Relative Clause Processing and Working Memory in Japanese, Chinese and Korean Learners of English as a Second Language

Summary

Ken Romeo – Stanford University School of Education (kenro at stanford dot edu)

Paradigms for Development
Orders of Acquisition ➔ Mechanism = UG based language acquisition device
Standards-based approach ➔ Mechanism = experience
The Parameter-setting Approach ➔ Mechanism = experience, switches
Constraint-based Lexicalism ➔ Mechanism = cognitive processes: WM

Working Memory
Object Relative: The reporter who the senator attacked [-] admitted the error.
Subject Relative: The reporter [who] [-] attacked the senator admitted the error.

The Research Question
How does processing change during SLA, specifically in listening comprehension?
Look at working memory in the acquisition of relative clauses:
Compare to WM associated with longer sentences
Compare to WM associated with syntax-free lists of words

Measure 1 – The Instrument
- 15 picture sets, sentences with relative clauses, 6 subject, 6 object, and 3 fillers
- Organized into sets - Each picture set contains: 1 “normal” sentence, 1 longer version: adjectives, filler prepositional phrases added (average of 7 words longer than “normal” version)
- 45 sentences, randomized into 5 sets of 9
- Subjects attempt 1 set per week

Example:
Short: A man that she did now know was sitting between the door and the window.
Long: A strange man that she did now know was sitting quietly but patiently between the empty chair and the front window.

Results
Significant effects: RMANOVA Time, Time x type interaction
Non-significant: RMANOVA Time x proficiency level, Time x language (well, marginally significant for correct responses)
Experiment 2 – Word Span
10 words, 2 sec each, PowerPoint
Results: Paired sample t-test and RMANOVAs were highly significant, Average increase of ~30%
No interaction with proficiency or language

Results: RT differentials
Unsurprising result: Longer subject relatives have longer reaction time than shorter ones
Surprising result: Shorter object relatives have a longer reaction time than longer ones
Possible explanation: Subjects are shifting resources to integration of long-distance gap-antecedent relationship

Results: Developmental
RT on longer subject relatives tends toward that of shorter subject relatives
RT on shorter object relatives tends toward that of longer object relatives
Possible explanation: Does not fit a model with global parameter re-setting. Processing becomes more efficient in the places where it is lacking.

Results: Word Span
Surprising result: A significant increase
Subjects reported using strategy of trying to create a sentence or story with the words → context
Possible explanation: Cue strength is increasing (Ericsson and Kintsch, 1995)

What does this mean?
For theory: Need a further study to confirm or deny this effect but it does not appear to fit a framework which postulates parameter-setting. A constraint-based framework where all available resources are used looks more likely. Also, word span results indicate that working memory is not necessarily constant.
For teachers: Learners should not be discouraged from using a lexical strategy. Also, the variability of working memory means that even “low span” readers can eventually improve.
The methodology: Shows the importance of reaction time in non-transformational approaches. Also shows how web-based data collection can be a powerful tool in doing cognitive research in the classroom.
Relative Clause Processing and Working Memory in Japanese, Chinese and Korean Learners of English as a Second Language

Summary Outline

Ken Romeo – Stanford University School of Education (kenro at stanford dot edu)

1. Introduction
   a. Long term teaching/observation
   b. Doubts about the progression in textbooks
   c. Three literatures: SLA, linguistics, psychology

2. Literature Review
   a. Orders of Acquisition
      i. Dulay and Burt (1974), Pienemann, Johnston and Brindley (1988) – L1 independent, morphological, based on UG and exposure
      ii. Functional approaches – exposure
      iii. Exposure = no teaching. Where is the mechanism?
   b. Linguistic Theory and Second Language Acquisition
      i. Chomsky’s Principles and Parameters Approach (Hawkins, 2001) – experience resets switches
      ii. Bates and MacWhinney’s Competition Model (MacWhinney, 1997) – experience gives stronger cue strength
      iii. Constraint-based lexicalism
         1. Head driven Phrase Structure Grammar (Pollard and Sag, 1994) – order independent rules in processing (comprehension/production)
         2. Parallel processing (McClelland, Rumelhart, 1986) – rules out modularity
         3. The role of working memory – r
            a. Relative clause processing is an example – subject relatives are easier than object relatives. (Just and Carpenter, 1992; Juffs and Harrington, 1995)
            b. Long sentences are an example – longer sentences are harder to process, especially with longer clauses at the end. (Arnold, Wasow, Losongco & Ginstrom, 2000)
   c. English Relative Clause Acquisition in Speakers of Asian Languages
      i. No distinction between relative clauses and other types of noun modifying clauses in Japanese, Korean and Chinese (Matsumoto, 1997)
      ii. Differences in acquisition based on word order and head direction (English and Spanish are SVO, head initial; Japanese is SOV, head final; Chinese is SVO, head final)
         1. Acquisition is fastest for Spanish speakers, Chinese next and Japanese last – Flynn, 1989
         2. However, Flynn 1989 methodology was criticized in Bley-Vroman and Chaudron, 1990
      iii. Subject/object relative acquisition varies with mode: production lags comprehension (Izumi, 2003)
iv. Japanese speakers learn words easier than syntax, Arabic speakers learn syntax easier than words (Fender, 2003)

d. Working Memory and Second Language Processing
   i. Vocabulary acquisition is not related to working memory (Masoura & Gathercole, 1999)
   ii. Ability to remember non-words predicts vocabulary learning in early stages (Cheung, 1996)
   iii. Reading working memory in L2 predicts reading ability in L2 (Harrington and Sawyer, 1992)

e. One Measure of Working Memory: Word Span
   i. Ability to remember word lists not related to syntactic processing (Roberts & Gibson, 2002)
   ii. Ability to remember word lists correlates with higher level verbal measures (Cantor, Engle & Carullo, 1992)

f. Processing in Listening
   i. Self-paced reading methodology cannot be implemented with listening (Ferreira, Henderson, & Anes, 1996)
   ii. Eye-tracking has shown that processing object relatives is more difficult than processing subject relatives (Tanenhaus, Spivey-Knowlton, Eberhard & Sedivy, 1995)

3. Hypotheses and Counter-hypotheses
   a. H1. Long subject relatives will have slower reaction time than short subject relatives.
   b. H2. Long object relatives will have slower reaction time than short object relatives.
   c. H3. Development of L2 proficiency across trials will only cause changes in those aspects of processing not related to integration. Thus, it will only increase the processing efficiency of words, not of distance effects, such as object relatives, or of long sentences. Reaction time will decrease on all sentences uniformly.
   d. H4. As an indicator of working memory, word span will not change over the course of assessment.
   e. CH1. Reaction time will show a sharp drop in both short and long object relatives simultaneously.
   f. CH2. Chinese speakers will show a sharp drop in reaction time to relative clauses sooner than Korean or Japanese speakers.
   g. CH3. Reaction time on subject relatives will not decrease over time for all language groups.

4. Methodology
   a. Classroom-based interface
   b. Reaction time
   c. Word span word lists – 150 unique 10 word lists based on the General Service List (West, 1953)
5. Experiment: Part 1 Comprehension Reaction time

a. Subjects

<table>
<thead>
<tr>
<th>Proficiency Level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Chinese</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Japanese</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Korean</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td>6</td>
<td>10</td>
<td>24</td>
</tr>
</tbody>
</table>

b. Instruments

i. Two sets of sentences: Subject relatives and object relatives (6 each)

ii. Two conditions on each sentence: Base form and long form, which was made by adding non-content filler: adjectives, prepositional phrases, etc. Long form was approximately 7 words longer than base form

iii. 21 Filler sentences were included, for a total of 45 sentences

c. Procedure – Subjects responded to 9 unique sentences each week over 5 weeks

d. Data Analysis – RMANOVA

e. Results – Neither native language nor proficiency level was a significant factor. However, time and time x sentence type were. In the graphs below, the base form is the line labeled “A” while the long form is labeled “C”. In addition, graphs are shown for reaction time on all items (“All Responses”) and reaction time only on items which were correct (“Correct Responses”).

   a. Method
      i. Subjects – same as above
      ii. Instrument and procedure – 150 unique word lists, within each list, words presented at 2 sec intervals, subjects recall words in writing
      iii. Data Analysis – RMANOVA
   b. Results – Neither native language nor proficiency level were significant factors, however, time was:
7. Discussion
   a. Listening comprehension reaction time
      i. Subject relatives: Response time is shorter for shorter sentences
      ii. Object relatives: Response time is shorter for longer sentences
      iii. Why? Possibly a resource shift: with longer gap-antecedent distance, processing shifts to main content words, which are the same in both long and short versions
      iv. Gibson (1998) – two types of memory loads: storage and integration. In subject relatives integration load is low so storage load is high. In object relatives, integration load is high so storage load is low. In order to accomplish this, it is possible that function words are ignored.
      v. Need a further study to confirm or deny this (How well do subjects recall function words on object relatives compared to subject relatives?)
   vi. Theoretical implications
      1. Does not fit a framework which postulates parameter-setting
      2. Fits a constraint-based framework where all available resources are used to the extent they can
   vii. Educational implications
      1. Learners can (and often will) shift processing automatically
      2. Gives support to instructional approaches that
         a. Do not restrict processing strategies to either lexical or syntactic, but encourages learners to make what sense they can of aural input
         b. Encourage attention to content words as a first strategy for processing
         c. Promote the awareness of structure, but not absolute dependence on it
   b. Word span
      i. Subjects get better at remembering strings of words
      ii. Subjects report: the trick is to make a sentence of the words – they are adding syntax
      iii. Theoretical implications
         1. Working memory for words is not constant for the individual.
         2. Gives further support to models of working memory which are not monolithic
   iv. Educational implications
      1. “Low span readers” are not necessarily doomed to a lifetime of reading disability
      2. Gives support to instructional approaches that
         a. Encourage an expansion of this type of word span memory – memorization should not be the sole focus, but has a role (Ericsson & Kintsch, 1995)
         b. Allow for all areas of individual development – there is less support for any concept of inherent lack of “aptitude”
   c. Methodology
      i. Reaction time may be a better source of data than simply number correct or incorrect when studying language learners
      ii. Web-based instruments offer the possibility of the expansion to the classroom of methodologies that were once restricted to the psychology laboratory. Researchers would no longer be restricted to assessing one
subject at a time, and therefore teachers who have access to computers could initiate and participate in such studies. The word span instrument in this study could also be implemented in a web-based application.

iii. The language learning classroom may have many resources to inform cognitive psychology.

References


