Applying the Competition Model to eCALL Learning

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• experimentalized Computer-Assisted Language Learning (eCALL) (MacWhinney, 2017): computerized instruction that collects controlled experimental data while engaging learners with computerized pedagogical tasks
  – Web-based cognitive tutors
  – Solid linguistic analysis
  – Rich and validated feedback
  – Experimental design: tight control of stimulus variables
  – Database for the study of cognitive processes in learning
  – Results automatically gathered for data-mining and hypothesis testing
  – HTML5, image, audio, video, easy accessibility (computers, tablets, mobile devices), app
eCALL tutors

- The English article tutor
- The English preposition tutor
- The Spanish conjugation tutor
- The French gender tutor
- The German case tutor
- The Chinese Pinyin tutor
- The Cantonese Jyutping tutor
- ...

SLAWeb is a system designed to promote sharing of ECALL tutorial methods and data for second language acquisition (SLA) researchers. Between 2007 and 2015, this work was supported by an NSF grant to the Pittsburgh Science of Learning Center (PSLC).

Second language and bilingual transcript data are in SLABank and BillingBank, using access from the TalkBank homepage.

<table>
<thead>
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<th>Basic Skills Tutors</th>
<th>Article/Gender Tutors</th>
<th>Media and VR Tutors</th>
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<td>English Preposition Tutor</td>
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<td>Spanish verbs</td>
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<th>Web-based Experiments</th>
<th>Wikipedia Tutors</th>
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<td>Language Learning City Tours</td>
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<tr>
<td>German Separable Prefixes</td>
<td>Wikipedia German Article Quiz</td>
<td>Dimsum Menu</td>
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</tbody>
</table>
English articles & prepositions

• Semantic tutors

• Polysemy: a single form associated multiple functions (Goldberg, 1995; Lakoff, 1987; Tyler & Evans, 2003)

• Polysemes (MacWhinney, 1982; 1984):
  • second mention $\rightarrow$ *the*
  • uniqueness $\rightarrow$ *the*
  • river names $\rightarrow$ *the*
  • high than $\rightarrow$ *over*
  • from one side to another $\rightarrow$ *over*
  • repetition $\rightarrow$ *over*

• Forms serve as cues for the activation of functions (MacWhinney, 1987; 1989; 2012); Polysemeic forms are not reliable cues due to one-to-many mappings.

• Also semantic abstractness $\rightarrow$ L2 challenges
English articles

• What are the polysemes in the English article system?

• What are the properties (availability and reliability) of these polysemes?

• How to design instruction to effectively teach the article polysemes to second language learners?
English articles

Zhao & MacWhinney (2018) MLJ

• A mini-corpus (26,468 words) (McDonald & MacWhinney, 1989)

• Extracted a complete list of article cues from well-recognized English grammar books (Celce-Murcia & Larsen-Freeman, 1999; Huddleston & Pullum, 2002; Quirk et al., 1985) and an ESL textbook (Cole, 2000)
English articles

• Analyze 86 polyseme properties (availability, reliability)
  • plural → Ø
  • non-countable → Ø
  • singular countable with post-modifiers → the
  • non-countable with post-modifiers → the
  • second mention → the
  • anaphoric reference in phrase → the
  • names of countries, cities or states → Ø
  • habitual location → Ø
  • ranking words → the
  • superlative → the
  • ...
Availability: A polyseme’s frequency of occurrence

Top 4 polysemes: add up to account for 50.8% of all the tokens
Top 10 polysemes: account for 76.3% of all the tokens
Most idiosyncratic polysemes have very low token frequencies
**Reliability**: a polyseme’s probability of correctly indicating the interpretation

Article polysemes are all highly reliable (mean reliability = .93), with only a few exceptions.
# Properties of the five cues with the highest availabilities

<table>
<thead>
<tr>
<th>Article Cue</th>
<th>Example</th>
<th>Availability</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 plural → 0</td>
<td><em>0 books</em></td>
<td>0.154</td>
<td>1.000</td>
</tr>
<tr>
<td>2 non-countable → 0</td>
<td><em>0 water</em></td>
<td>0.120</td>
<td>1.000</td>
</tr>
<tr>
<td>3 singular countable with post-modifier → the</td>
<td><em>the man she is dating</em></td>
<td>0.119</td>
<td>0.435</td>
</tr>
<tr>
<td>4 singular countable → a/an</td>
<td><em>a Shakespearean drama</em></td>
<td>0.115</td>
<td>0.988</td>
</tr>
<tr>
<td>5 plural with post-modifier → the</td>
<td><em>the letters I received today</em></td>
<td>0.063</td>
<td>0.392</td>
</tr>
</tbody>
</table>
Competition

• Polysemic competition rich in the English article system: conflict validity (MacWhinney, 1989)

1. Ø coffee
2. the coffee they gave us

3. a man
4. a man who came late to dinner
5. the man who came late to dinner and gave you this letter
• Learning on conflict; form-driven learning (MacWhinney, 1987): knowing the “blocking” relation between competing polysemes
  • non-countable $\rightarrow \emptyset$
  • non-countable with post-modifiers $\rightarrow \text{the}$

• Learning-on-error mechanism (McDonald, 1989): explicit feedback
• 74 intermediate-advanced Chinese-L1 EFL learners (Michigan Test of English Language Proficiency: mean score of 83.5/100)

• Random assignment

  1) Article training, metalinguistic feedback (n = 33)
  2) Article training, exemplar feedback (n = 31)
  3) Control group, preposition tutor (Wong, Zhao, & MacWhinney, 2018; Zhao et al., under review) (n = 10)

• Procedure

<table>
<thead>
<tr>
<th>Pretest</th>
<th>Training I</th>
<th>Training II</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>(25min)</td>
<td>(45min)</td>
<td>(45 min)</td>
<td>(25min)</td>
</tr>
</tbody>
</table>

Zhao & MacWhinney (2018) MLJ
Random Assignment:
1. Conflict learning with **Metalinguistic** feedback

**Compare the two sentences: Why do they require different articles?**

1) The two sisters were only interested in **the** wealth of their parents.

**Correct!**
The rule to apply is: **the-noncountable+clause/PP**.

Use *the* when a non-countable noun is modified by a relative clause or a prepositional phrase.

2) The two sisters were only interested in **the** wealth.

**Wrong.**
The rule to apply is: **0-noncountable**.

Use **0** with unmodified noncountable nouns.

**Your Accuracy: 80%**
Time remaining: 25:47

(Page 5 of 13)
Random Assignment:
2. Conflict learning with Exemplar feedback

Compare the two sentences: Why do they require different articles?

1) Nice job, Bob! Everyone liked a/an topic we picked.

Wrong.
Examples using the same rule:
The man she married was rich.
The math teacher that we had last year was very responsible.
The teacher explained the lesson in the class.

2) Bob, we need to pick a/an topic that everyone will like.

Correct!
Examples using the same rule:
Jim saw a man in the park.
There is a dirt road at the north end of this town.
He is an honest person.

Your Accuracy: 50%
Time remaining: 39:9
(Page 1 of 13)

An average of 12.24 seconds per screen
Results:

<table>
<thead>
<tr>
<th>Mean Accuracy</th>
<th>Pretest</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article training groups</td>
<td>0.677</td>
<td>0.879</td>
</tr>
<tr>
<td>Control group</td>
<td>0.628</td>
<td>0.687</td>
</tr>
</tbody>
</table>
Article training groups vs. Control group

<table>
<thead>
<tr>
<th>Mean Response Time (in Seconds)</th>
<th>Pretest time</th>
<th>Posttest time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article training groups</td>
<td>6.178</td>
<td>4.277</td>
</tr>
<tr>
<td>Control group</td>
<td>8.3</td>
<td>7.285</td>
</tr>
</tbody>
</table>
• No significance difference in terms of posttest accuracy \( (t = .875, p = .385, d = .22) \)

• Significant difference in terms of posttest response time \( (t = 3.176, p = .002, d = .80) \)
  - Exemplar-feedback group faster than metalinguistic-feedback -> analogical learning (Herron & Tomasello, 1992) leads to more fluent application of new knowledge obtained from feedback with high-frequency exemplars
• Polysemes: L1 (Mandarin) vs. L2 (English)

• Mandarin coverb *zai* (Li & Thompson, 1981)
  1) tā zhù zài Zhōngshān lù
      3sg live on Zhongshan Road
      S/He lives on Zhongshan Road.
  2) tā zhù zài Qīngdào
      3sg live in Qingdao (city)
      S/He lives in Qingdao.
  3) tā shuì zài guǎi jiǎo
      3sg sleep at corner
      S/He sleeps at the corner.
L1-L2 competition

L1 polysemes (Mandarin)
- Contact
- Containment
- Point

zai

L2 polysemes (English)
- on
- in
- at

Contact
Containment
Point
English Preposition Tutor

• Learning on conflict; Form-driven learning (MacWhinney, 1987)

• Learning-on-error mechanism (McDonald, 1989): explicit feedback

• Cognitive linguistics inspired feedback: image schemas (Johnson, 1987) helping learners achieve target-like conceptualization

• eCALL tutor

• Behavioural and electroencephalogram (EEG) measures

Zhao, Huang, Zhou & Wang (under review)
Random Assignment:
1. Schema-based feedback

Which of the following sentences best describes the picture?

- The frog hopped **towards** the pebbles.
- The frog hopped **over** the pebbles.

**Incorrect.**

Take time to carefully study why "**over**" is the correct choice:

The preposition "**over**" can be represented by this schema:

- The landmark is "pebbles". The trajector is "the frog".
- The preposition OVER shows how the trajector, from one side, crossed the landmark and reach another side. That is, the frog on one side crossed the pebbles and reached another side of the ground. The preposition TOWARDS only shows nearer and nearer to the landmark or a particular direction of the landmark.

Score: 75%
Time remaining: 72 minutes.
(12 of 84)
Random Assignment: 2. Correctness feedback

Which of the following sentences best describes the picture?

- Her friends leaned *against* her sick bed.
- Her friends leaned *over* her sick bed.

Correct!

Take time to carefully study why "over" is the correct choice.

Score: 100%
Time remaining: 75 minutes.
(1 of 84)
Acceptability judgment test

Correct: wave at the mosquitoes

Distractor: wave to the mosquitoes

Wrong: wave across the mosquitoes
wave to the mosquitoes

schema-based feedback

correctness feedback
• When the Competition Model is applied in L2 instruction:
  • When neither focus-on-meaning or focus-on-form works, form-driven learning can intervene to help solving fossilization-related acquisition problems due to low cue validity (availability and reliability) and L1 transfer.
  • Competition (phonological, lexical, syntactic, polysemic): Conflict learning (contrast)
  • Implementations in eCALL tutors
Thank you,
Brian!