Questions? Comments? Please write me an e-mail!

Statistics and Language-World Knowledge Interact in Foreign-Language Learning

Judith Köhne(judith@coli.uni-sb.de) & Matthew W. Crocker, Saarland University

Universität des Saarlandes

Adults rely on statistics

▪ To **learn word meanings**, they keep track of co-occurrences of words & referents (cross-situational word learning, CSWL, Yu & Smith, 2007).

Adults rely on their Knowledge about Language structures & the World

▪ They use this knowledge to **make predictions and inferences when processing spoken** sentences (Altmann & Kamide, 1999)

How do statistics and knowledge interact in foreign language word learning?

➔ ***Experiment 1***

Which cue dominates when they are in conflict?

➔ ***Experiment 2***

Experimental Paradigm & Basic Procedure

▪ German adults learn a mini semi-natural language (based on Indonesian) in three basic phases:

1. Verb learning: Participants are familiarized with restrictive verbs (e.g. eat, sew) and non-restrictive verbs (e.g. take).

2. Noun learning: Visual static scenes & auditory SVO-sentences are presented. Participants are asked to understand the sentences and learn the nouns.

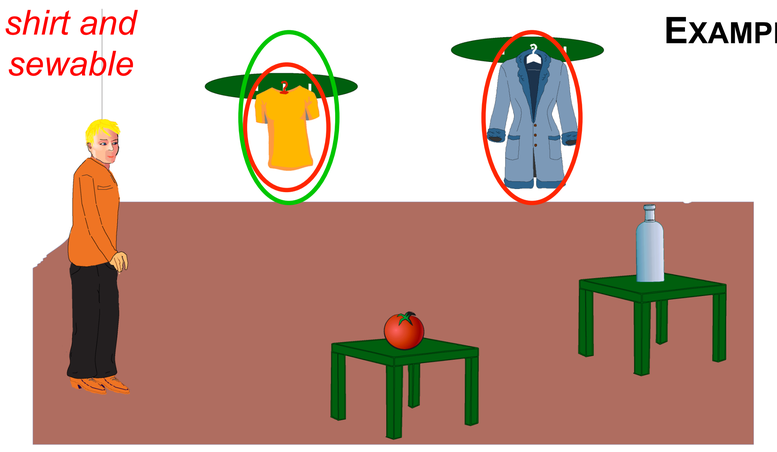
3. Vocabulary test ('Click on the object matching the spoken noun.') & confidence rating ('How sure are you about your choice?', 1(not sure)-9(sure))

Example Noun Learning Phase

Verb cue: shirt and jacket are sewable

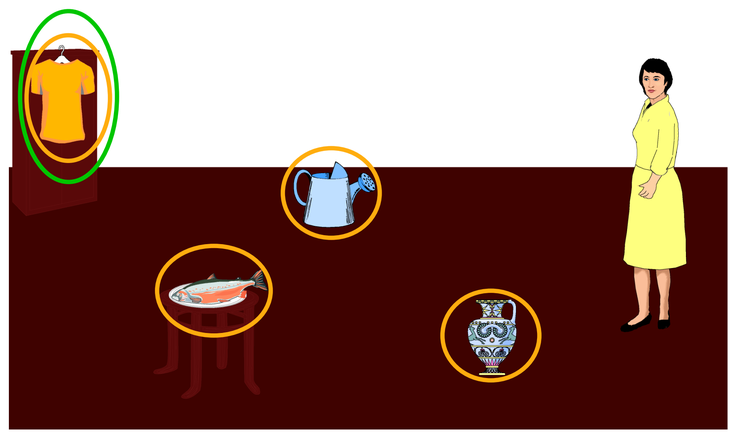
CSWL: shirt repeated, 'badut' repeated

Trial 1



[Si laki]$_{NP1}$ [mankemema]$_{verb}$ [si badut]$_{NP2}$.
DET man sew-MEMA DET shirt
'The man will sew the shirt.'

Remember: All verbs are known already in this phase!



Trial 2

[Si gadis]$_{NP1}$ [tambamema]$_{verb}$ [si badut]$_{NP2}$.
DET woman take-MEMA DET shirt
'The woman will take the shirt.'

Experiment 1

Manipulation of the degree of verb restriction to study the interaction of CSWL and verb-derived inference learning

Conditions

The nouns (Phase 2) were in one of three conditions:

1. Noun occurs with restrictive verb and there is only 1 object in scene matching the verb category (+3 distractor objects):
   ***Si laki bermamema si sonis* ('The man eats the tomato')**
   tomato, shirt, bottle, jacket, man
2. Noun occurs with restrictive verb but there are 2 objects in scene matching the verb category (+2 distractor objects):
   ***Si laki mankemema si badut* ('The man sews the shirt')**
   shirt, jacket, tomato, bottle, man
3. Noun occurs with non-restr. verb > 4 potential referent objects:
   ***Si gadis tambamema si badut* ('The woman takes the shirt')**
   shirt, fish, vase, can, woman

Results

✓ Noun learning was significantly above chance for all conditions.

✓ Nouns were learned best (77%) and decisions were rated highest (7.0) in Condition 1. > Direct verb cue (with the visual context and word knowledge) helped learners to learn noun meanings.

✓ Learning & rating were higher for Condition 2 (74%; 6.4) than 3 (66%; 5.4). > Verb cues worked together with CSWL.

Overall Conclusions

▪ CSWL and verb information (with visual context & world knowledge) can work together in foreign language word learning.
▪ When in conflict, both cues are considered.
▪ Statistical information cannot be fully ignored but overridden.
▪ Prior knowledge can be ignored in principle, however, probably there is an even stronger influence in real life.

Experiment 2

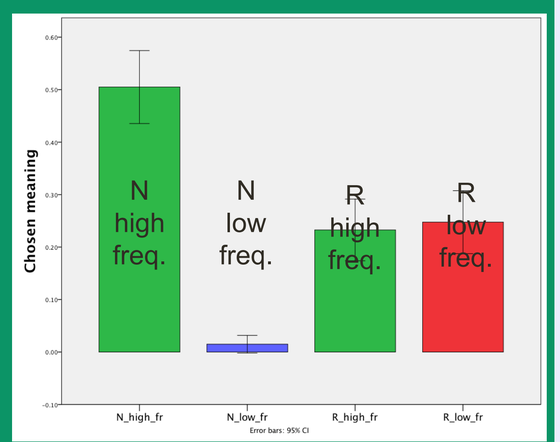
Each noun has two potential meanings (= 2 potential referents) - one favored by frequencies, the other favored by verb information

Crucial Design Characteristics

▪ Each noun has two potential conflicting meanings
– Low frequency meaning (co-occurrence noun & object: 50%)
– High frequency meaning (co-occurrence noun & object: 83%)

▪ AND each noun is in one of 2 Conditions
– **R**(estrictive): Noun occurs with restrictive verb which favors the low-frequency meaning!
– **N**(on-restrictive): Noun occurs with non-restrictive verbs, i.e. there is no cue except statistics applicable.

>>> *Nouns in **Condition N** just have a frequency-favored and a frequency-disfavored meaning. Nouns in **Condition R** have a frequency-favored and a verb-favored meaning (= conflict)!*



RESULTS

✓ Noun learning sig. above chance for both conditions, no sig. difference (N: 87.5%, R: 80.8%)

✓ **N**: High-freq. meaning chosen 97%
✓ **R**: High-freq. meaning: 48.5%
>>> Interaction chosen meaning & condition

✓ No difference in confidence ratings for N vs. R BUT sig. higher confidence rating for high-frequency choices than low-frequency choices in R (7.5 vs. 6.5)

>>> In R, learners' choices are clearly biased by verbs! However, when learners chose the verb-favored meaning, their confidence was lower > frequencies still influenced them!

References
Altmann, G.T.M., & Kamide, Y. (1999). Incremental interpretation at verbs: Restricting the domain of subsequent reference. *Cognition*, 73, 247-264.

Yu, C. & Smith, L.B. (2007). Rapid word learning under uncertainty via cross-situational statistics. *Psychological Science*, 18, 414-420.