What Freud Got Right About Speech Errors: Evidence From Aphasia

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Thanks to
Myrna Schwartz, Nadine Martin, Eleanor Saffran, Dan Foygel, Deb Gagnon, Paula Sobel, Susanne Gahl, Harlan Harris, Adelyn Brecher, Elizabeth Lawler, Jean Gordon, Nazbanou Nozari, Audrey Kittredge, Gary Oppenheim

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Freud: So wrong and yet so right

By Marilyn Elias, USA TODAY
5/3/2006

As the 150th anniversary of Sigmund Freud's birth approaches on Saturday, mental-health experts consider his legacy mixed: A seminal thinker, Freud was far ahead of his time with some ideas but dead wrong on others...
Joe Biden

“Many of us were in Rome at the president’s funeral — excuse me, Freudian slip, I beg your pardon — at the pope’s funeral that the president attended.”

“George B… John McCain…” later explained by Biden as “Freudian slip, folks. Freudian slip.”

Google searches for “Freudian slip”
Source: businessshrink.biz
A "Freudian slip" is when you say one thing . . .

. . . but mean your mother.

I mean "another".
The Linguistic Tradition:
The properties of slips arise from the nature of language (Meringer, 1896)

THOUGHT

Word slips

Meaning-related patterns

“president” (pope)

Phonological slips

Sound-related patterns

“mexed missages” (mixed messages)
Even ‘phonological’ slips express meaning

“What I find in slips of the tongue is not the influence of the contact effect of sounds, but the influence of thoughts outside of the intended speech.”

Freud (1901)
Freud was right – phonological slips express meaning

GET ONE → “WET GUN”

Primed by “damp rifle”

Motley & Baars (1976)
Overdetermination

A single observed effect (e.g. a slip, a particular component of a dream) is usually determined by multiple causes at once, any one of which might be sufficient to cause the effect if strong enough.

Freud (1899)
Freud was right
Semantic word slips are sensitive to phonological similarity

Mixed Error Effect
Martin, Gagnon, Schwartz, Saffran, & Dell, (1996)
197 semantic errors

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"The president
I mean, the pope."
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Phoneme position

1st 2nd

"pope"
match /p/ mismatch

"president"
Interaction: two-way processing flow

-- meaning influences phonological slips
-- phonology influences semantic slips
A 2-step Interactive Model of Lexical Access in Production

Semantic Features

Onsets: f, r, d, k, m
Vowels: ae, o
Codas: t, g

FOG, DOG, CAT, RAT, MAT
Step 1 – Word Access

Activate semantic features

Onsets: f r d k m

Vowels: ae o

Codas: t g

Words:
- FOG
- DOG
- CAT
- RAT
- MAT
Step 1 – Word Access

Activation spreads through network

- Onsets: f, r, d, k, m
- Vowels: ae, o
- Codas: t, g
Step 1 – Word Access

Most active noun is selected and linked to syntactic frame

Onsets: f, r, d, k, m
Vowels: ae, o, t, g
Codas: MAT, RAT, CAT, DOG, FOG

NP
N
Step 2 – Phonological Access

Activation jolt to selected word

Onsets: f, r, d, k, m
Vowels: ae, o
Codas: t, g

FOG, DOG, CAT, RAT, MAT
Step 2 – Phonological Access

Activation spreads again
Step 2 – Phonological Access

Most activated phonemes are selected
Why 2 steps?
The tip-of-the-tongue effect

You can get stuck between the steps

What is Joe Biden’s middle name?

“It’s on the tip of my tongue. It starts with R…”

“It’s kind funny sounding…”

Robinette!..Good name for a boy wonder
Semantic Error – “dog”

Shared features activate semantic neighbors
Formal Error – “mat”

Phoneme-word feedback activates formal neighbors
Mixed Error – “rat”

Integration of semantic and phonological information is achieved by interactive activation.
Errors of Phonological Access - "dat" "mat"
Multiple words - “CAT in the FOG” - lead to interference and speech errors

“fat in the fog”
The continuity between the normal and the abnormal

“The paraphasia in aphasic patients does not differ from the incorrect use and distortion of words which the healthy person can observe in himself in states of fatigue or divided attention.”

Freud (1891)
Modeling Freud’s continuity thesis

- Normal error pattern

Define continuum between normal and total breakdown states

- Total breakdown
Lesioning the model: The semantic-phonological weight hypothesis

Semantic Features

Semantic-word weight: $S$

Phonological word weight: $P$

Onsets: f r d

Vowels: ae o

Codas: k m t g
A Test of the Model: Picture-naming Errors in Aphasia
(Schwartz, Dell, Martin, Gahl, & Sobel, 2006)

“cat”

175 pictures of concrete nouns–Philadelphia Naming Test
94 patients (Wernicke, Broca, anomic, conduction)
60 normal controls
### Example error patterns

<table>
<thead>
<tr>
<th></th>
<th>CAT</th>
<th>DOG</th>
<th>MAT</th>
<th>RAT</th>
<th>LOG</th>
<th>DAT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Correct</strong></td>
<td>.98</td>
<td>.02</td>
<td>.00</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Semantic</strong></td>
<td>.71</td>
<td>.03</td>
<td>.07</td>
<td>.01</td>
<td>.02</td>
<td>.15</td>
</tr>
<tr>
<td><strong>Formal</strong></td>
<td>.77</td>
<td>.10</td>
<td>.06</td>
<td>.03</td>
<td>.01</td>
<td>.03</td>
</tr>
<tr>
<td><strong>Mixed</strong></td>
<td>.29</td>
<td>.04</td>
<td>.22</td>
<td>.03</td>
<td>.10</td>
<td>.32</td>
</tr>
<tr>
<td><strong>Unrelated</strong></td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Nonword</strong></td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
</tbody>
</table>

**conduction**

LH: .71  .03  .07  .01  .02  .15

**anomic**

IG: .77  .10  .06  .03  .01  .03

**Wernicke**

GL: .29  .04  .22  .03  .10  .32
<table>
<thead>
<tr>
<th>Patient</th>
<th>CAT Correct</th>
<th>DOG Semantic</th>
<th>MAT Formal</th>
<th>RAT Mixed</th>
<th>LOG Unrelated</th>
<th>DAT Nonword</th>
</tr>
</thead>
<tbody>
<tr>
<td>controls</td>
<td>.98</td>
<td>.02</td>
<td>.00</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>s=.067  p=.047</td>
<td>.98</td>
<td>.02</td>
<td>.00</td>
<td>.01</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>LH</td>
<td>.71</td>
<td>.03</td>
<td>.07</td>
<td>.01</td>
<td>.02</td>
<td>.15</td>
</tr>
<tr>
<td>s=.024  p=.018</td>
<td>.69</td>
<td>.06</td>
<td>.06</td>
<td>.01</td>
<td>.02</td>
<td>.17</td>
</tr>
<tr>
<td>IG</td>
<td>.77</td>
<td>.10</td>
<td>.06</td>
<td>.03</td>
<td>.01</td>
<td>.03</td>
</tr>
<tr>
<td>s=.019  p=.032</td>
<td>.77</td>
<td>.09</td>
<td>.06</td>
<td>.01</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>GL</td>
<td>.29</td>
<td>.04</td>
<td>.22</td>
<td>.03</td>
<td>.10</td>
<td>.32</td>
</tr>
<tr>
<td>s=.010  p=.016</td>
<td>.31</td>
<td>.10</td>
<td>.15</td>
<td>.01</td>
<td>.13</td>
<td>.30</td>
</tr>
</tbody>
</table>
Representing Model-Patient Deviations

Root Mean Square Deviation (RMSD)

LH  .016
IG  .016
GL  .043
94 patients—no exclusions

94 new patients--mean rmsd = .024

94.5 % of variance accounted for
Location of patients in parameter space
Locating s and p parameters in the brain: Voxel-based symptom-lesion mapping

(Schwartz, Kimberg, Walker, Faseyitan, Brecher, Dell, & Coslett, 2009)

Correlate lesion locations with speech error behavior

Lots of semantic errors

Lots of phonological errors

Lots of formal errors
S (semantic weights)
P (phonological Weights)
Predictions from the model fits

“Prediction is very difficult... especially about the future.”

Niels Bohr
Using model parameters to measure recovery of aphasia over time
Can we predict who will recover? 
(Schwartz & Brecher, 2000)

High initial value of semantic parameter predicts that recovery will occur

<table>
<thead>
<tr>
<th></th>
<th>No recovery</th>
<th>Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low semantic</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>High semantic</td>
<td>1</td>
<td>16</td>
</tr>
</tbody>
</table>

Values show number of patients
EG severe non-recovery

Low s predicts poor chance of recovery
Higher $s$ predicts better chance of recovery.
Freud's prediction

“I really do not think that anyone would make a slip in an audience with one’s Sovereign [or] in a serious declaration of love...”

Freud (1901)
Nozari & Dell (2012)

Freud was right – paying attention reduces slips

<table>
<thead>
<tr>
<th>Condition</th>
<th>Probability</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>0.04</td>
<td>3,756</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.05</td>
<td>15,108</td>
</tr>
<tr>
<td>No Focus</td>
<td>0.06</td>
<td>11,520</td>
</tr>
</tbody>
</table>
The “Freudian” part

“Almost invariably I discover ... a disturbing influence from something outside of the intended speech. The disturbing element is ... a single unconscious thought, which comes to light through the special blunder.”

Freud (1901)
Freud’s support for the “Freudian” part:
After-the-fact interpretation of a small selected set of slips

e.g.

Patient:

“Es war mir auf der Schwest...auf der Brust so schwer...”
It was to me upon the sist...upon the breast so heavy

Dr. Freud:

“Very interesting. Tell me more about your sister.”
There is NO clear evidence for the "Freudian" part

1. Large scale analysis of natural errors (Ellis, 1980)

No clear "Freudian" slips found.

2. Laboratory generated slips (Baars, Cohen, Bower, & Berry, 1992)

Target utterances: "ig pout" (potential slip = "pig out")
   "kurger bing" (potential slip = "Burger King")

Subjects who were concerned about their weight showed no significantly greater tendency to make these slips.
Freud’s check list

Phonological slips express meaning. ✓

Word slips are influenced by phonology. ✓

Continuity between aphasic and normal slips. ✓

Attention to your speech prevents slips. ✓

Slips express repressed thoughts and wishes. ❌

NO EVIDENCE
Throw out the Freudian “baby” (unconscious wishes), but save the Freudian “bath water” (interactive retrieval theory)

Phonological slips express meaning.
Word slips are influenced by phonology.
Continuity between aphasic and normal slips.
Attention to your speech prevents slips.
Slips express repressed thoughts and wishes.
Interactive spreading activation and the Freudian bath water

Spreading activation provides a mechanism for information retrieval.

Interaction explains effects of meaning on phonological slips and phonology on semantic slips.

Parametric variation in spreading-activation parameters explains aphasic error patterns and normal-abnormal continuity.
Thanks to

Myrna Schwartz, Nadine Martin, Eleanor Saffran, Dan Foygel, Deb Gagnon, Paula Sobel, Susanne Gahl, Harlan Harris, Adelyn Brecher, Elizabeth Lawler, Jean Gordon, Nazbanou Nozari, Audrey Kittredge, Gary Oppenheim,

and the Illinois production lab group
Lexical-level formal errors
“cat” → “mat”

Same grammatical class (noun)
Phonological-level formal errors
“cat” → “sat”
different grammatical class

Onsets Vowels Codas
Prediction: Proportion of formals that are nouns increases as \((p - s)\).

**low (p - s):** formals are phonological (‘sat’)

**high (p - s):** formals are lexical (‘mat’)

Prediction confirmed: Tendency for formal errors to be nouns increases with \((p - s)\)

<table>
<thead>
<tr>
<th>(p – s)</th>
<th>Relative semantic vs. phonological lesion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chance</td>
<td>&lt; 0</td>
</tr>
<tr>
<td>.001-.01</td>
<td></td>
</tr>
<tr>
<td>.011-.020</td>
<td></td>
</tr>
<tr>
<td>.021-.030</td>
<td></td>
</tr>
</tbody>
</table>

N= 76 patients
High initial value of phonological parameter does not predict recovery.

Values show number of patients.