Speech Production

Name these objects

What does naming involve?
Picture—>Concept—>Speech?

Describe these actions in one sentence

How much of the sentence are you planning at a time?

- Do you plan the whole sentence before you start speaking?
- Do you plan one word, then the next?
- Something in between?

Word vs. Sound

- They seem to be one and the same: word=sound
- But are they?

CAT

/kat/

What is this?

“Navigation device”

Abacus?

Compass?

Protractor?

Sextant?

Tip of the tongue state

When you know the word you are looking for but you can't recall the sound pattern.

If you recognized the object, but didn't know the sound of the word, what *did* you know? What information did you access?

Concepts that have words vs. those that don't.

- The dark liquid that you brew in the morning or buy at Starbucks is _____.
- When you do something that you really wished you hadn't you feel _____.
- A mother who relentlessly pushes her children toward academic achievement is a _____.
- The act of hesitating while introducing someone because you've forgotten their name is to _____.
- A person who is ready to forgive and forget any first abuse, tolerate it the second time, but never forgive nor tolerate on the third offense is a _____.

There are words for these concepts in other languages

- A mother who relentlessly pushes her children toward academic achievement is a 教育ママ. ('kyōikumama' - Japanese).
- The act of hesitating while introducing someone because you've forgotten their name is to *tartle.* (Scottish)
- A person who is ready to forgive and forget any first abuse, tolerate it the second time, but never forgive nor tolerate on the third offense is a *Ilunga.* (Tshiluba language, Southwest Congo)

Word vs. Sound

- They seem to be one and the same: word=sound
- But are they?

CAT

Lemma

/kat/

Lemma = 'Abstract word'
- The thing in between the concept and the sound.
- Encodes grammatical info (N, V, etc.)

Word vs. Sound

CAT

Lemma (+masculine)

/gato/

Speakers of languages that mark grammatical gender can often tell the gender of tip-of-the-tongue words.

Not a conceptual thing.
Not a phonological thing.
Something in between.

More evidence for stages/levels of speech production from speech errors

- "Slips of the tongue"
- Spoonerisms
- Malapropisms
- ("Freudian slips" — a different, but partially related concept)

Some Facts About Slips

Lots of different slip varieties

Anticipations: *cuff of coffee (cup of coffee)*
Perseverations: *gave the goy (gave the boy)*
Exchanges: *teep a cape (keep a tape)*
with this wing I do red
cassy put (pussy cat)
piss and stretch (stress and pitch)

Some Facts About Slips

Slips occur among several different sized units:
- Phrases: *I wouldn't buy kids for the macadamia nuts*
- Words: *I have to fill up the gas with car.*
- Morphemes: *Oh, that's just a back trucking out.*
- Syllables: *canpakes (pancakes), butterpiller and catterfly*
- Phonemes: *fost and lound (lost and found); we're going to have to fart very fide (fight very hard)*
- Features: *mity the due teacher (pity the new teacher; nasal-stop exchange)*

Some Facts About Slips

Slips can provide information about the order of these planning stages:

"Phonetic conditioning" applies appropriately after slips take place; thus conditioning occurs after phonol. insertion
A meeting arathon (an eating marathon)
Add up/s/ to (add/z/ up to)

Syllabic stress patterns are modified to accommodate the slipped syllable pattern; thus stress assignment must follow
Cómputated (compúted)

Phrasal stress is unaffected by slips of stressed elements (ie, stress doesn't slip with the words)
Stop beating your BRICK against a head wall

Some Facts About Slips

Slips can provide information about the size and structure of planning units at the various stages:

- Sound exchanges tend to occur within a clause; often adjacent words
- Word exchanges can occur across clausal boundaries
- Sound exchanges respect syllable structure: onsets exchange with onsets, rhymes with rhymes, etc.,
- Sound exchanges do not respect grammatical form class of words: sounds can exchange between nouns & verbs, etc.
- Word exchanges tend to respect grammatical form class, when exchanges cross phrasal boundaries, but not when they occur within a clause

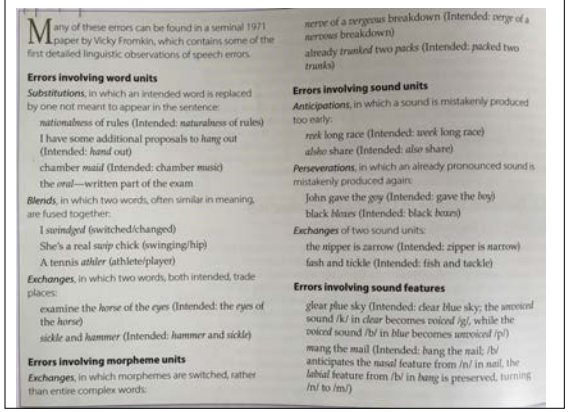
*What does this tell us about words vs. sounds?

*What does this tell us about planning unit size?
One word at a time? Whole sentence?

What units of planning are involved?

Slips tell us that…

- Speech is not planned simply one-word-at-a-time. (*I have to fill the gas with car)*
- Planning occurs on multiple levels of analysis (phrases, morphemes, phonemes, features)
- Sound and word level planning is not the same thing (i.e., concept—>sound is the wrong model)



Many of these errors can be found in a seminal 1971 paper by Vicky Fromkin, which contains some of the first detailed linguistic observations of speech errors.

Errors involving word units

Substitutions, in which an intended word is replaced by one not meant to appear in the sentence:

nationalness of rules (Intended: *naturalness* of rules)

I have some additional proposals to *hang* out (Intended: *hand* out)

chamber *maid* (Intended: chamber *music*)

the *oral*—written part of the exam

Blends, in which two words, often similar in meaning, are fused together:

I *swindged* (switched/changed)

She's a real *swip* chick (swinging/hip)

A tennis *athler* (athlete/player)

Exchanges, in which two words, both intended, trade places:

examine the *horse* of the *eyes* (Intended: the *eyes* of the *horse*)

sickle and *hammer* (Intended: *hammer* and *sickle*)

Errors involving morpheme units

Exchanges, in which morphemes are switched, rather than entire complex words:

nerve of a *vergeous* breakdown (Intended: *verge* of a *nervous* breakdown)

already *trunked* two *packs* (Intended: *packed* two *trunks*)

Errors involving sound units

Anticipations, in which a sound is mistakenly produced too early:

reek long race (Intended: *week* long race)

alsho share (Intended: *also* share)

Perseverations, in which an already pronounced sound is mistakenly produced again:

John gave the *goy* (Intended: gave the *boy*)

black *bloxes* (Intended: black *boxes*)

Exchanges of two sound units:

the *nipper* is *zarrow* (Intended: zipper is narrow)

fash and *tickle* (Intended: fish and tackle)

Errors involving sound features

glear plue sky (Intended: *clear blue* sky; the *unvoiced* sound /k/ in *clear* becomes *voiced* /g/, while the *voiced* sound /b/ in *blue* becomes *unvoiced* /p/)

mang the *mail* (Intended: *bang* the *nail*; /b/ anticipates the *nasal* feature from /n/ in *nail*, the *labial* feature from /b/ in *bang* is preserved, turning /n/ to /m/)

Lexical Bias Effect

- Slips result in real words more often than you'd expect by chance.

Lexical Bias Effect

weal rords

Rips slesult *more moften*

- Slips result in real words more often than you'd expect by chance.

Models of speech production need to explain lexical bias

I can has slips?

Inducing slips in the lab

read these words silently to yourself

read the words in **bold** out loud

dawn boat

dark boast

dart bone

barn door

Note:

1. phonological similarity — similar items are slippery and phonological priming enhances slipperiness.
2. slip = real words (darn bore)

dawn boat
dark boast
dart bone
barn door

If the target words were “barge dope” (darge bope) slips are less likely.

The “Internal Monitor”

read these words silently to yourself

read the words in **bold** out loud

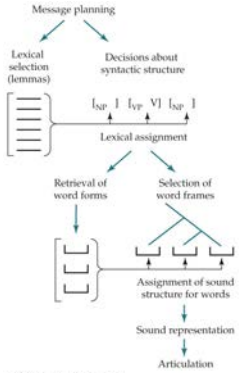
kook tin

coop tilt

coon tips

kook tin
coop tilt
coon tips
tool kits

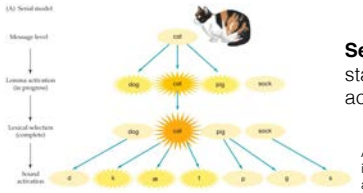
Slips are less likely for this pair suggesting a mechanism for catching error *before* they occur <— the “internal monitor”



Models

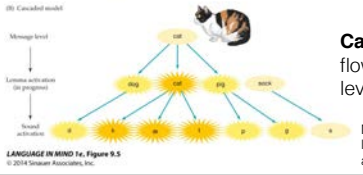
Sketch of the speech production system

- General agreement that something like these stages are involved
- Debate about the particulars, e.g., whether it is serial, cascaded, and interactive (bidirectional).



Serial: Finish one stage before activating next.

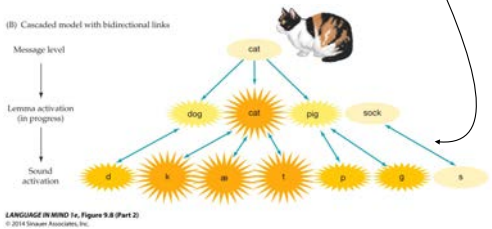
A single selected lexical item activates only its associated phonemes



Cascaded: Activation flows through multiple levels simultaneously.

Multiple partially-activated lemmas activate multiple associated phonemes

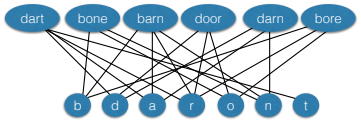
Cascaded with bidirectional interaction



Cascaded with bidirectional interaction

. . .

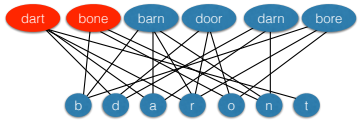
dart bone
barn door



Cascaded with bidirectional interaction

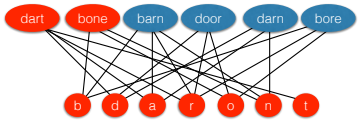
. . .

dart bone
barn door



Cascaded with bidirectional interaction

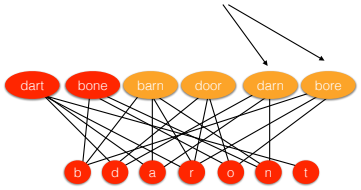
dart bone
barn door



Cascaded with bidirectional interaction

Feedback partially activates competitor lemmas

dart bone
barn door



\+ phonological frame priming [d_ _ _] [b_ _ _]
= greater probability of sound exchange error

Speech Production: The view from motor control

Speech Production: The view from motor control

- Speech production is fundamentally a motor control task

  >The goal is to control the vocal tract to make sounds

- Therefore research on motor control as well as (psycho)linguistics should be relevant.

A brief digression: The dual stream brain

A “bung borer”, used to tap wooden barrels of liquid (basically a faucet).

The Dual Stream Brain

The brain must perform two computationally distinct tasks with sensory information:

1. Recognize *what* it is sensing
2. Compute *how* to interact with it.

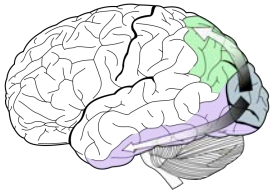
Visual Agnosia: Ventral stream dysfunction

- Impaired visual object recognition (not a naming problem)
- Spared reaching

Optic Ataxia: Dorsal stream dysfunction

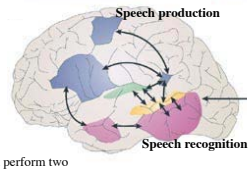
- Impaired visually guided reaching
- Visual object recognition spared

Dorsal "How" (sensorimotor) Stream



Ventral "What" Stream

The dual stream model



The brain must perform two computationally distinct tasks with auditory speech information:

1. Recognize *what* it is hearing
2. Compute *how* to reproduce it with the vocal tract.

Hickok & Poeppel 2007

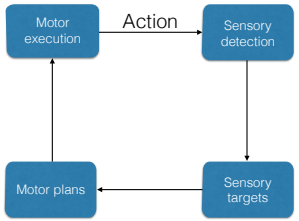
Sensory input is key to motor control

- Sensory information serves as "targets" for actions
- Also provides a means to assess the outcome success of actions

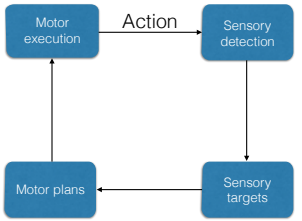
Sensory input is key to motor control

- "The man who lost his body"
- The people who learned to speak (that's you)
- Altered auditory feedback
- Uptalk & vocal fry

Sensorimotor Loop



How does this relate to psycholinguistic models?



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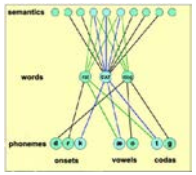
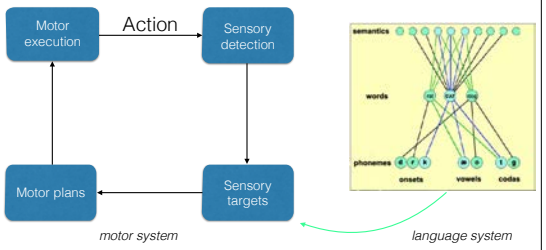
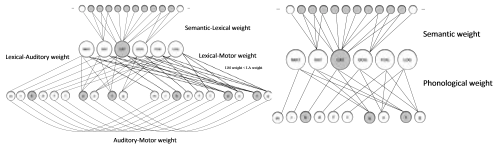


How does this relate to psycholinguistic models?

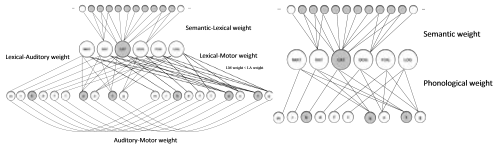


The typical assumption

Integrated Model The Standard Model

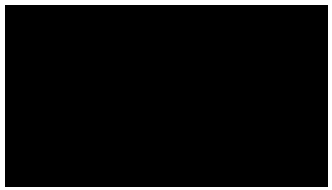


Integrated Model The Standard Model



Does better at modeling speech error data in aphasia

- Aphasia: acquired disorder of language
- Often involves deficits in speech production
- Speech errors are often more frequent



Target word: “cookie jar”