** where the set of features and/or markedness constraints is **universal** and **part of UG**?”
 - ▶ Tobias Scheer, p.c.
- ▶ Is markedness universal?
- ▶ Is markedness innate?

Structure

- ▶ A: What is markedness?
- ▶ B: Where is markedness (in formal terms)?
- ▶ C: Theory of markedness
- ▶ D: Does markedness require universal features?
- ▶ E: How do we discover markedness? (Methodology)
- ▶ F: Evidence for markedness
- ▶ G: Current issues in markedness

- ▶ Argument
 - ▶ Theory -> Responsibility
 - ▶ Methods -> Evidence
 - ▶ Do we know anything?
 - ▶ No.

A: What is markedness? Non-cognitive tradition

- ▶ Ambiguous! Taxonomy vs. Cognition
- ▶ Taxonomic markedness
 - ▶ Taxonomic goal: To describe and classify languages
 - ▶ Markedness: A means of description and classification
 - ▶ “The greatest use of such explicit structural descriptions [as in Harris 1957] will be in the cataloguing of language structures, and in the comparing of structural types.” (Harris 1957:3)
- ▶ “Language” = definition(?)
 - ▶ Communicative system used by members of some community
- ▶ “Markedness” = definition
 - ▶ “prototypicality”, where there are prototypical inventories, structures, etc.
 - ▶ Certain elements (segments?) are common in inventories and corpuses, learned early, and so on

A: What is markedness? Non-cognitive tradition 2

- ▶ [t] occurs in lots of consonant inventories
- ▶ [q] does not occur in many inventories
- ▶ Therefore, [q] is more marked than [t]
- ▶ We can classify languages based on their inventory markedness
- ▶ We can classify them based on their inventories:
 - ▶ [t q] vs [t]
 - ▶ No (or rare) languages with [q] but no [t]

A: What is markedness? Cognitive 'tradition'

- ▶ Which tradition?
 - ▶ SPE chapter 9
 - ▶ ... de Lacy (2006) *Markedness*
 - ▶ and many others
- ▶ What does 'markedness' mean for cognitive theories?
 - ▶ Specifically Generative ones
 - ▶ Specifically about the **Phonological Module (PhM)**
- ▶ Let's define states...

A: What is markedness? Cognitive 'tradition'

- State of the PhM
 - Input = any permissible input structure (i.e. not just lexical items)
 - A complete input->output mapping set
 - All possible inputs and (all of) their mappings to outputs
 - There are many possible PhM states

Inputs	/in1/	/in2/	/in3/	/in4/	/in5/	...
	↓	↓	↓	↘	↓	
Outputs	[out1]	∅	[out2]		[out3]	...

- A “grammar” is a mechanism that describes a state (rules, constraints, etc.)

A: What is markedness? Cognitive 'tradition, 2

- ▶ Are there asymmetries in states?
 - ▶ i.e. are there definable states that don't exist in the PhM?
- ▶ Suppose we examine all possible states of the PhM
 - ▶ Some state(s) in which /p/->[t] in codas: e.g. /ip/ -> [it]
 - ▶ No state in which /t/->[p] in codas: e.g. ☠ /it/ -> [ip]
 - ▶ This is an 'asymmetry'
 - ▶ We need a theory of such PhM state asymmetries
- ▶ A **theory of PhM state asymmetries** is a **theory of PhM markedness**

A: What is markedness? Taxonomic vs. Cognitive

- ▶ There are *big* differences between taxonomic and cognitive markedness
- ▶ Object of study
 - ▶ Taxonomic: 'language'
 - ▶ Cognitive: PhM states
 - ▶ **Caveat:** Phonologists lazily use the term 'language' when they mean 'state' (or more often 'grammar')
- ▶ Generality
 - ▶ Taxonomic: all factors relevant to a language
 - ▶ Cognitive: only asymmetries **in the PhM**, not other modules or mechanisms

A: What is markedness? Other markednesses

- ▶ Optimality Theory “markedness constraints”
 - ▶ *Should* be called ‘output constraints’
 - ▶ OT’s markedness constraints do *not* implement a theory of markedness
 - ▶ *Both* markedness and faithfulness constraints are needed to explain asymmetries

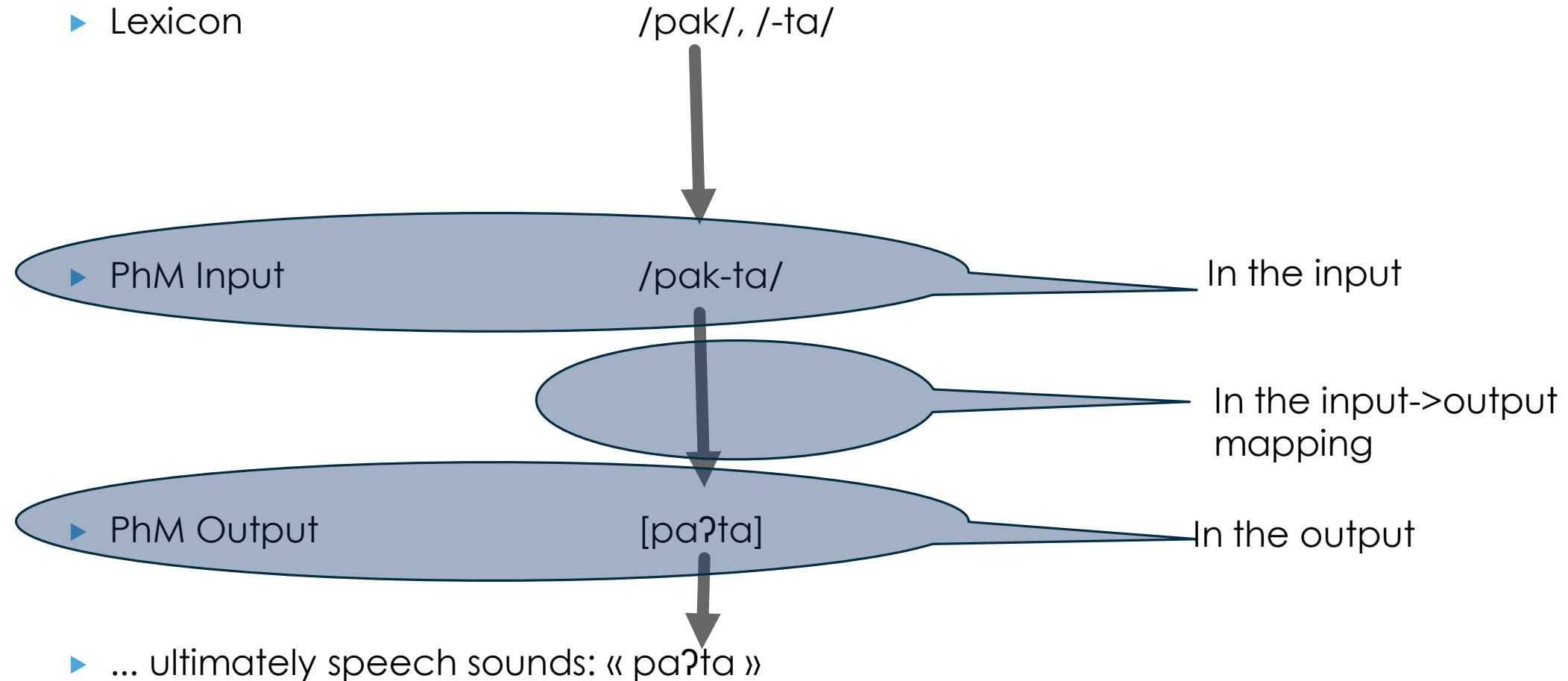
A: What is markedness? Summary

- ▶ The rest of this talk focuses on **cognitive markedness**, specifically in Generative theories
- ▶ 'Markedness' refers to PhM state asymmetries
- ▶ A theory of markedness is a theory of PhM state asymmetries
- ▶ **Are** there any PhM state asymmetries?
- ▶ **Where** would we look?

B: Where is markedness?

- ▶ Taxonomic markedness
 - ▶ Largely about 'surface' properties – directly visible ones
 - ▶ Phoneme theory complicates things – definitely not about direct surface properties
- ▶ Taxonomic legacy in cognitive theories
 - ▶ A great deal of work on 'markedness' focuses on *outputs*.
- ▶ Where else should we look?

B: Where is markedness? Generative model



B: Where is markedness? The output

- ▶ An output markedness observation
 - ▶ “No state has output o_1 [in the context of $o_2, o_3, \dots$]”
 - ▶ “No state has trisyllabic feet”
 - ▶ “If a state has no [t] in its outputs, then some outputs have a [ʔ]” (deL06)
 - ▶ “If a language doesn’t have a [t], it must have a [ʔ].”
- ▶ A great deal of research focuses on output markedness
 - ▶ But is this is where asymmetries are to be found?

B: Where is markedness? The output: Coda stop inventories

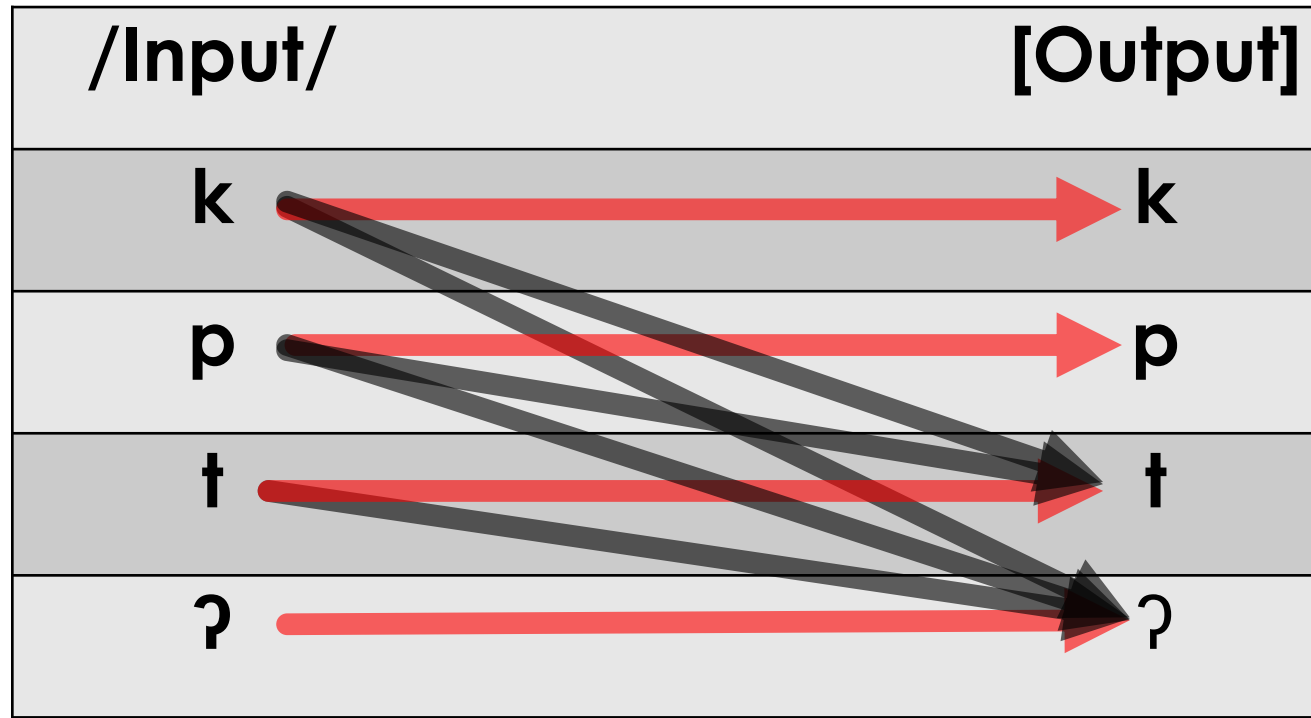
		k	p	t	ʔ	
	markedness-compliant				X	Kashaya (Buckley 1994), Kelantan Malay (Teoh 1988, Trigo 1988), Toba Batak (Hayes 1986)
				X	X	Chickasaw (Munro & Ulrich 1985)
			X	X	X	Standard Malay (below)
		X	X	X	X	Pendau (Quick 2000§4.2.1)
				X		Uradhi (Hale 1976, Crowley 1983)
			X	X		Formal Kiowa (Watkins 1984)
		X	X	X		New Zealand English
	Markedness-gapped		X		X	Nganasan (Helimski 1998)
		X			X	Fuzhou (Yip 1982:646)
		X	X		X	Yamphu, Cockney English (Sivertsen 1960)
		X		X	X	Nambiquara (Kroeker 1972)
		X		X		Mordva (Zaicz 1998)

B: Where is markedness? The input

- ▶ Are there asymmetries in inputs?
- ▶ Do we find that inputs systematically lack information found elsewhere (e.g. outputs)?
- ▶ Inputs lack prosodic structure
 - ▶ No contrastive syllabification
 - ▶ No contrastive footing
 - ▶ Yes: Contrastive *main stress* (see de Lacy 2018 for a theory about that)

B: Where is markedness? Mappings

- ▶ A mapping asymmetry:
 - ▶ Some states have $/A/ \rightarrow [B]/_E$
 - ▶ No state has $/B/ \rightarrow [A]/_E$



Important

These asymmetric mappings can generate complete inventories!

B: Where is markedness? IO Mappings 2

- ▶ See de Lacy (2006) in *Theoretical Linguistics*

	/b/	/d/	/g/
Attested	p	t	k
No	p	t	g
No	p	d	k
No	p	d	g
No	b	t	k
No	b	t	g
No	b	d	k
Attested	b	d	g

B: Where is markedness? Representation & Computation

- ▶ Computational markedness
 - ▶ When a computational mechanism applies to one structure/mapping, but not the inverse
 - ▶ e.g. /dorsal/ -> [coronal] /__σ, but not /coronal/ -> [dorsal]/ __σ
 - ▶ e.g. ***dorsal**, but no ***coronal**
- ▶ Representational markedness
 - ▶ Classic: *complexity*
 - ▶ When structure A is more complex than B (e.g. B is a proper substructure of A)
 - ▶ The computational system refers to that complexity

C: Principles of markedness in de Lacy (2006)

- ▶ Markedness hierarchies
 - ▶ are feature hierarchies: Orders between feature values
 - ▶ Voice: [+voice] > [-voice]
 - ▶ PoA: dorsal > labial > coronal > glottal
 - ▶ Onset sonority: onset/glides,laryngeals > onset/liquids > onset/nasals > onset/obstruents
 - ▶ Head sonority: FtHd/ə > FtHd/i,u > FtHd/e,o > FtHd/a
- ▶ **Markedness hierarchies** are converted into **constraints**
- ▶ Markedness hierarchies are **not segment hierarchies**
 - ▶ There is no “least marked segment”
- ▶ Consequence: segments can *clash* in markedness
 - ▶ e.g. ? is unmarked in **PoA**, but marked in **sonority**

C: Principles of markedness in de Lacy (2006) (GIMF)

- ▶ Preservation of the Marked
 - ▶ In rule-based theories, 'preservation' refers to *rule non-application*
 - ▶ In parallelist theories, 'preservation' refers to specific constraints (e.g. faithfulness)
 - ▶ In OT: for a hierarchy $A > B$, there are faithfulness constraints $F(A)$, $F(A,B)$, but no $F(B)$.
- ▶ Example: Coda /t/->[?] in Yamphu, but [k] and [p] do not

/akmat/	Faith (dorsal)	*dorsal	*dors,lab,cor	Faith (dors,lab,cor)
ak.mat		*	* *!	
a?.ma?	*!			* *
a?.mat	*!		*	*
↺ ak.ma?		*	*	*

C: Principles of markedness in de Lacy (2006) (GIMF)

- ▶ Markedness conflation
 - ▶ If $A > B$, does this mean:
 “A is more marked than B”
 or “B is never more marked than A”?
- ▶ Conflation is a fairly complex topic
 - ▶ Avoid stressed [i] and [e] equally, even though stressed [e] is less marked than stressed [i]
- ▶ Conclusion: B is never more marked than A.
 - ▶ Perhaps we should represent markedness as: $A \geq B$

C: Principles of markedness in de Lacy (2006) (GIMF)

- ▶ Summary
- ▶ (a) Hierarchies are **featural**, not segmental
 - ▶ Therefore, we can expect some **segmental markedness contradictions**
- ▶ (b) Markedness reduction: $A > B$ licenses $/A/ \rightarrow [B]$
- ▶ (c) Markedness preservation: $A > B$ licenses $/A/ \rightarrow [A]$ even if $/B/ \rightarrow [B']$
- ▶ (d) Markedness conflation: $A \geq B$, not $A > B$

D: Is markedness universal and innate?

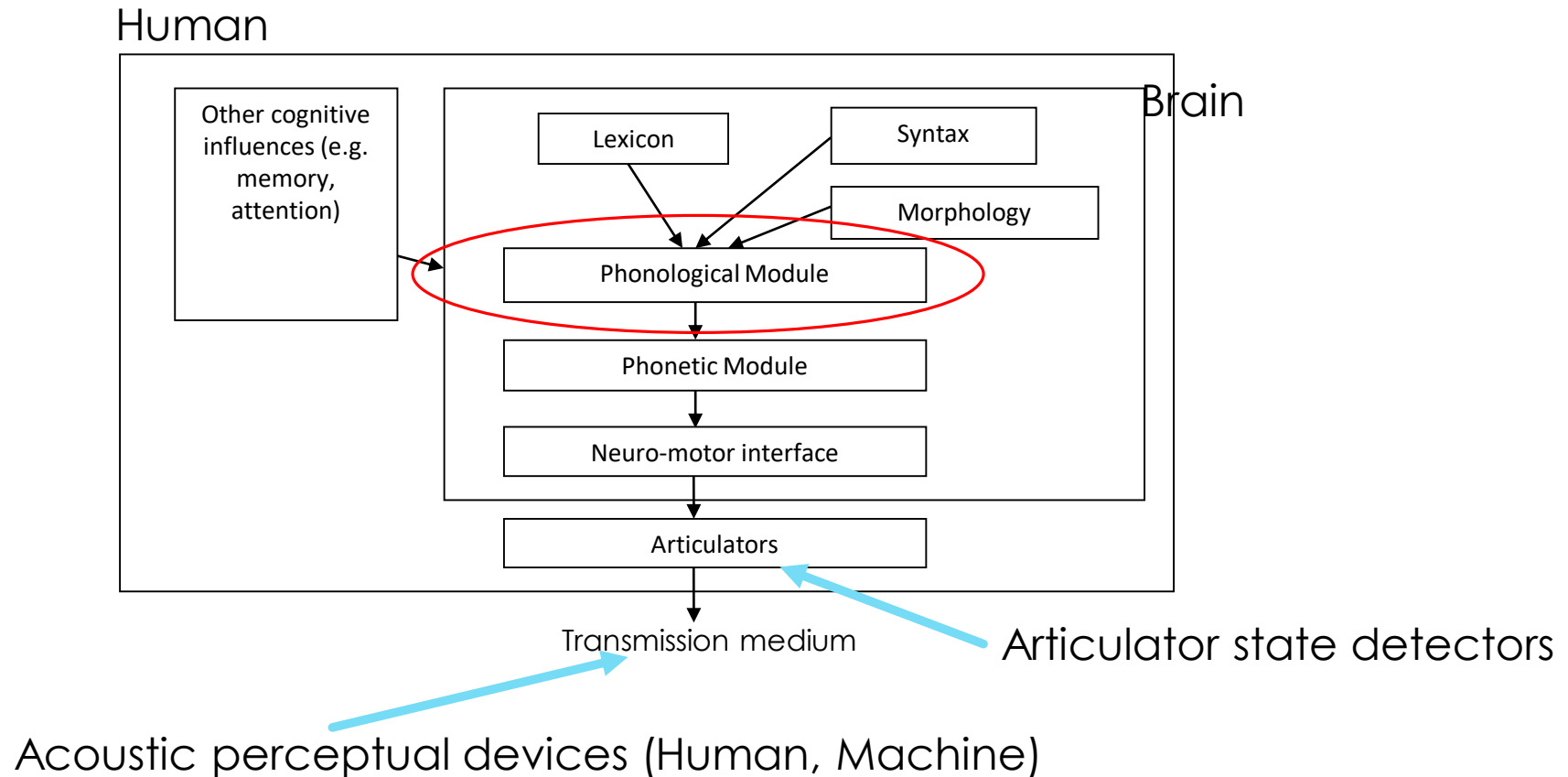
- ▶ What does “Is markedness universal?” mean?
 - ▶ deL06: Are feature value hierarchies and the computational mechanisms that refer to them (e.g. constraints) found in every PhM?
 - ▶ Answer: Yes, otherwise there would be no universality of consequences
- ▶ “Can we have markedness (i.e. PhM state asymmetries) without universal features?”
 - ▶ No.
 - ▶ It is not possible to have feature value hierarchies without having the features that they refer to.
- ▶ “If we have universal features, **must** we have universal markedness?”
 - ▶ No.
 - ▶ However, defining a theory that has **no** asymmetries **anywhere** is not trivial!
- ▶ If someone says “The phonological module can do anything!”
 - ▶ Ask “What is your PhM theory?”

E: Discovering markedness

- ▶ Where do we get our evidence for the PhM?
- ▶ Observations from 'devices'
 - ▶ Human perception (e.g. in fieldwork)
 - ▶ Interpretation of spectrograms (by human or algorithm)
 - ▶ Interpretation of grammars
 - ▶ etc.
- ▶ Problem: No device that sees PhM inputs/outputs **directly**

GENERATIVE PHM-CONTAINING THEORY AND DEVICES

For *some* human, *some* PhM, in *some* state ...



E: Discovering markedness: The cognitive contribution

- ▶ For any observation:
 - ▶ what is the contribution of the PhM?
 - ▶ what is the contribution of other modules/mechanisms?
- ▶ Example: /ʔ/ transference
 - ▶ We deduce that there is an input /paʔ/, yet detect «pa̤»

	Option A	Option B	Option C
PhM input	/ paʔ /	/ paʔ /	/ paʔ /
PhM output	[pa̤]	[paʔ]	[paʔ]
Phonetic module output	[[pa̤]]	[[pa̤]]	[[pa̤ʔ]]
Speech sounds	<< pa̤ >>	<< pa̤ >>	<< pa̤ >>

E: Discovering markedness: The cognitive contribution

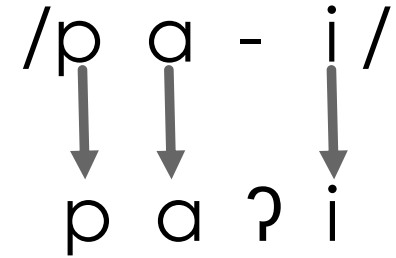
- ▶ “[s] is found in 80% of languages, and so [s] is quite unmarked”
 - ▶ *A taxonomic statement; not a cognitive one*
- ▶ Translating into something cognitively expressible
 - ▶ There is some PhM state in which some output contains [s]
 - ▶ There is some PhM state in which [s] does not occur in any output
- ▶ If there is a ‘language’ with [s], then we **could** assume that there is some human who has an L1 intact PhM that generates [s]
 - ▶ This is not actually a reasonable assumption, but let’s assume it anyway.

E: Discovering markedness: The cognitive contribution

- ▶ What we can know:
- ▶ If, for some human, $/A/ \rightarrow [B]$, then there is at least one PhM state in which $/A/ \rightarrow [B]$
 - ▶ Assuming human PhM homogeneity
- ▶ Compare: “Every language has a [t], except Hawaiian”
 - ▶ Translation: “There are PhM states with [t] and states without [t].”
- ▶ What about “80% of PhM states have some output that contains [s]”
 - ▶ Not valid!
 - ▶ Assumes that “language” = PhM state!
 - ▶ Guns! Germs! Steel!

F: Evidence for markedness: A practical example

- ▶ Is **consonant epenthesis** evidence for markedness?

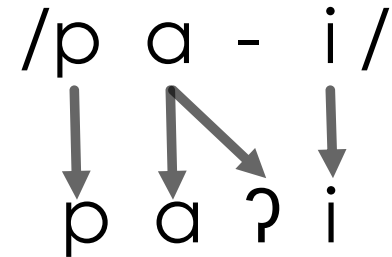


- ▶ **First question:** What is epenthesis?

- ▶ deL06: An epenthetic consonant is one which has **no input correspondent**.
 - ▶ In **non-assimilative** environments, epenthetic consonant quality can *only* be determined by output constraints.
 - ▶ Output constraints are constructed via markedness hierarchies
 - ▶ Therefore, non-assimilative consonant epenthesis provides (relatively!) easy insight into markedness hierarchies.

F: Evidence for markedness: A practical example

- ▶ Staroverov (2014): Epenthetic consonants ALWAYS have **input correspondents**.



- ▶ Consequence of Staroverov (2014)'s theory:
 - ▶ Epenthetic consonants (almost?) *never* show the direct effect of output constraints, and therefore markedness hierarchies.
 - ▶ Makes **different predictions** from deL06's theory: i.e. just glides and laryngeals
- ▶ Point: It's not possible to say "X is evidence for markedness"
 - ▶ It's necessary to specify the *theory*.

F: Evidence for markedness: A practical example

- ▶ Assuming deL06's theory...
- ▶ How do we detect epenthetic consonants?
 - ▶ A: the theory tells us
 - ▶ For any putative epenthetic consonant C, we must demonstrate that:
 - ▶ C is lacking in the input
 - ▶ C is not influenced by assimilation or dissimilation

Epenthetic ? : Sample evidence

- ▶ How hard is it to do this?
 - ▶ Quite hard: de Lacy & Kingston (2013)
 - ▶ Alternations!
 - ▶ Not suppletive allomorphy!

[po] *root1*
[po?a] *root1 + affix1* (? appears!)
[no?] *root2* (so *root1* is not /po?/!)
[poka] *root3 + affix1* (so *af1* is not /?a/...)
[ak?a] *root4* (as long as [k?] is allowed)

F: Evidence for markedness: A practical example

- ▶ **How do we ‘prove’ a statement like “[k] is never default-epenthetic”?**
i.e. there is no PhM state in which $\emptyset \rightarrow [k]$ (modulo assimilation/dissimilation)
(de Lacy & Kingston 2013)
- ▶ I have never observed epenthetic [k], but **so what? (et alors?)**
- ▶ Commonality?
 - ▶ How common is [k]? (97.12% of UPSID languages)
 - ▶ How common is epenthesis? (??)
 - ▶ What else are we assuming can be epenthetic? [p t ʔ ...?]
 - ▶ Roughly!: $p(k) \cdot p(\text{epenthesis}) \cdot (1/n_{\text{epenthetic}}) = \text{????}$ (reasonably high?)
- ▶ Learnability
 - ▶ Is epenthetic [k] learnable?
 - ▶ Hard to see why not. We can model its learning.

F: Evidence for markedness: A practical example

- ▶ Is epenthetic [k] **actuatable**?
 - ▶ Yes, through misperception (de Lacy & Kingston 2013)
 - ▶ Diachronic evidence: *t > k in Oceanic
- ▶ Is epenthetic [k] **transmissible**?
 - ▶ Probably.
 - ▶ cf. word-initial glottal stops (easy to actuate, hard to transmit)
 - ▶ cf. clicks (hard to actuate, easy to transmit)
- ▶ Epenthetic [k]?
 - ▶ Potentially common
 - ▶ Learnable
 - ▶ Actuatable
 - ▶ Transmissible
 - ▶ Yet not attested.

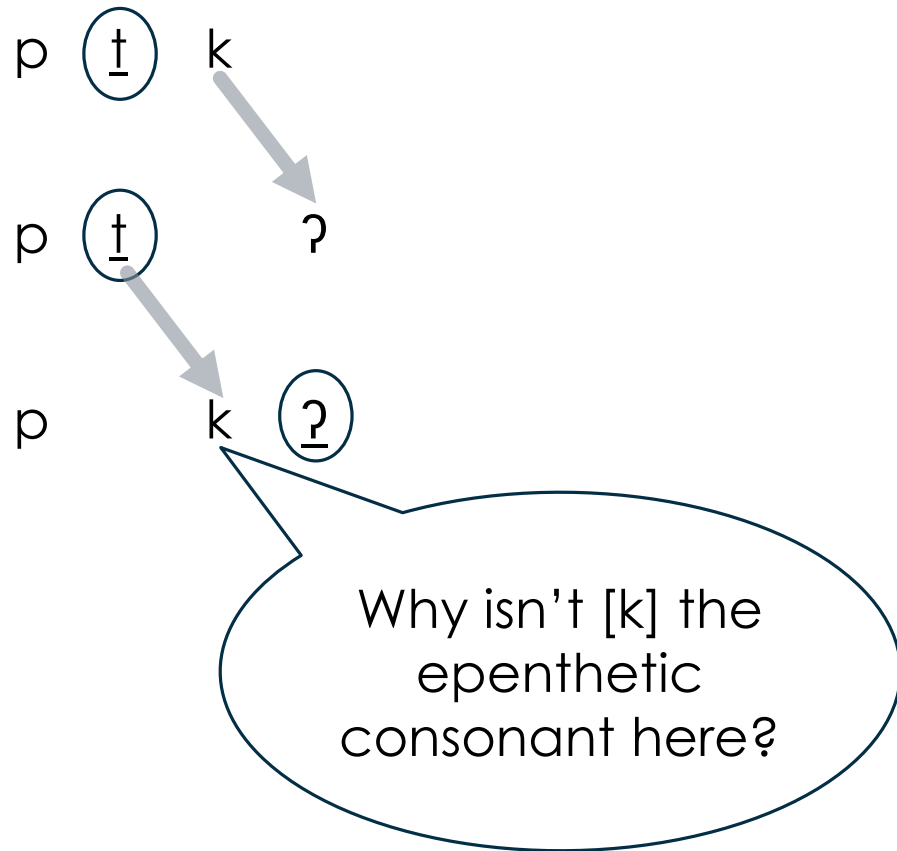
F: Evidence for markedness: A practical example

- ▶ Epenthetic [k]: diachronic path

- ▶ Proto-Eastern Polynesian: p t k

- ▶ Pre-Hawai'ian: p t ?

- ▶ Hawai'ian: p k ʔ



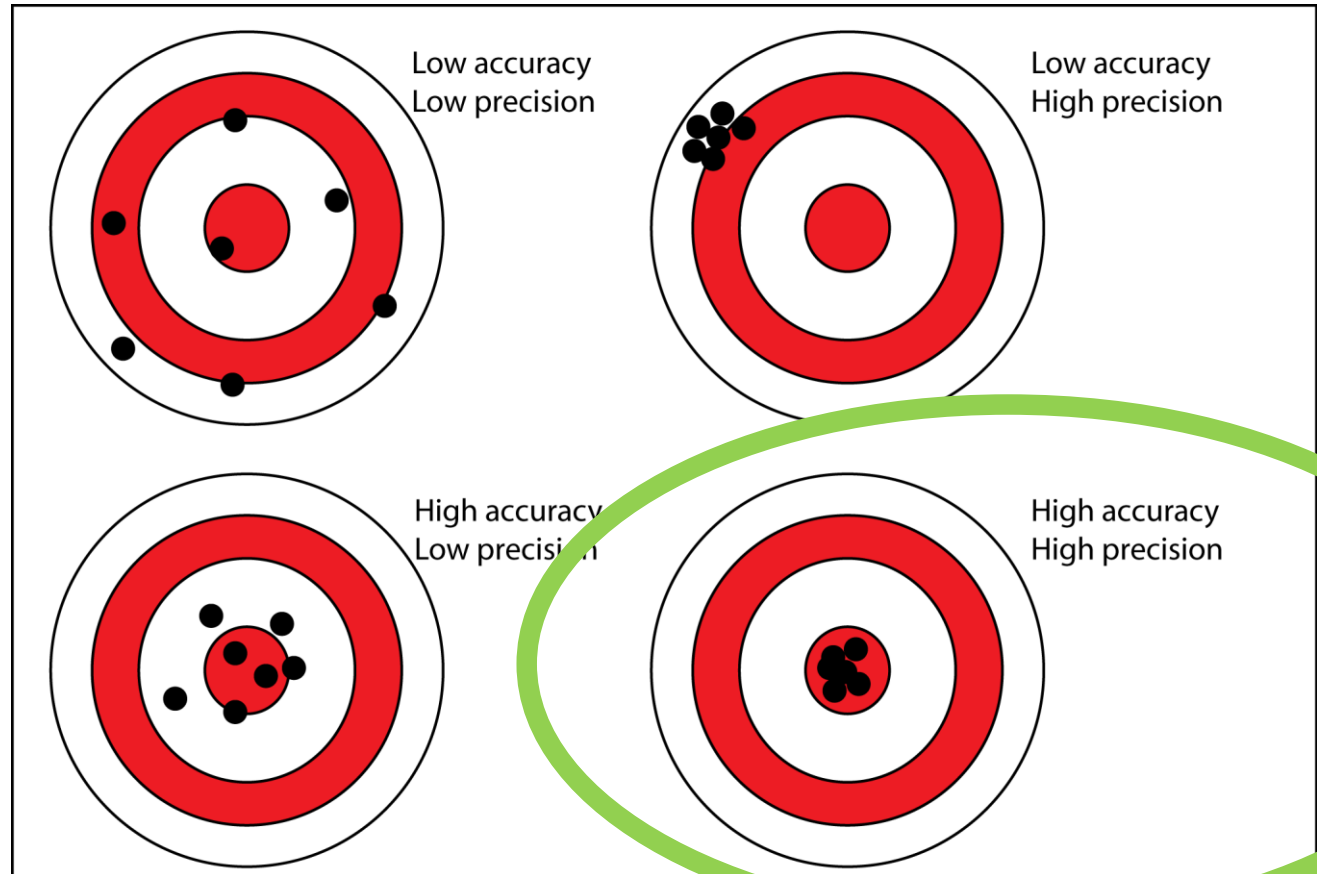
Why isn't [k] the
epenthetic
consonant here?

G: Current Issues in Markedness

- ▶ Is phenomenon X evidence for markedness?
 - ▶ Depends on the theory!
 - ▶ No evidence without a theory.
 - ▶ No 'atheoretism'/'theory neutrality' (see Medawar 1969 *Induction and intuition in scientific thought*)
- ▶ The big problem with markedness is the same problem we find with all phonological work
 - ▶ Methodology
 - ▶ Evidence

H: Methodology

- ▶ For any evidence type, we have a **method M** of evidence collection
 - ▶ Is M reliable?
 - ▶ Is M precise? (How so?)
 - ▶ Is M accurate?



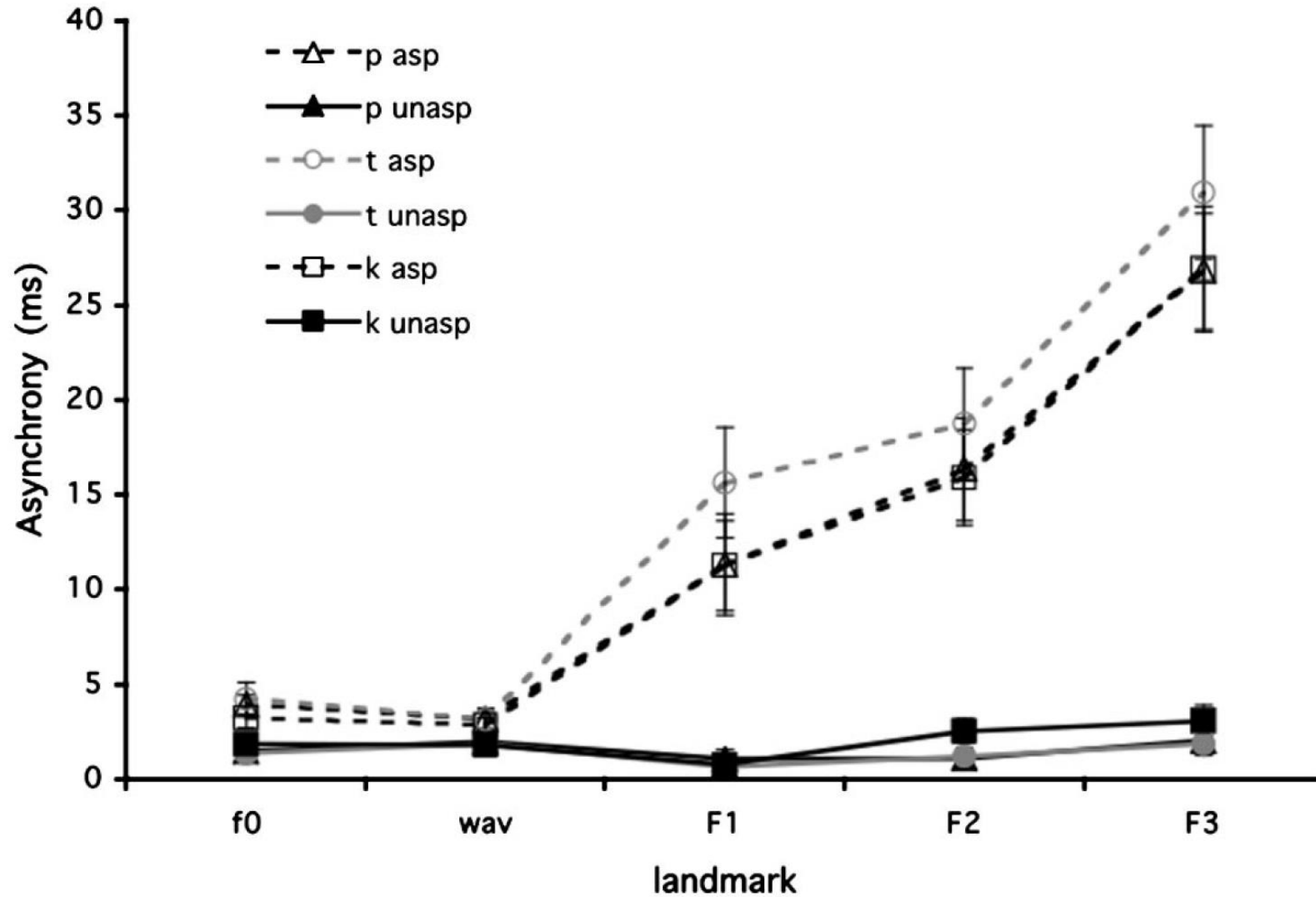
Reliability: Gujarati stress

Source	Categories				
Penultimate stress					
Turner 1921 Master 1925: 2σ	a	ε ɔ e o	u	i	ə
Sonority-driven stress					
Mistry 1997 de Lacy 2002: 2σ Cardona & Suthar 2003: 2σ & 3σ	a	ε ɔ e o	u	i	ə
Cardona 1965: 2σ de Lacy 2002: 3σ Doctor 2004: 2σ Schiering & van der Hulst 2010: 2σ & 3σ	a	ε ɔ e o	u	i	ə
Cardona 1965: 3σ Doctor 2004: 3σ	a	ε ɔ e o	u	i	ə
Adenwala 1965: 2σ	a	ε ɔ e o	u	i	ə
Campbell & King 2011 Modi 2013: 2σ	a	ε ɔ e o	u	i	ə

Shih & de Lacy
to appear;
see Shih (2018a)
Phonology,
Shih (2018b) - PhD

Table 1. *Sonority distinctions in descriptions of Gujarati stress*

Accuracy and Precision in VOT



Comparing 6 methods
of measuring VOT

Francis et al (2002)
J Acoust Soc Am 113(2)

Can we trust evidence for epenthesis?

- ▶ Very little careful work showing that putative epenthesis is actual epenthesis
 - ▶ de Lacy & Kingston (2013)
 - ▶ Staroverov (2014)
- ▶ Staroverov (2015)
 - ▶ Showed that an apparently robust case of dorsal epenthesis (in Buryat), is not reproduced with novel morphemes
- ▶ Staroverov (2014)
 - ▶ Showed that Apurucayali (~‘Axininca Campa’ ☹) does not have epenthetic [t]
- ▶ What’s the reliability, accuracy, and precision of epenthesis methodology?

Conclusions

- ▶ If someone says “markedness”...
 - ▶ Are they talking about taxonomic markedness or PhM state asymmetries?
- ▶ If they are talking about cognition, then
 - ▶ What's the theory?
 - ▶ We have a right to know!
 - ▶ No evidence without a theory!
- ▶ If someone says “Here is evidence for/against markedness”
 - ▶ Does the PhM theory claim that it is responsible for this evidence?
 - ▶ Does the theory assign responsibility to other modules and mechanisms?

Conclusions

- ▶ If someone says “Here’s some evidence ...”
 - ▶ Ask “**Is your method valid?**”
- ▶ What’s next
 - ▶ We have many theories that make (more or less) clear predictions.
 - ▶ Now let’s study method validity.
 - ▶ Then we can figure out what our evidence is.
 - ▶ Then we’ll know if PhM theories with state asymmetries (‘markedness’) are right.

Thanks!

- ▶ Thanks to Diana Passino, Jonathan Bucci, Alex Chabot, Paolo Danesi, and Tobias Scheer for inviting me.
- ▶ Thanks to whoever paid for this conference.
- ▶ If my dinner is free, thanks for that, too.
- ▶ Thanks to many audiences over many years for their feedback on related work (Barcelona, UDelaware, UMass, Cornell, and many others).