On the evolution of heterophony: semantic pressures on phonetic forms

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“Neutralization” is a conditioned limitation on the distribution of a language’s contrastive values.

Silverman (2012):
Neutralizing alternations (rarely) derive homophones
This is a function-negative outcome

Neutralizing alternations (typically) serve as an aid to parsing
This is a function-positive outcome

Today’s goal: to demonstrate these functional consequences of neutralizing alternations, and to suggest that we might employ the heterophony-maintenance proposal as a framework for linguistic inquiry

Martinet (1952): Languages may tolerate neutralization (sound mergers) up to derived homophony; potentially excessive derived homophony tends to inhibit neutralization

Labov (1994): “It is not the desire to be understood, but rather the consequence of misunderstanding that influences language change. This mechanism implies a mismatch between producer and interpreter: the type of built-in instability that we would expect to find behind long-term shifts in language behavior”

Semantic misperception (Labov, *pace* Baudouin de Courtenay, Martinet): "If speakers do not consciously or unconsciously adjust their sentences to maximize the transmission of meaning, then we need to find some other mechanism that accounts for the systemic adjustments that maintain informational content" (1994: 585)

Spontaneous phonetic variants that are semantically confusing to listeners are unlikely to be reproduced, hence will never get off the ground as new conventions

The very spoken variants (*chance* variants) that are successfully communicated to listeners are also the very variants (*selected* variants) that are likely to be reproduced as these listeners become speakers

Successful speech propagates; failed speech does not get reproduced

39 **Hypothetical example (Labov 1994):**

The speaker:	The listener:
Intends: drɑp (“drop”)	
Produces: dræp (“drop”)	Hears: dræp (“drop”)
	Pools: dræp (“drop”)

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The speaker:	The listener:
Intends: blɑk (“block”)	
Produces: blæk (“block”)	Hears: blæk (“????”)
	Maintains: blɑk (“block”)

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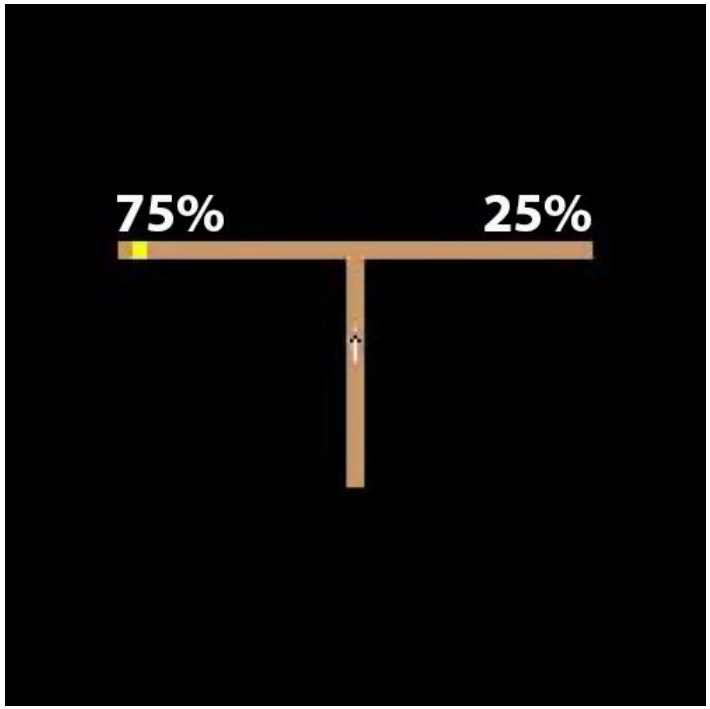
The mechanisms:

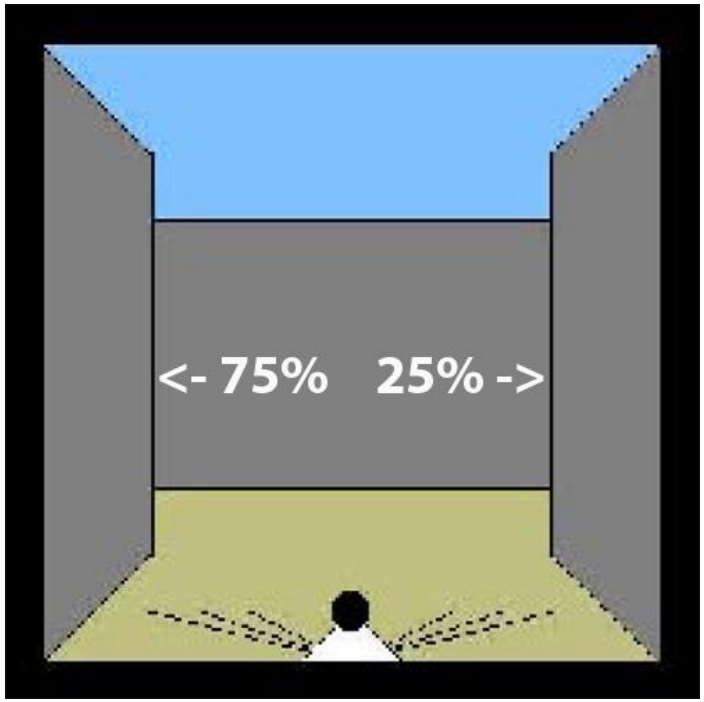
Probability matching:

Animals perform sophisticated statistical analyses as they navigate the world around them, e.g. in foraging, they match their behavior in terms of likelihood of payoff….even in the lab

Environment:



Behavior:



Similar statistical calculations underlie aspects of human linguistic behavior, in that the nature and extent of variation in speech is indeed largely matched as listeners become speakers:

In phonetics (for example): variable vocalic nasalization: different languages vary in different ways (Clumeck 1976).

In morphology (for example): optional use of certain morphemes is probability-matched across speakers (Poplack 1980)

In the lab: Exposure to variably present markers in a contrived mini-language is recapitulated in their variable use by subjects (Hudson and Newport 1999)

Variation is conventionalized on a language-specific basis.

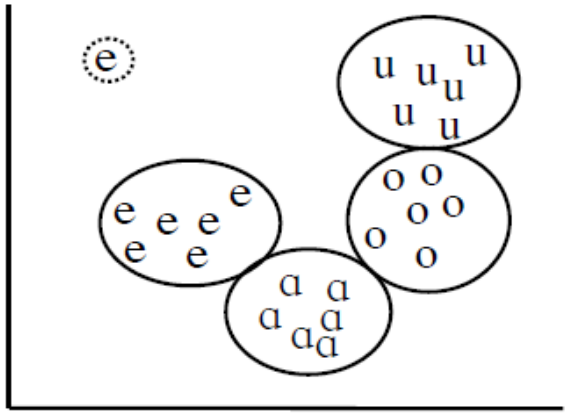
Exemplar theory:

Perceptual categories are defined as the set of all experienced instances of the category, such that variation among tokens actually contributes to the categorical properties themselves.

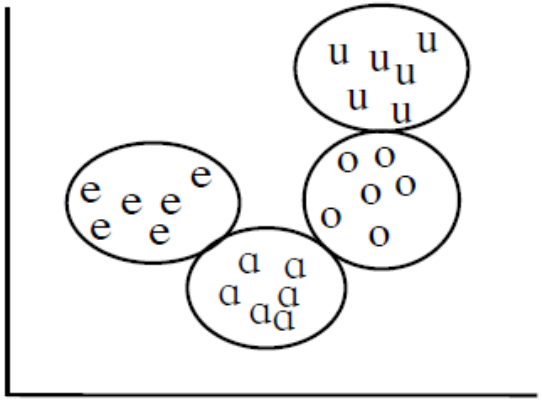
Global (motor) consequences: dispersion

Under certain conditions, probability matching of exemplars promotes category separation and phonetic **stability**:

Vowel production
(a **wild** stray):

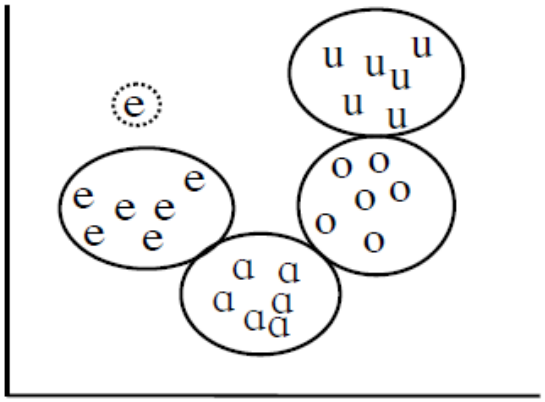


Vowel perception
(token thrown out):

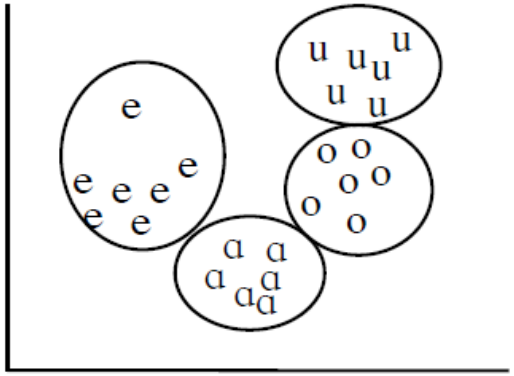


Under different conditions, probability matching promotes category separation and phonetic **change**:

Vowel production (a **mild** stray):



Vowel perception (token pooled):



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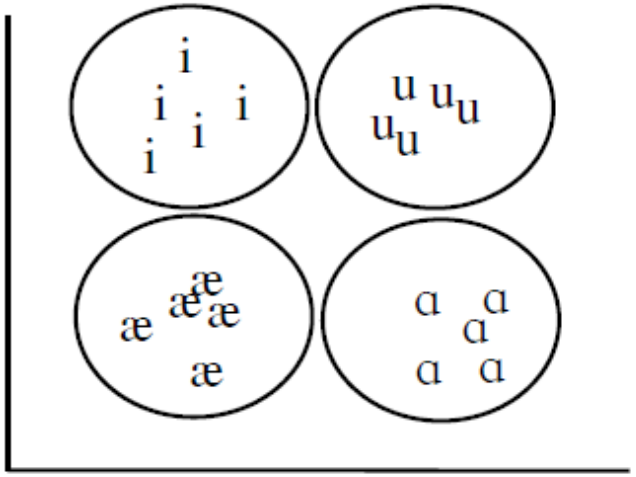
Newly evolved system:



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Local (lexical) consequences:
Neutralization and heterophony maintenance

There seem to exist semantic pressures on phonetic forms such that heterophony is largely maintained

Language use involves a built-in homophony-limiting mechanism

Labov (1994):

French: the plural marker -s has been lost except when a vowel follows, and thus, for example, the plural article la (earlier, las in all contexts) sometimes runs the risk of being homophonous with the singular

However, the plural is now (usually) signaled by a change in vowel quality: las > le (and is now non-“pro-drop”)

Labov: “[This] show[s] how long-range changes in the French phonological, morphological, and syntactic systems compensated for sound changes, in ways that suggest a causal link”

How it works (a quick summary)

(1) The low level phonetic variation inherent to speech production
(2) The consequences of **lexical semantic ambiguity** and **misunderstanding**, when similar words sound the same, and
(3) The tendency for speakers to **reproduce** the variation they perceive (upon successful perception)

"Successful" speech propagates; "failed" speech is passively filtered out of the system

Communicative success or failure affects the trajectory of language structure and change such that it inevitably settles towards a semantically unambiguous state

Martinet (1952): mergers are more likely to proceed when

(1) The values in opposition are phonetically similar

(2) The number of minimal morpheme pairs that the opposition is responsible for is low

(3) The number of minimal pairs within a correlated opposition is low (or the opposition is uncorrelated)

(4) The minimal pairs belong to different syntactic categories

(5) The lexical/token frequency of one or both members of the minimal pairs is low

(6) The presence of additional morphological markers serves a disambiguating function

Six linguistic domains over which heterophone maintenance is observed:

(1) Heterophone maintenance in the lexical domain: Sound mergers are more likely to proceed unimpeded (to the point of globality) if heterophony is maintained

Wedel, Kaplan, and Jackson (2013):

"[P]honeme pairs undergoing merger [previously distinguished] significantly fewer minimal pairs in the lexicon than unmerged phoneme pairs"

Eight languages: Korean, French, German, Dutch, Slovak, Spanish, Hong Kong Cantonese

"The more minimal pairs, the less likely merger is"

(2) Heterophone maintenance in the morphological domain: root homophony is indeed tolerated, but any counter-functional consequences are offset by a concomitant morphological response

Chinese

Middle Chinese possessed monosyllabic root-final consonants p˺ t˺ k˺ m n ŋ (still retained in Cantonese)

Mandarin now has only two: n ŋ

Mandarin possesses a significant amount of root homophony: Cantonese has about 1800 syllable shapes, but Mandarin has only about 1300, with largely equivalent semantic reference (Duanmu 2000)

Mandarin—but not Cantonese—co-evolved a huge inventory of two-root compounds, which means that its words are now usually two syllables in length, and so have ample opportunity to maintain distinctness

(3) Heterophone maintenance in the phonological domain: across-the-board alternations are more likely to enter a language if heterophony is largely maintained

Korean (Silverman 2010): Neutralizing alternations are rampant in Korean. But out of 35,907 nouns in an online corpus, there are only 42 sets of homophones as a consequence of five categorical neutralizing alternations investigated

Alternation	Number of nouns, both lexical and derived (out of 34,803)	homophonic sets	homophonic tokens (out of 1,234,323)
Aplosivization	10,138	15	6,117
Nasal lateralization	1,001	10	1001
Liquid nasalization	695	6	520
Nasal assimilation	7,592	10	732
Coronal assibilation	131	1	14
Cluster reinforcement	4,048	0	0
Totals:	13,258	42	8,384

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Kaplan (2011) compares actual neutralization patterns to simulated "hypothetical" patterns structurally similar to the actual patterns

In most cases, the actual pattern created fewer homophones than the hypothetical ones

“Lenition and Contrast” (Gurevich 2004)

Investigated 230 phonetically conditioned sound changes/alternations, mostly lenitions

92% are heterophone-maintaining

Gurevich: “This suggests that such processes [lenitions] do not operate independently of functional considerations”

(4) Heterophone maintenance in the phonotactic domain: neutralizing alternations that otherwise apply pervasively are blocked from applying in particular phonotactic contexts, thus avoiding excessive derived homophony

Hindi (Silverman 2011)

Schwa alternates with zero in would-be **VCəCV** contexts (this is historic syncope, not epenthesis; Misra 1967)

pitʃka	squeezed	pitʃək	squeeze
pɪgʰla	melted	pɪgʰəl	melt
dewrani	brother-in-law's wife	dewər	brother-in-law

The alternation is absent in **VCCəCV** and **VCəCCV**. Here, the middle **C** would be perilously susceptible to misperception: the loss of schwa in these contexts may lead to a percept involving only two—not three—consonants. **VCCəCV** and **VCəCCV -> VCCCV -> VCCV**. At this point, the chances of inducing homophony increase dramatically

By hypothesis, syncope is blocked if it would induce significant homophony (study yet to be undertaken…!)

But when **VCCCV**-creating syncope would *not* jeopardize the medial **C** (usually of the form *nasal* - *homorganic stop* - *sonorant*), it is variably observed (the stops do not possess oral values distinct from their preceding nasals):

kadəmbri ~ kadəmbəri	a novel, name for a girl
puɳḍrik ~ puɳḍərik	white lotus
məɲdʒri ~ məɲdʒəri	tiny cluster of flowers, name for a girl

(5) Heterophone maintenance in the morpho-syntactic domain: neutralizing alternations are blocked in those morphological paradigms where semantic ambiguity would otherwise result

Trigrad Bulgarian (Mondon 2009):

o lowers to a under stresslessness (a neutralizing alternation); consider the plural:

ˈrog "horn" - ˈrog-ave "horns" - rag-aˈve-te "the horns"

Inflectional suffix -a:

ˈklɔb-a "ball of thread" ˈrebr-a "rib"

But notice the *absence* of unstressed suffix lowering in a large group of neuter nouns:

ˈzɔrn-o "grain, seed" (not ˈzɔrn-a)
ˈpetal-o "horseshoe" (not ˈpetal-a)

If **-a** were employed here, the singular forms would be rendered homophonous with their plural counterparts, since the nominative plural marker is *always* **-a** in neuter nouns:

ˈzɔrn-**o** (sg.) - ˈzɔrn-**a** (pl.)
ˈpetal-**o** (sg.) - ˈpetal-**a** (pl.)

Mondon: “to prevent singular – plural homophony, vowel reduction does not apply to these forms”

Banoni (Lincoln 1976, Mondon 2009, Blevins and Wedel 2009)

A lexical vowel length distinction has evolved from deletion of a consonant between identical vowels:

vom "turtle" - voːm "new"

This length contrast is now being lost

However, possessed nouns are marked *solely* by vowel length, and are resisting the length merger

tama "father" - tamaː "my father"
kasi "brother" - kasiː "my brother"

Lincoln: "Banoni speakers tend to shorten long vowels, except when necessary for disambiguation"

Yucunany Mixtepec Mixtec (Paster 2010)

Suppletive allomorphy in the clitic pronoun system maintains heterophony

1s (/possessive) is ` with non- ` -final stems:

nàmá	“soap”	nàmâ	“my soap”
ví́lú	“cat	ví́lû	“my cat”
sì’ī	“leg”	sì’ì	“my leg”

But it’s yù with ` -final stems

sòkò	“shoulder”	sòkò yù	“my shoulder”
tūtù	“paper”	tūtù yù	“my paper”
chá’à	“short”	chá’à yù	“I am short”

Paster: “The majority of L-final stems that are understood…to be 1sg forms will have the yù allomorph rather than the floating L”

Many examples considered by Gessner and Hansson (2004) Blevins (2004) and Blevins and Wedel (2009)

Gessner and Hansson (2004) on “anti-homophony” syncope blocking in **Dakelh (Carrier)**

Blevins (2004) on “anti-homophony”-“anti-gemination” syncope blocking, mostly in **Afro-Asiatic** (**Arabic** dialects, **Tiberian** and **Modern Hebrew**, **East Cushitic**): “[S]yncope between identical consonants appears to be blocked just in case its output would give rise to neutralization of a *paradigmatic* opposition”

Blevins and Wedel (2009) on “inhibited sound change” in **Classical Greek**, **Estonian** and **Livonian**, and **Yurok**

(6) Heterophone maintenance in the pragmatic domain: neutralizing alternations that otherwise apply pervasively are blocked "on line", due to situation-specific semantic factors

Catalan (Charles-Luce 1993):

"[T]he perception and production of spoken words is affected differentially by the presence and absence of higher levels of linguistic information and…the degree of precision of articulation is inversely proportional to the presence of semantic information"

Final devoicing is more likely to be nearly-neutralized (as opposed to completely neutralized) in pragmatic contexts that would otherwise be semantically ambiguous

rik	"rich"	riɡ̊	"I laugh, pres. ind. "
duk	"duke"	duɡ̊	"I carry, pres. ind."
fat	"fate"	faḍ̊	"tasteless, masc."
sɛk	"dry, masc"	sɛɡ̊	"I set down, pres. ind."
sɛt	"seven"	sɛḍ̊	"thirst"

In semantically unambiguous contexts, devoicing was usually complete: complete neutralization was tolerated when it nonetheless resulted in a semantically unambiguous speech signal

In semantically ambiguous contexts, devoicing was often incomplete: complete neutralization was observed less often if it would have resulted in a semantically ambiguous speech signal

English (Gahl 2008)

Frequency-of-word-usage inversely correlates with word duration: "homophones" (either lexical or derived) are produced with different durations, depending largely on their frequency-of-use: "thyme" is longer than "time"

Related phenomenon #1: neighborhood density effects

English (Wright 2004): in dense lexical neighborhoods, vowels may be hyperarticulated, presumably to ensure semantic clarity

English (Munson and Solomon 2004): Dense neighborhood words are hyper-articulated and frequent words are hypo-articulated

Related phenomenon #2: the non-coarticulatory origins of language-specific patterns of coarticulation

Language-particular patterns of coarticulation may (at least in part) be attributable to language-particular system of contrastive values, hence semantic distinctions

Öhman (1966): In **Swedish** and **English VCV** contexts, trans-consonantal vowel coarticulation is greater than in **Russian**, in which the consonants may be contrastively palatalized

Coarticulation may be curtailed in systems where lexical contrasts might otherwise be jeopardized

Manuel and Krakow (1984), Manuel (1990, 1999): In **CVC** contexts, five-vowel systems like **Shona** and **Swahili** may display more vowel coarticulation than in a language like **English**

"Because the vowel inventories of Shona and Swahili are small, they can presumably tolerate larger ranges of production without running the risk of encroaching on each other's distinctive spaces"

See also Clumeck 1976, Beddor, Krakow, and Goldstein 1986, Recasens 1987, Recasens, Pallarès and Fontdevila 1998, Beddor and Krakow 1999, Beddor, Harnsberger and Lindemann 2002)

Coarticulation may be conventionalized on a language-specific basis in ways that bear the clear mark of lexical semantic pressure; language-particular patterns of coarticulation may have *semantic* origins

So-called "low-level" or "phonetic" effects may in fact be the result of deep, systemic, historical pressures many times removed from the physical systems that proximally underlie speech

Neutralization and parsing

Recall:

Neutralization is only function-negative to the extent that it increases homophony

In most cases, neutralization increases lexical semantic clarity by clarifying cues to morpheme and especially word boundaries

Cement (Kruszewski 1883):

Due to the constant repetition of speech motor routines—and the especially frequent repetition of word-internal speech motor routines—morphemes within words come to phonetically “accommodate” (assimilate) to one another. Word-internal assimilations tend to result in suspension of contrast within some lexical domain, the functional consequences of which may serve as an aid in parsing: the less-frequent phonetic patterns across word-boundaries are thus set in high phonetic relief against the suspended background

Boundary signals (Trubetzkoy 1939):

"In addition to the phonological means serving to distinguish individual units of meaning (sememes), each language has a number of means that effect the delimitation of such individual units of meaning…[E]ach language possesses specific, phonological means that signal the presence or absence of a sentence, word, or morpheme boundary at a specific point in the sound continuum"

"Positive" boundary signals cue the presence of a boundary

"Negative" boundary signals cue the absence of a boundary, etc.

Prosodies (Firth 1948):

Prosodies are those elements of the speech stream that impart syntagmatic information

A prosody may consist of a segment-sized element, a sub-segment-sized element, or a supra-segment-sized element

Danish stød ("glottal stop"): "The Danish glottal stop…occurs chiefly with sounds said to be originally long, and in final position only in stressed syllables. If the word in question loses its stress for rhythmical or other reasons, it also loses the glottal stop. It is therefore best considered prosodically as a feature of syllable structure and word formation."

Transitional probabilities (Saffran et al. 1996):

The statistically rare sound sequences found at word boundaries serve to cue these boundaries

The necessary flipside to this finding is that statistically more prevalent sound sequences—those involving contrast suspension within some domain—may function as "negative boundary signals"

$$\frac{\text{frequency of pair } \mathbf{xy}}{\text{frequency of } \mathbf{x}}$$

If this ratio is high, the presence of **x** is a good predictor of a following **y**; such sequences might thus serve as negative boundary signals

If this ratio is low, then the sequence **xy** may serve as a positive boundary signal

The functional role of transitional probabilities in terms of signaling boundaries is a purely statistical calculation over physical objects (speech tokens)

Unlike real language use, there is no role for lexical semantic feedback in such analyses

In real-world contexts the utility of transitional probabilities cannot be accurately gauged, since any statistical calculations engaged in by language learners is necessarily accompanied by lexical semantic feedback

In sum, the ubiquitous interaction of phonetic and semantic pressures influence:

Phonetic dispersion of motor routines

Heterophony maintenance

Boundary signals

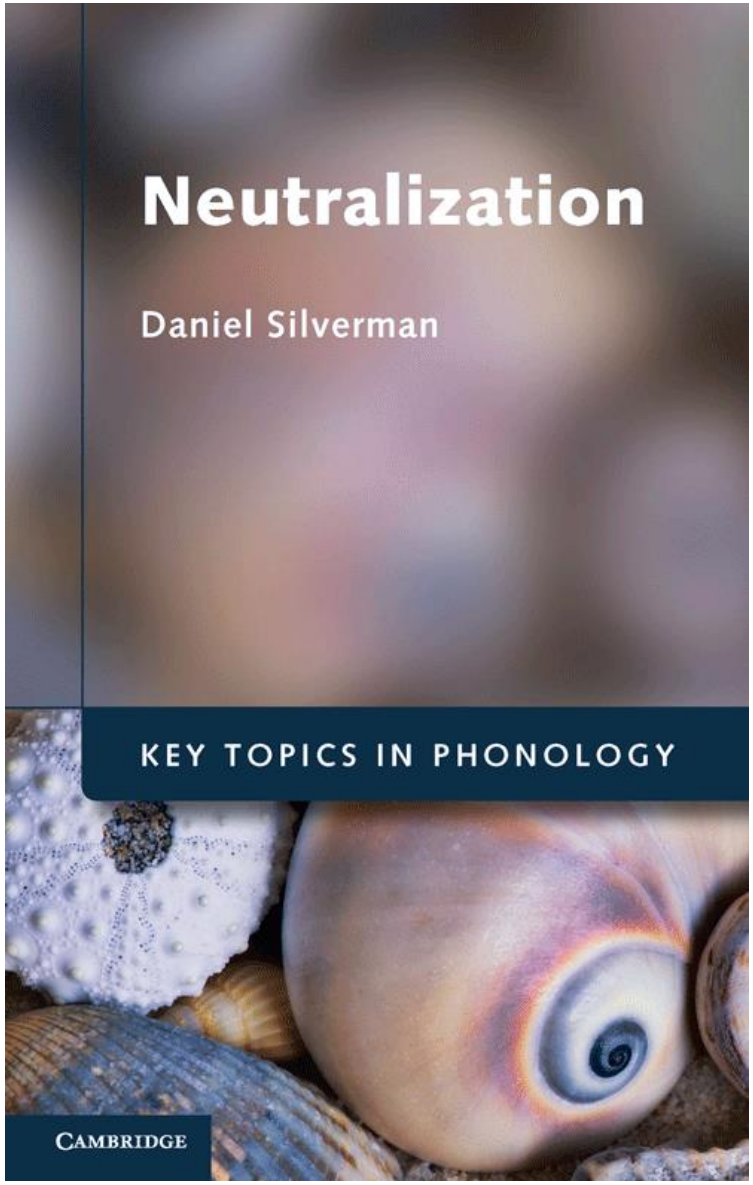
Labov (1994): “It is not the desire to be understood, but rather the consequence of misunderstanding that influences language change. This mechanism implies a mismatch between producer and interpreter: the type of built-in instability that we would expect to find behind long-term shifts in language behavior”

Labov (1994): “We should not be embarrassed if we find that systematic readjustments in…language are governed by the same cognitive faculty that governs the social behavior of [lower animals]…We are products of evolving history, not only our own but that of the animal kingdom as a whole, and our efforts to understand language will be informed by an understanding of this continuity with other populations of socially oriented animals”

The predictions of the heterophony-maintenance proposal are crystal clear: if we can find a language in which communicative success has become genuinely eroded as a consequence of phonetically-based semantic ambiguity, the proposal would be shown incorrect

The incontestable fact that we will never find such a language means that we can table heterophony-maintenance as a topic of controversy, and get on with the business of using it as a framework for linguistic inquiry

Our job now is to employ post-hoc analyses of our acquired data with the goal of isolating and motivating the myriad functional pressures that might act on its structure



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Questions:

"If sound change is triggered by local lexical pressures, why do systems come to respond globally in terms of the motor routines they deploy?"

Speech consists of motor activities that are repeated and routinized; that is, speech involves *motor routines*

When semantic pressures come to passively act on these motor routines, the consequent repetition of the altered pattern may activate change, acting as *attractor states*, (see also Schuchardt (/Bybee))

These changes may generalize exactly because they don't induce semantic confusion in the rest of the lexicon

Lexical semantic pressures may trigger systemic motor changes

Mergers may be avoided *not* to optimize the system as a whole (Liljencrants and Lindblom 1972, Flemming 1995, de Boer 2001). Rather, the system's inevitable success is a passive consequence of locally-triggered changes in language use

“Wait a minute. In Southern French global merger was tolerated, and individual words responded, but don’t you propose that mergers should be blocked under such circumstances?

No. A few well-placed potential homophones should not be expected to hold back a merger, especially since languages may respond just as this French dialect did

Predictive value is not lost: these issues are subject to empirical verification

“If language are structured so as to avoid semantic ambiguity (in the form of heterophone maintenance, among other pressures), then why should systems ever put themselves at risk, only to “seek out” a response that countervails the ensuing threat?”

Language is *not* inexorably destined towards any particular end-state, functionally efficacious or otherwise

Just as in the evolution of species, there is a plethora of pressures, some working in harmony, others in a state of antagonism, that are all subject to any number of contingent factors

There may be a slow-going diachronic tendency towards a lack of acoustic clarity among neighboring speech motor routines, resulting in coarticulation that, left unchecked, might further evolve toward a genuinely assimilatory state, oftentimes resulting in neutralization and, in the limiting case, homophony

412 But along with such slow-going phonetic pressures on language structure,
413 there are also slow-going semantic pressures: any passive phonetic
414 pressures towards acoustic indistinctness among lexical forms will
415 ultimately encounter a counter-pressure that inhibits undue decreases in
416 semantic indistinctness

417 These pressures are “end-state-blind”: one pressure will not be inhibited
418 because it “knows” that it might someday culminate in a counter-
419 functional linguistic state

420 It is consequence of language *use* that languages settle towards a
421 semantically unambiguous state

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“If Heterophone maintenance really is a driving (though passive) pressure on language structure and language change, then why don’t we see evidence of its power all over the place?”

Heterophone maintenance is not an *active* pressure for which there is an abundance of overt evidence

Heterophone maintenance is a *passive* result of the pressures that inherently act upon interlocutionary events

The very fact that language is not chock full of homophones provides evidence—however indirect—that heterophone maintenance is indeed a genuine pressure passively acting on language structure and language change

“Regarding ‘pragmatic pressures’ in particular, are you proposing that linguistic change is teleological?”

No: in situations where a completely neutralized token might result in confusing homophony, speakers dip into their pool of “clear speech tokens” encountered in comparable situations

As a mere by-product of their randomly sampling the tokens in this pool, the probability is high that this token is merely nearly-neutralized, as opposed to completely-neutralized

Speakers are not striving to make the speech signal clearer for the listener “on the fly”. Rather, clear speech signals are a passive consequence of speakers’ matching their own speech patterns to those in their linguistic experience

- Variable behaviors in lower animals may be characterized comparably
- Gyger & Marler (1988) observed the natural food-calling behavior of males in a free-ranging situation
- When a male found food and called, females approached in 53-86% of cases, depending on the food
- When males called in the absence of food (i.e., dishonestly), females only approached 29% of the time
- Males were more likely to call honestly when females were nearby, and to call dishonestly when females were far away
- Do the males intend to deceive? No. *Context-dependent variable behaviors may be inherited*

“What about King’s (1967) work addressing Martinet’s Functional Load proposals?”

King’s definition of the term “functional load” possesses two components:

(1) “The global text frequencies of the two phonemes involved,” and

(2) “The degree to which [the two phonemes] contrast in all possible environments, where environment means, roughly speaking, one phoneme to the left and right.”

Neither of these contexts targets Martinet’s crucial “minimal pair” criterion.

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