Reading:

*Steven Pinker’s, Words and Rules, Chapter 2*
Human language involves two different kinds of “mental tissue”:

- a finite lexicon of words, stored in and retrieved from memory;
- a finite grammar of rules (productive, abstract, combinatorial);
- these two mechanisms produce an infinite set of sentences;

What is the evidence for dichotomy between words and rules?
Human language involves two different kinds of “mental tissue”:

- a finite lexicon of words, stored in and retrieved from memory;
- a finite grammar of rules (productive, abstract, combinatorial);
- these two mechanisms produce an infinite set of sentences;

What is the evidence for dichotomy between words and rules?

The existence of regular and irregular verbs.
Regular Verbs

- Past tense: just add *-ed* to the end of present tense form.
- Set of regular verbs is open-ended (probably tens of thousands in the mental lexicon of an educated adult).
- New regular verbs enter English every year.

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<tr>
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<td>played</td>
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(snarf: to download a file, mung: to damage something, mosh: to dance in a roughhouse fashion)
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| spam | → |
| snarf | → |
| mung | → |
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- walk → walked
- play → played
- kiss → kissed
- spam → spammed
- snarf → snarfed
- mung → munged
- mosh → moshed

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(snarf: to download a file, mung: to damage something, mosh: to dance in a roughhouse fashion)
Berko Gleason’s wugs (1958)

This is a wug.

Now there is another one.

There are two of them.

These are two.

4–7 year old kids were shown a hand-drawn picture of a bird.

The kids generally replied: “These are two wugs”.

75% of the 4–5 year olds, 99% of the 6–7 year-olds

So, kids don’t just repeat words they have heard. They are capable of forming regular plural forms creatively.
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These are two __________.
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Berko Gleason’s wugs (1958)

http://www.youtube.com/watch?v=ElabA5YICsA
What about Verbs?

This is a man who knows how to BING. He is BINGING. He did the same thing yesterday. What did he do yesterday? Yesterday he __________.
Almost all kids replied *binged* (or *ricked, glinged*).

- So children form regular past tense forms creatively as well.
- Even when they have never heard the verb used before!

This is a man who knows how to *bing*. He is *binging*. He did the same thing yesterday. What did he do yesterday? Yesterday he __________.
Irregular Verbs

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<tr>
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<td>bought</td>
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<td>hold</td>
<td>→ holded</td>
<td>held</td>
</tr>
<tr>
<td>steal</td>
<td>→ stealed</td>
<td>stole</td>
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<tr>
<td>go</td>
<td>→ goed</td>
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- Some past tense forms don’t just add *-ed* to the end of the present tense form.
- Irregular past tense inflection is chaotic and idiosyncratic.
- Irregular verbs are a closed list, of 150–180 members.
- There have been no recent additions (not since *sneak–snuck* arrived during the 19th century).
- Kids rarely produce irregular past forms in the *wug*-test.

Linguists use an asterisk (*) to mark things which are not part of the language, or, at least, which make native speakers uncomfortable, or are meaningless.
Irregular Verbs

- buy → *buyed → bought
- hold → *holded → held
- steal → *stealed → stole
- go → *goed → went

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- hold → *holded → held
- steal → *stealed → stole
- go → *goed → went
- sing → sang
- think → *thank → thought
- ring → rang
- cling → *clang → clung

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A Simple Theory of Regular and Irregular Verbs

Regular past tense forms are formed by a rule.

\[ V_{past} \quad \text{V} \quad -ed \quad V_{past} \quad \text{walk} \]

Irregular past tense forms are stored and retrieved as words.

sound: hold
meaning: part of speech: V

sound: held
meaning: part of speech: V\_past
Regular past tense forms are formed by a rule.

\[ V_{past} \]
\[ V \rightarrow \text{ed} \]
\[ V_{past} \rightarrow \text{ed} \]

walk

Irregular past tense forms are stored and retrieved as words.

**sound:**

- hold

**meaning:**

- part of speech: V

**sound:**

- held

**meaning:**

- part of speech: \( V_{past} \)
We have two independent mechanisms for past tense formation:

- irregular past tense forms stored as words;
- a productive rule for regular past tense forms;
- Why don’t they get in each other’s way? held vs. *holded, stole vs. *stealed

Simple Answer
If a past tense verb form is stored in memory as a word, the rule is **blocked**. If no past tense form is stored, then the rule may be applied (e.g., _snarfed, moshed, ricked_).
There aren’t really that many of them.

Adding 180 words to a lexicon of tens of thousands of words is not such a big deal in terms of memory capacity.

Rules cut our mental storage needs!

Retrieving a word from memory is faster than applying a rule.

Especially for words we hear often (e.g., be, have, do, go, say).

**Simple Conclusion**

The existence of both words and rules, somewhat counterintuitively, makes human language more efficient.
Two Kinds of Words

<table>
<thead>
<tr>
<th>Linguistics:</th>
<th>word-as-morphological object, as opposed to phrases and sentences</th>
</tr>
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<tbody>
<tr>
<td>Psychology:</td>
<td>word-as-lexical entry, stretch of sound which has been memorized and cannot be produced by a rule</td>
</tr>
<tr>
<td>Pinker:</td>
<td>calls this a listeme</td>
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- Some memorized chunks are smaller than a word in 1st sense.
- Others are larger than a word in the 1st sense.
- The second sense of word covers things which appear only as parts of words in the 1st sense.
Two Kinds of Words

<table>
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<th>Suffixes</th>
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<tr>
<td>-able (cap-able)</td>
<td>piece of cake</td>
</tr>
<tr>
<td>-ed (wak-ed)</td>
<td>when pigs fly</td>
</tr>
<tr>
<td>-al (refus-al)</td>
<td>like two peas in a pod</td>
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<td>-ship (fellow-ship)</td>
<td>beat around the bush</td>
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<td>un- (un-finished)</td>
<td>see eye to eye</td>
</tr>
<tr>
<td>ante- (ante-cedent)</td>
<td>once in a blue moon</td>
</tr>
<tr>
<td>co- (co-pilot)</td>
<td>the last straw</td>
</tr>
<tr>
<td>re- (re-claim)</td>
<td>the best of both worlds</td>
</tr>
<tr>
<td></td>
<td>costs an arm and a leg</td>
</tr>
<tr>
<td></td>
<td>add insult to injury</td>
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The Anatomy of Language

Mouth and ears

Phonology
(rules that define the sound pattern of a language)

Lexicon
(stored entries for words, including irregulars)

Morphology
(rules for forming complex words, including regulars)

Syntatx
(rules for forming phrases and sentences)

Semantics
(meanings expressed through language)

Beliefs and desires
Regular English Verbs

- English inflection is very simple.
- Only suffixes; no prefixes
- At most one inflection per verb

Examples

- walk
- walk-s
- walk-ing
- walk-ed

One Rule for English Verb Inflection

A verb is composed of a stem and an optional suffix. The stems and suffixes themselves are stored in, and retrieved from, the mental lexicon.
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One Rule for English Verb Inflection

A verb is composed of a **stem** and an optional suffix. The stems and suffixes themselves are stored in, and retrieved from, the mental lexicon.
Irregular Verbs and Broken Telephones

- All irregular past tense verb forms used to be regular!
- They were formed by productive rules (e.g., sing → sang).
- Language acquisition has slightly imperfect fidelity.
- Your language is slightly different from your parents’ language, a little bit more different from your grandparents’, etc.
- The “broken telephone” metaphor (a.k.a. Chinese Whispers)

Hypothesis

For any irregular past tense form in Modern English, some past generation of English speakers must have failed to grasp the relevant rule; they memorized the forms as separate words, then passed the new version of the language on to their children; Once a past tense form has been stored as a word, it can become more and more irregular down the generations!
Irregular Inflection is Semi-systematic

- blow-blew, grow-grew, know-knew, ...
- bind-bound, find-found, grind-ground, ...
- drink-drank, shrink-shrank, sink-sank, ...
- bear-bore, wear-wore, swear-sware, ...

- Irregular verbs seems to display some patterns!
- Suppletion (e.g., go → went) is exception rather than rule.
- These patterns are the fossils of rules that lived in the minds of Old English speakers.
- But, evidence suggests that these patterns are represented, in some way, in the minds of modern-day English speakers.
Errors preschool children make in their spontaneous speech!

- It was neat – you should have sawn it!
- Doggie bat me [bit].
- The cheerios got aten by the Marky.
- I know how to do that. I truck myself [tricked].
- This is the best place I ever sot [sat].

- 8 out of 9 children make at least one error of this kind.
- Such errors persist well into their school-age years.
- Children have never heard adults using past tense forms like *swang* or *shuck*. Must be constructing these forms creatively, by analogy with other verbs they already know.
Irregular verbs cannot simply be memorized by rote. They show evidence of **patterning** even in minds of modern-day English speakers! Thus, the distinction between regular and irregular verbs, and hence between **words** and **rules**, is not so clear anymore.

**Hypothesis A**

Irregular past tense forms are also generated by rules.

**Hypothesis B**

There are no rules, only a general associative mechanism for recognising patterns.

500 year old debate about the nature of the human mind.
**Q1:** How do we acquire knowledge? Clearly, we are not born knowing everything! Else we wouldn’t have to go to school!

**Q2:** But are we born knowing anything at all?

**Q3:** Is the mind completely blank or do we start with some rudimentary understanding of the world?

- Questions examples of **nature-nurture** debate.
- Debate centers on relative contributions of biology and experience in determining any particular capacity.
- Nature: traits that are **genetically** or **biologically** determined.
- Nurture: traits that are **learned through experience** and interaction with the environment.
Rationalism versus Empiricism
### Rationalism
- Intelligence arises from the **manipulation of symbols** by rules.
- Associated with Leibniz and Descartes, Noam Chomsky.
- The human mind has lots of **innate structure**.
- Knowledge comes from logical deduction (i.e., “calculation”).

### Empiricism
- Intelligence arises from the mind **connecting together things** that were experienced together or that look alike.
- Associated with John Locke and David Hume.
- More recently with behaviourism (Ivan Pavlov, B.F. Skinner) and even more recently with connectionism.
- The human mind starts out as a **“blank slate”**.
- Knowledge comes by **generalising from observations**.
Some forms of procedural knowledge are innate. Newborn infants come into the world with a variety of different skills; reflexes are important for survival. Innate abilities are domain-specific, i.e., attuned to perform special operations only on a certain type of information. Nature constrains or limits on environmental influence.
Can the study of regular and irregular English verbs address one of the most important controversies in philosophy?

- Irregular verbs display some patterns, which sheds doubt on the words and rules theory.
- Perhaps there exist rules for irregular verbs too, we just haven’t thought of them yet.
- Or, there are no rules, all we need is a mechanism for recognising patterns.
- Rationalism vs empiricism.

Next lecture: more on words & rules and language development.