Language

How can we possibly simulate language abilities?...

- Just another set of input/output paths.
- Levels: phonemes/letters, words, phrases, sentences, paragraphs, and beyond.
- Huge combinatorial power: distributed reps over time!

Biological Substrates of Language

Phonology Features: Vowels

tongue position:

```
<-- front  |  back -->
  1  2  3  4  5  6  7
```

```
U
E--A--

1 e
2 i --
3 u

/ -/

v = -I- W

/ a
```

lips round/flat, length long/short
Phonology Features: Consonants

where airflow is restricted: labial, labio-dental, dental, alveolar, palatal, velar, glottal

how it is restricted: plosive, fricative, semi-vowel, liquid, nasal vocalized, not vocalized

<table>
<thead>
<tr>
<th>Phon</th>
<th>Examples</th>
<th>Loc</th>
<th>Mnr</th>
<th>Vce</th>
</tr>
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<tbody>
<tr>
<td>/p/</td>
<td>pit</td>
<td>lb</td>
<td>ps</td>
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<td>/g/</td>
<td>get</td>
<td>vl</td>
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Questions

- What general processes are involved in reading, and how do these sometimes fail (e.g., in dyslexia)?
- How are we able to read “cat”, “yacht”, and “nust”?
- Why do kids say “I goed to school” after first saying “I went”?
- How do words come to mean anything?
- How do we go beyond words to sentences?

Distributed Lexicon Model

Orthography

Semantics

Hidden

Hidden

Phonology

Hidden

Distributed Lexicon Model & Dyslexias

Phonological: nonwords (“nust”) impaired.

Deep: phono + semantic errors (“dog” as “cat”) + visual errors (“dog” as “dot”).

Surface: nonwords OK + semantic access impaired + difficulty reading exception words (“yacht”) + visual errors.
The Model

Corpus and Semantics

20 concrete (more features), 20 abstract.

Semantic Pathway Lesions, Intact Direct

Semantic Pathway Lesions, Lesioned Direct
**Direct Pathway Lesion**

![Graph](image)

**Errors**

- Visual
- Vis + Sem
- Semantic
- Blend
- Other

**Lesion Proportion**

0.0 0.2 0.4 0.6 0.8

**Concrete**

- No Sem
- Full Sem

**Abstract**

- No Sem
- Full Sem

**Reading: Distributed Lexicon Model**

- Distributed reps (not localized to one region).
- Interactive (not modules), leads to interesting divisions of labor.