Overview: How can we find out what generalizations are real to the speaker? How can we find out whether some generalizations are better than others?

1 Back to the Chomskyan basics¹

• Let a grammar consist of (at least)²
  ▪ a function that labels any utterance as grammatical or ungrammatical.
  ▪ a function that assigns truth conditions to any utterance
    ▪ The grammar might be implemented as a lexicon and a list of rules, or a set of constraints, or something else.

• Let a linguistic theory be a function that, given a (finite) set of utterances (the learning data), produces a grammar.³

• These functions should ideally be accompanied by algorithms for calculating them.

So...

• a descriptively adequate grammar captures the psychologically real generalizations
• the real prize, an explanatorily adequate theory, will, given typical learning data, return an descriptively adequate grammar

But how do we figure out what the psychologically real generalizations are??????

2 Example: English noun plurals

<table>
<thead>
<tr>
<th>Word</th>
<th>kʰæt</th>
<th>kʰæts</th>
<th>pʰi</th>
<th>pʰiz</th>
</tr>
</thead>
<tbody>
<tr>
<td>cat</td>
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<tr>
<td>sack</td>
<td>sæk</td>
<td>sæks</td>
<td>kʰau</td>
<td>kʰaʊz</td>
</tr>
<tr>
<td>dog</td>
<td>daq</td>
<td>daqz</td>
<td>mæn</td>
<td>mæn</td>
</tr>
<tr>
<td>grub</td>
<td>gæb</td>
<td>gæbz</td>
<td>fut</td>
<td>fit</td>
</tr>
<tr>
<td>dish</td>
<td>dɪʃ</td>
<td>dɪʃiz</td>
<td>warf</td>
<td>warvz</td>
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<tr>
<td>fudge</td>
<td>fʌdʒ</td>
<td>fʌdʒiz</td>
<td>wɪf</td>
<td>wɪfs</td>
</tr>
</tbody>
</table>

¹ Mostly Chomsky 1965 pp. 25-27 but an amalgam of various Chomsky works, simplified and colored by my own views.
² We probably want the grammar to do much more. It could, given an utterance, return a gradient “goodness score” rather than a simple binary judgment. Given one utterance and some instruction, it could return some other utterance (e.g., cat + PLURAL = cats). And there’s a lot more to meaning than truth conditions! (Chomsky also requires a grammar to assign a structural description to an utterance, but I wonder if this is begging the question: a structural description can be used to explain more-observable properties of a sentence like its truth-conditions, but we don’t know a priori that it’s necessary.)
³ Chomsky’s definition of a linguistic theory is weaker: it need only define the set of possible grammars, independent of learning data. This allows Chomsky to define the term descriptively adequate theory, which is a theory that includes, as possible grammars, a descriptively adequate grammar for every language—but does not necessarily return that grammar given learning data for that language.
• Possible grammars

I. (just list every word you know)

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<tbody>
<tr>
<td>kʰæt</td>
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<td>pʰi</td>
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<tr>
<td>sæk</td>
<td>sæks</td>
<td>kʰau</td>
</tr>
<tr>
<td>dãg</td>
<td>dãgz</td>
<td>mæn</td>
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<tr>
<td>gãb</td>
<td>gãbz</td>
<td>fut</td>
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<tr>
<td>dãʃ</td>
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<td>wɪf</td>
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<td>pʰi</td>
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</table>

I.e., the grammar’s judgment function accepts utterances containing those items in positions where a plural is required (I like cats); its truth-condition-assigning function assigns the appropriate truth-conditions to utterances containing the items in the right column (I like cats is true iff I like members of the cat group—it has nothing to do with whether I like members of the dog group).

II. Add –s to everything, except for these exceptions:

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<tr>
<td>dãg</td>
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<td>gãb</td>
<td>gãbz</td>
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<td>dãʃ</td>
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<td>fãdʒiz</td>
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III. Add –z to everything, except for these exceptions:

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<tr>
<td>kʰæt</td>
<td>kʰæts</td>
<td>mæn</td>
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<td>sæk</td>
<td>sæks</td>
<td>fut</td>
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<td>dãʃ</td>
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<td>warf</td>
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<td>fãdʒ</td>
<td>fãdʒiz</td>
<td>wɪf</td>
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<tr>
<td>pʰi</td>
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</table>

IV. Add –shed after “sibilant” sounds, –s after non-sibilant [–voice] sounds, and –z otherwise, except for these exceptions:

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<tbody>
<tr>
<td>mæn</td>
<td>mæn</td>
<td></td>
</tr>
<tr>
<td>fut</td>
<td>fit</td>
<td></td>
</tr>
<tr>
<td>warf</td>
<td>warvz</td>
<td></td>
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<tr>
<td>...</td>
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</tr>
</tbody>
</table>

V. Change final /f/ to [v], and then add –shed after “sibilant” sounds, –s after non-sibilant [–voice] sounds, and –z otherwise, except for these exceptions:

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<tbody>
<tr>
<td>mæn</td>
<td>mæn</td>
<td></td>
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<tr>
<td>fut</td>
<td>fit</td>
<td></td>
</tr>
<tr>
<td>wɪf</td>
<td>wɪfs</td>
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<tr>
<td>...</td>
<td>...</td>
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</tbody>
</table>
2.1 Which generalizations are real? How about a wug test.

(Berko 1958, p. 154)

- Berko found that English-speaking adults (all highly educated, in her sample) consistently give the following plurals when presented with invented words (pp. 155-158):

\[
\begin{array}{llll}
\text{waŋ} & \text{waŋz} & \text{lan} & \text{lanz} \\
\text{gaŋʃ} & \text{gaŋʃiz} & \text{niz} & \text{niziz} \\
\text{kæʒ} & \text{kæʒiz} & \text{kia} & \text{kiaz} \\
\text{toʃ} & \text{toʃiz} & \text{tæs} & \text{tæsiz}
\end{array}
\]

Which of the grammars above could be descriptively adequate, given these data?

The adults disagreed about this word—what might we conclude?

\text{heaf} \quad \text{hifs, hivz}
3 Why is it hard to develop a descriptively adequate theory in phonology?

- Words that the speaker already knows are uninformative!
  - They don’t tell us anything about what generalizations the speaker has learned—she may have simply memorized that word.
- Constructing novel phonological situations to put speakers in is difficult.
  - Contrast this with syntax, where it’s easy to construct sentences that—presumably—the speaker has not encountered before.
- We often can’t be sure that these novel situations really test what we want them to test.
- Let’s look at some methods beyond the wug test for probing speakers’ knowledge…

4 Novel words from other languages—loan adaptation as a natural wug-test

- What do speakers do with words imported from other languages (loan adaptation), or when learning other languages (L2 phonology)?

- Context is less controlled than in wug test:
  - who did they first hear the word from?
  - do they know the spelling in the original language?
  - how well do they speak the foreign language?
  - are there established conventions for borrowing words from this language?

Russian

- Kenstowicz & Kisseberth 1979, p. 46—native words:

<table>
<thead>
<tr>
<th>dative sg</th>
<th>nominative pl</th>
<th>nominative sg</th>
</tr>
</thead>
<tbody>
<tr>
<td>xlebu</td>
<td>xleba</td>
<td>xlep</td>
</tr>
<tr>
<td>gribu</td>
<td>griby</td>
<td>grip</td>
</tr>
<tr>
<td>grobu</td>
<td>groby</td>
<td>grop</td>
</tr>
<tr>
<td>ěrepu</td>
<td>ěrepa</td>
<td>ěrepl</td>
</tr>
<tr>
<td>xolopu</td>
<td>xolopy</td>
<td>xolop</td>
</tr>
<tr>
<td>trupu</td>
<td>trupy</td>
<td>trup</td>
</tr>
<tr>
<td>sadu</td>
<td>sady</td>
<td>sat</td>
</tr>
<tr>
<td>prudu</td>
<td>prudy</td>
<td>prut</td>
</tr>
<tr>
<td>cvetu</td>
<td>cveta</td>
<td>cvet</td>
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<tr>
<td>zakatu</td>
<td>zakaty</td>
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<tr>
<td>razu</td>
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<td>zakazu</td>
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<tr>
<td>lesu</td>
<td>lesa</td>
<td>les</td>
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<tr>
<td>usu</td>
<td>usy</td>
<td>us</td>
</tr>
<tr>
<td>storozu</td>
<td>storoża</td>
<td>storoš</td>
</tr>
<tr>
<td>dusu</td>
<td>dušy</td>
<td>duš</td>
</tr>
<tr>
<td>rogu</td>
<td>roga</td>
<td>rok</td>
</tr>
<tr>
<td>porogu</td>
<td>porogy</td>
<td>porok</td>
</tr>
<tr>
<td>raku</td>
<td>raky</td>
<td>rak</td>
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<tr>
<td>poroku</td>
<td>poroky</td>
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</tbody>
</table>

'bread'
'mushroom'
'coffin'
'kull'
'bondman'
'corpuse'
'garden'
'pond'
'color'
'sunset'
'time'
'order'
'forest'
'whisker'
'guard'
'shower'
'horm'
'threshold'
'crayfish'
'vice'
• K&K report that words borrowed into Russian behave the same way (p. 53):

<table>
<thead>
<tr>
<th>dative</th>
<th>nominative</th>
</tr>
</thead>
<tbody>
<tr>
<td>garažu</td>
<td>garaš</td>
</tr>
<tr>
<td>gazu</td>
<td>gas</td>
</tr>
<tr>
<td>klubu</td>
<td>klup</td>
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</table>

• Moreover, final devoicing can be seen in a typical Russian accent when speaking English (p. 53)
  ▪ Of course, when a Russian speaker gets more proficient in English they may suppress this
  ▪ But this tends to be at least a phase that Russian learners of English go through

• Russian lacks /dz/, /ʃ/, /ɬ/. So what do Russian learners typically do with these sounds?
  ▪ K&K report (p. 337), for speakers who have already mastered /ʃ/ in other environments,

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<table>
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</thead>
<tbody>
<tr>
<td>badge</td>
<td>ba[č]</td>
</tr>
<tr>
<td>judge</td>
<td>[ʃ]u[č]</td>
</tr>
</tbody>
</table>

• Cf. the Bach test (What is the plural of [bax]?), proposed by Lise Menn (Halle 1978).

❓ Let’s discuss pros and cons of this approach
(See Peperkamp 2005 for a model of loan adaptation that requires more than just the normal grammar.)

5 Explanatory adequacy
• Suppose we could somehow achieve description adequacy for real languages
  ▪ figure out the “significant” generalizations in those languages.

• To build our linguistic theory, we still need to know which generalizations people tend to extract from learning data.
  ▪ Are some preferred to others?
  ▪ Are there hard limits on learnability?

For example
• Suppose we’re convinced by the wug test that English speakers’ grammar includes “use the [əz] form of the plural after sibilants”.
  → Exposed to the English data, they prefer a grammar with that generalization to one without it.
• But we know nothing about the learnability of “use the [ɨz] form of the plural after non-sibilants”.
• How can we investigate the relative learnability of generalizations?
6 Typology?

- Chomsky & Halle 1968 (“SPE”) proceed more or less according to this logic:
  - Assume that languages change when members of one generation learn a slightly different grammar from the grammar that generated the data they were exposed to.
  - Further assume that these changes involve learners’ constructing a more-preferred grammar than what would be strictly consistent with the learning data.
  - Therefore, if a certain phonological phenomenon is predominant cross-linguistically, it must be because learners prefer it (and therefore have introduced it into many languages).
  - Thus, we can tell what learners prefer by inspecting cross-linguistic tendencies.

I’m sure you can think of a lot of problems with this approach (see Blevins 2003, Ohala 1992)

7 Poverty-of-the-stimulus experiments

(See Wilson 2006, White 2012 for other nice artificial-language cases; Zuraw 2007 for within-language)

- Kim 2012
  - Teach people two alternations in an artificial language:
    - Mapi + alop + a → mapalopa (‘dog’s kiwi’)
    - Nat + ipul + a → natʃipula (‘monkey’s watermelon’)
  - In testing phase, sneak in some items like
    - Kito + ilip + a → ?

Discuss possible outcomes and what they’d tell us.

8 Surfeit-of-the-stimulus experiments

- Becker, Ketrez & Nevins 2011
  - Turkish has words whose final C alternates in voicing…
    - [kebap] ‘kebab-citation’ [kebab-u] ‘kebab-accusative’
    - …and words whose final C doesn’t alternate in voicing
    - [ketʃap] ‘ketchup-citation’ [ketʃap- u] ‘ketchup-citation’
  - Turkish speakers could have learned various generalizations about whether a final obstruent alternates in voicing under suffixation.
  - When tested on new words, they showed evidence of generalizations referring to syllable count and place
    - e.g., monosyllables tend not to alternate
    - Labial Cs tend to alternate
• But they didn’t show evidence of knowing generalizations about preceding vowel quality.
  more alternation after a high vowel \( \leftrightarrow \) true in lexicon but no effect in wug test

• Becker & al.’s conclusion:
  constraints like \(* \left[ \begin{array}{c} V \\ +hi \\
\end{array} \right] \left[ \begin{array}{c} C \\ \text{voice} \end{array} \right] V\) just don’t exist.
  But constraints like \(* VpV\) do.

9 Processing of native-language rules (Zhang & Lai 2006)
• Chinese languages often have tone sandhi
  when two syllables are put together into a word, their tones change:

\[
\text{(2) Mandarin tone sandhi:}
\]
\[
a. \quad 213 \rightarrow 35 / \_ \_ \_ 213
\quad \begin{align*}
xaw213-teju213 & \rightarrow xaw35-teju213 \quad \text{’good wine’} \\
t\_\_an213-lan213 & \rightarrow t\_\_an35-lan213 \quad \text{’exhibit’}
\end{align*}
\]
\[
b. \quad 213 \rightarrow 21 / \_ \_ \_ \{35, 35, 51\}
\quad \begin{align*}
xaw213-\_\_u55 & \rightarrow xaw21-\_\_u55 \quad \text{’good book’} \\
xaw213-\_\_an35 & \rightarrow xaw21-\_\_an35 \quad \text{’good person’} \\
xaw213-\_\_\_55 & \rightarrow xaw21-\_\_\_51 \quad \text{’good-looking’}
\end{align*}
\]

(Zhang & Lai p. 80)

• Various reasons to think that rule (b) should be “better” than rule (a):
  Both rules simplify a complex contour, so that it is easier to realize in a shorter time
  being nonfinal makes the first word shorter—see Zhang 2000.
  But (a) also involves raising of pitch, which increases articulatory demands in a short time.
  (b), on the other hand, involves straightforward simplification of the original tone
  (Zhang & Lai discuss other reasons...)

• Mandarin speakers use both rules very frequently—but is (b) nevertheless “easier” than (a)?
**Experiment**
- Zhang & Lai presented Mandarin speakers with a variety of real and “wug” combinations.
- Subjects hear the two syllables and had to pronounce them as a single word.

(Zhang & Lai p. 96)

- Subjects responded more slowly (higher values) when applying rule (a), for all types of words (real and wug).
  - (There are other interesting results concerning how the words were produced.)

- Zhang & Lai’s conclusion: Mandarin speakers have learned both rules, but have more difficulty using the “unnatural” one.

10 If we have time: Literary invention
- Also challenging to interpret, but has the advantage of getting speakers out of zone of memorization

**Imperfect rhyme in Japanese rap lyrics** (Kawahara 2007; see also Steriade 2003 on imperfect rhymes in Romanian translated poetry):

(2) *Mastermind* (DJ HASEBE feat. MUMMY-D & ZEEBRA)

a. ket拓base
    kick it kick it
    ‘Kick it, kick it’

b. ket拓bashita kashi de gettomanee
dea
    funkly lyrics with get money
    ‘With funky lyrics, get money’

(Kawahara p. 115)

- Unlike typical English rhyme where stressed syllable to end should be similar
  - *I hate parading my serenading* (Cole Porter, *You’re the Top*)
  - Instead, whole word or phrase should be similar
• Overall, sounds that belong to more natural classes together occur more often in rhymes:

(Kawahara p. 121)

Cluster splittability
• There is diverse evidence that languages treat sp, st, sk as less splittable than other cluster (bl, kr, ...).

• Fleischhacker 2006: reduplication, loan adaptation, (also puns)
  ▪ e.g., Farsi: esparta ‘Sparta’ vs. pelutus ‘Plutus’

• Is there a real preference for grammars that don’t split s{p,t,k}?
  ▪ or is it just a matter of mis-hearing or mis-articulation?

• Minkova 2003: evidence from alliteration in Middle English.
  ▪ When words that start with 2 or more consonants alliterate, poets allow C₁C₂ to alliterate with just C₁ (sl...s...; dr...d...; b...br...):

(Minkova 2001 p. 1)

• But s-stop clusters alliterate in full:

(Minkova 2001 p. 1)
How often do different $C_1C_2$ clusters alliterate with $C_1C_2$ rather than just $C_1$:

(Minkova 2001 p. 3)

(Minkova 2001 p. 6)
11 Where have we been?

- **Structure above the segment**: mora, syllable, grid, foot, p-word; prosodic morphology
- **“Downwards” interfaces**
  - phonetic motivation in phonology
  - phonologization of phonetic effects
  - autosegmentalism and its relation to articulation
- **“Upwards” interfaces**
  - phonology-morphology interactions
  - paradigms
  - syntax-phonology interface, phrasal phonology
  - prosodic structure above the p-word
- **“Sideways” interfaces**
  - phonology vs. the lexicon
  - phonology vs. processing

12 Where can you go?

*Next quarter*

- Phonological Theory III! (Ling 219; Bruce Hayes)
  - the exclamation mark is because it’s rarely offered
- Phonetic Theory (Ling 203; Pat Keating)
- April 6: Junko Itô colloquium
- June 1: Adam Albright colloquium

*Any time*

- You’re always free to drop by the phonology seminar—you don’t have to enroll and commit to the whole quarter.
  - Journal club episodes are a particularly efficient time to visit: learn about 10 or more phonology articles in just 2 hours!

References


