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Regularities & Exceptions: A Continuum

Regularities in pronunciation are often partial, *context dependent*:
bint

i in *mint, hint, stint, ...* (regular)

vs *pint* (exception)

but also: *mind, find, hind, ...* (regular)

mine, fine, dine, ... (regular)

Pronunciation depends on context.

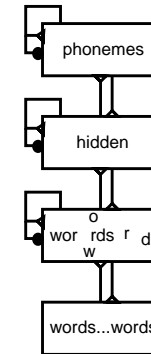
Exceptions are extreme of context dependent.

Need a range of context dependency for regulars and exceptions.

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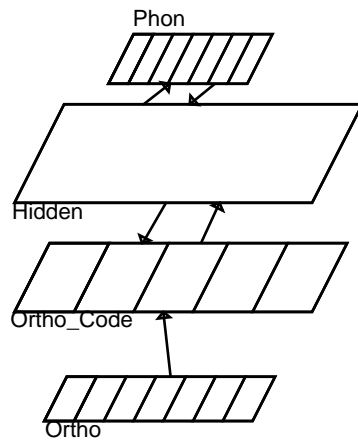
Reading as Object Recognition

Tradeoff between dependence & independence similar to object recognition: need invariance but also need to bind features.



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Reading Model



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Nonword Performance

Regularity tests (Glushko): bint → /bint/

Pseudo-homophones (McCann & Besner):

phoyce → /fYs/, choyce → /CYs/

Matched regularity/exception cases (Taraban):

High freq: poes → /pOz/, goes → /gOz/, does → /d^z/

Low freq: mose → /pOs/, poes → /pOz/, lose → /lUz/

Nonword Set	Model	PMSP	People
Glushko regulars	95.3	97.7	93.8
Glushko exceptions raw	79.0	72.1	78.3
Glushko exceptions alt OK	97.6	100.0	95.9
McCann & Besner ctrls	85.9	85.0	88.6
McCann & Besner homoph	92.3	n/a	94.3
Taraban & McClelland	97.9	n/a	100.0 ¹

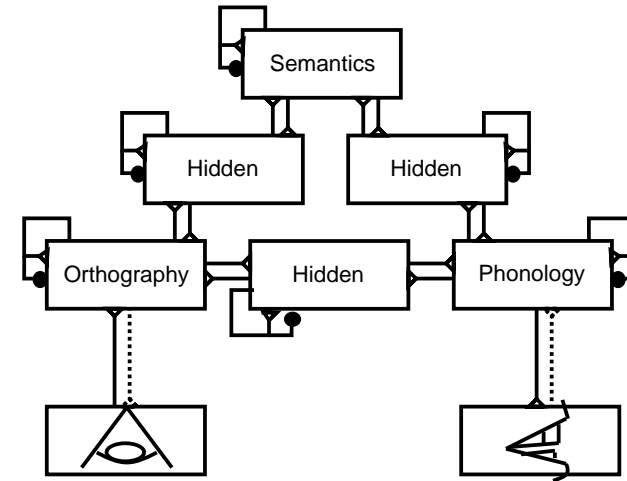
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Questions

- 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?

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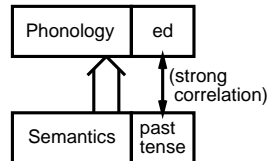
Distributed Lexicon Model



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Past Tense

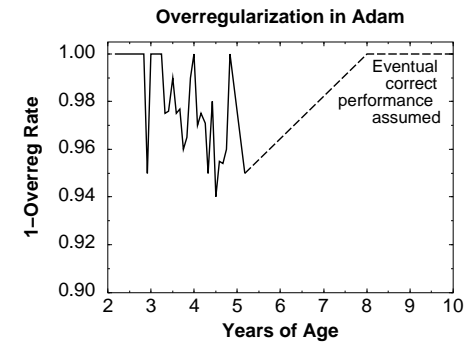
Simple production model: semantics to phonology, with inflections:



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Past Tense: U-Shaped Curve

This is the interesting target developmental phenomenon:



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U-Shaped History

Initially: separate, overzealous rule system.

Then: Rumelhart & McClelland, U-shaped curve based on network processing of regularities.

BUT: trained irregulars first, then regs.

(much controversy ensues)

Later: Plunkett et al., etc, manipulate enviro in graded way.

Problem: backprop is gradient descent!

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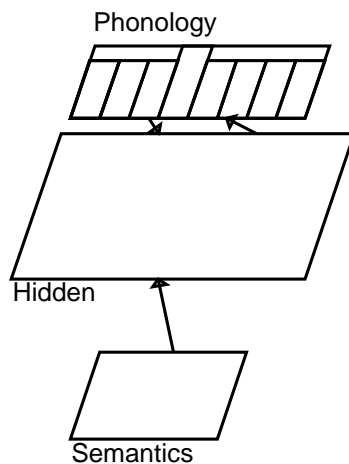
U-Shaped Model in Leabra

Interactivity, competition & Hebbian learning produce network that is in dynamic balance between reg & irreg mappings.

Small tweaks can shift it one way or the other (priming model).

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The Past Tense Model



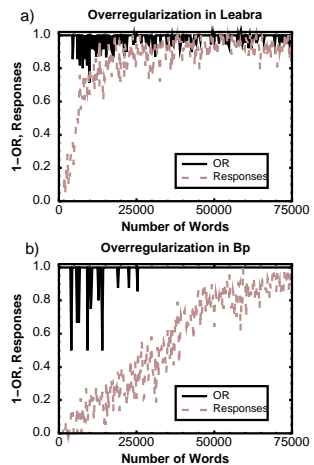
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The Past Tense Model

Inflection	Reg sfx	Regular/Irregular examples
Base	-	I walk to the store daily. I go to the store daily.
Past	-ed	I walked to the store yesterday. I went to the store yesterday.
3rd pers sing	-s	She walks to the store daily. She goes to the store daily.
Progressive	-ing	I am walking to the store now. I am going to the store now.
Past participle	-en	I have walked to the store before. I have gone to the store now.

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Past Tense Results



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Past Tense Results

