How do we Produce a Word?

“Well, we just think of the word we want to use, and then… we say it.”

- Regular Human
Prerequisites for Producing a Word

intention to communicate
existence of a pre-lexical message

conscious

word production / lexical access system

subconscious
How do we Investigate Word Production?

- analysis of speech errors, both natural and induced
- research on brain-lesioned patients
- analysis of TOT states
- response latencies in experiments with healthy participants
  - picture & word naming tasks
  - picture / word interference paradigms
  - priming tasks
We’ll look at...

- aspects of word production that are generally agreed upon
- some influential models of word production
  - why different models exist – aka, open issues in the field
- why & how errors happen, and also:
  - why tongue twisters are tongue twisters
  - what’s up with Freudian Slips
- some experimental research, and what it could mean for the proposed models
- [why the Stroop Effect trips you up every time]
Open Issues

- is there feedback/interactivity/interaction in the system?
- are elements co-activated / does information cascade?

- production research is VERY messy. (which is why your instructor has graciously agreed to step aside 😊)
Things We are Fairly Certain are Happening

1. Conceptualization
   - Translating pre-lexical message into lexical concepts

2. Formulation
   - Encoding of message in abstract units (lemmas/lexemes, syntactic features, phonological information)
     - Semantic, syntactic, and phonological information form separate representations

3. Articulation
   - Translating phonological information into articulatory gestures

Dell, Chang, & Griffin, 1999; Ferrand, 2001; Morsella & Miozzo, 2002; Roelofs, Meyer, & Levelt, 1998; Vigliocco et al., 2002
Levelt’s Discrete Model

Computational implementation: \textsc{WEAVER++}

Levett et al. 1999, p.4, Fig. 2
Lemma vs. Lexeme

**Lemma**
- modality-neutral
- syntactic representation
  - carries information on gender, part of speech, tense, aspect, etc.
- unspecified for phonology

**Lexeme**
- form representation
- carries phonological information

**Example:** `<ESCORT> - V, transitive, present, progressive.`

**Example:** `/ɛs.ˈkɔrt.iŋ/`

Chen, 2008; Ferrand, 2001; Kempen & Huijbers, 1983; Levelt et al., 1998, 1999; Marx, 1999; Roelofs et al., 1998
Evidence for the Distinction between Syntactic & Phonological Representations

- **homonyms**: same phonological representation (= lexeme), but different part of speech (= lemma)

- **TOT states**: tip-of-the-tongue states
  - where you “feel like you know a word”
  - most of the time, people can report the meaning, the gender, and the part of speech (= syntactic features) correctly
  - sound (= phonological representation) is inaccessible
Activity 1: Inducing TOT States

- What is the order of lower mammals including kangaroos and opossums which carry their young in an abdominal pouch?
- What is the name of the deck of cards often used for fortune telling?
- What is the word meaning favoritism in hiring based on family relationships?
- What are the small, shelled animals which accumulate on the underside of a ship?

James & Burke, 2000
TOTs happen here

Levél et al. 1999, p.4, Fig. 2
conceptualization

formulation

articulation

Levelt et al. 1999, p.4, Fig. 2
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<td>/ɹæt/ is produced more often than /dɔɡ/</td>
<td>/kæt/</td>
<td><strong>mixed error</strong></td>
<td>semantic and phonological similarity</td>
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Levelt et al. 1999, p.43 Fig. 1

- Anticipation error
- Semantic substitution error
- Mixed error
- Perseveration error
Discrete Models

- activation can only be transmitted top-down*
  - there is no feedback in lexical access – no bottom-up activation flow
  - all levels operate sequentially, one after the other
- only the lemma selected for production will be phonetically encoded
  - why mixed errors do not support this type of model
- * which is why sometimes you’ll hear discrete models also being described as feedforward models, or serial models.

see e.g. Bock & Levelt, 1994; La Heij et al., 1998; Levelt, 1999, 2001; Levelt et al., 1991b; Roelofs, 1992; Schriefers & Jescheniak, 1899; Schriefers et al., 1990.
Discrete Models

are supported by:

- TOT states
- error analyses Marx 1999
- computational models Howard et al. 2006
Discrete Models

are contradicted by:

- mixed errors
  - proposed: an output monitor as an addition
  - then again: just because something is an ad-hoc addendum doesn’t mean this is not the way it works…!?!


- homophone effects Cutting & Ferreira 1999
there is no feedback, but: all lexical concepts that have at some point received some activation immediately pass some activation on to their lemmas

it is not only the lemma selected for production that receives activation! - > phonological co-activation

the lemmas of semantically related concepts also receive activation, although a little less.
Which is Which?

Cascading

DOG → CAT → RAT

<DOG> → /dɒɡ/ → /d/ /ʊ/ /ɡ/ /t/ → /d/ /æ/ /l/ /æ/ /l/ /æt/ → /kæt/ → /k/ /æt/ → /ræt/ → <RAT>

Discrete

DOG ← CAT ← RAT

<DOG> ← /dɒɡ/ ← /d/ /ʊ/ /ɡ/ /t/ ← /d/ /æ/ /l/ /æ/ /l/ /æt/ ← /kæt/ ← /k/ /æt/ ← /ræt/ ← <RAT>

adapted from Navarrete & Costa 2005, p.360, Fig. 1
Cascading Models

are supported by:

- mixed errors
- all kinds of coactivation effects (near-synonyms, cognates in bilinguals, semantically unrelated primes)

Cascading Models

are contradicted/unsupported by:

- phonological interference effects that were expected, but not found
- the fact that they exist on paper only – there is no computational implementation to test or to simulate errors (cf. WEAVER++ for Levelt’s discrete model)
- most experimental evidence that supports cascading models also supports interactive models

Interactive Models

- also assume activation cascading
- plus: they assume feedback/interactivity in the system (bottom-up activation flow – hence the name)
- most popular: Dell’s Interactive Activation Model
  - praised as “the most influential alternative model” (Schriefers & Jescheniak 1999, p.579) – alternative to Levelt’s model

Dell’s IA Model

from Levent 1999, p. 226, Fig. 1
Interactive Models

are supported by:

- mixed errors
- a potential unified theory of speech production & comprehension systems in the future
- a computational implementation that correctly models aphasic speech errors
  - but: you change connection weights, and everything changes…
Interactive Models

are contradicted/unsupported by:

- So the only reason that interactivity exists in the system is to induce speech errors…?
- the fact that they underspecify syntactic feature connections.
- again: most experimental evidence that supports interactive models also supports cascading models

Levett et al. 1991b, 1999
"In the same way that psycho-analysis makes use of dream interpretation, it also profits by the study of the numerous little slips and mistakes which people make. [...] I have pointed out that these phenomena are not accidental, [...] that they have a meaning and can be interpreted, and that one is justified in inferring from them the presence of restrained or repressed impulses and intentions."

Activity 2: A Different Type of Error...?

"For seven and a half years, I've worked alongside President Reagan. We've had triumphs. Made some mistakes. We've had some sex... uh... setbacks."

- George H. W. Bush [Psychology Today]

/ˈsɛtˌbæks/

- /ks/, the end segment of the final syllable, receives too much activation too early – anticipation error

- … and hence becomes the end segment of the first syllable - et voila, you have yourself a "Freudian slip."
Amanda Seyfried is **many things**.

"We all know Amanda Seyfried for her roles as the nice, if a bit titsy - *ditzy*, excuse me - teen."

Someone explain what happened here?

- /t/ as the onset of /tin/ is activated too early – **anticipation error**
- … and replaces the /d/ in /ˈdɪtsi/
The "Freudian Slip" - Debunked

Conclusion

- Do not worry if you say embarrassing things as a result of a slip of the tongue. It happens to the best of us.
- It does NOT mean any of the following:
  - That what you said is your subconscious desire.
  - That the error is a reflection of “childhood issues” (or any such thing).
- It just means some node received too much activation at an unsuitable moment, and that the lexical bias effect is a thing.
Misery Loves Company

There’s many more errors, and they’re all interesting!
- morpheme level (stranding errors etc.)
- blends, …
- to learn more:
  - visit [the Wikiversity page on Models of Speech Production](#) (cross-check contents with reputable academic sources – like with all Wiki stuff)
  - ask Juhani
  - read your favorite Psycholing book (e.g. Traxler, chapter 2 😊)
Overall RQ: Is there feedback in the system?

The syntactic/grammatical gender feature has proved to be a great testing ground (Bajo et al. 2003; Caramazza 1997; Miozzo & Caramazza 1999; Roelofs et al. 1998; Schriefers & Teruel 2000).

If there is feedback, priming a determiner through phonological information should speed up the process.
Experiment 1 - Design

- gender-decision paradigm
- targets: simple line drawings from long-established set Snodgrass & Vanderwart 1980

see e.g. Bajo et al. 2003, Costa et al. 1999, La Heij et al. 1998, Schriefers 1993
Predictions

Effect of Phonologically Related Prime
- Interactive Models

No Effect of Phonologically Related Prime
- Discrete models
  - like Levelt’s
- Cascading Models
Experiment 1 - Results

- congruency had an influence
  - i.e. it took participants longer to say NO than to say YES as to whether the determiner matched the picture

- CRUCIAL: phonological relatedness did NOT have any influence
  - failed to reach significance in both congruency conditions

- these results* would then support all non-feedback models
  - Levelt’s discrete model, plus all other discrete models
  - cascading models
Experiment 2 - Design

- variation on picture-word interference paradigm
  - P’s name picture using a determiner + NP

see e.g. Costa et al 1999
Experiment 2 - Results

- absolutely no significant differences between response times.
- these results would then support all non-feedback models
  - Levelt’s discrete model, plus all other discrete models
  - cascading models

<table>
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<tr>
<th>Condition</th>
<th>Mean RT</th>
<th>N</th>
<th>SD</th>
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</thead>
<tbody>
<tr>
<td>unrelated</td>
<td>785.52</td>
<td>230</td>
<td>136.37</td>
</tr>
<tr>
<td>related</td>
<td>793.76</td>
<td>229</td>
<td>130.91</td>
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Issues with my Experiments & the Field in General

- you never know if your experiments test for what you think they test for Bloem & La Heij 2003, Navarrete & Costa 2005
- lab settings might be unnatural either way Morsella & Miozzo 2002
- episodic memory might play a role we cannot pinpoint yet Caramazza & Miozzo 1997
Activity 4: Tongue Twisters

Try saying this three times fast:

“I wish to wash my Irish wristwatch”

Based on the knowledge you have now about errors and word production, why does this tongue twister “work?”

- **Hint 1**: think especially: phonological errors.
- **Hint 2**: like perseveration & anticipation errors.

Activity 5: The Stroop Effect

/blu/ /əɾd/ /ɡriːn/ /ˈpɝpl/
Activity 5: The Stroop Effect

yellow  purple  green  blue

/red/  /blue/  /mart/  /ˈjɛləʊ/
Activity 5: The Stroop Effect

This shouldn’t really have been so hard, they’re just colors, right…?

What happened here!?

○ automatic processing + semantic interference

For more explanations, and how this test is being used in Psychological research, the Wikipedia article can be a great introduction (but: be a good scholar and cross-check what you read there.)
“[…] for neither of us appears to know anything great and good; […] I do not know anything, so I do not fancy I do.”

Plato - Apology
CONCLUSION II

BUT: You are now armed with more cool knowledge to share with your loved ones during the holidays. Like:

- How Freudian Slips are not a thing, at least not in the way most people think;
- Why tongue twisters are tongue twisters;
- Why we make speech errors;
- And why you should never research word production! (Except you should. It’s awesome.)

PS: How to Explain Linguistics to your Friends and Family this Holiday Season!
Thank you!

Any questions?

(If they come to you later, feel free to email me at isabell.hubert@ualberta.ca)