Residual indeterminacy in a core grammar phenomenon: evidence from the processing of Noun- Noun compounds

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introduction

- Word-order phenomena not driven by discourse/pragmatics are generally assumed to be mastered early in L2 acquisition.
- Phrasal semantics is predicted to be unproblematical for advanced L2 speakers (Slabakova 2008).
- We compared the acquisition of 2 word-order phenomena by very advanced learners of English (with Spanish/ German L1)
  a) Noun-noun compounds *(car key)* – involving phrasal semantics
  b) Split verb-particle structures *(He ate it up)*– "strictly" syntax
  (possibly reliant on the same parameter – see Snyder (2007).
  (a) German and English feature productive compounding and head-last word order in the DP. The reverse is true in Spanish.
  (b) Neither German nor Spanish allow P stranding, but German has verb particles and these appear after the object in V2 structures.
- <u>QUESTION</u>: Is residual indeterminacy found in advanced learners in these structures?

methods

Participants: 10 Spanish and 10 German very advanced L2 speakers of English (with min. score of 60% on cloze test from the Cambridge Certificate in Advanced English) + 10 native controls. All right-handed. Initial exposure to L2 after 8 years of age.

<u>NOUN-NOUN COMPOUND STUDY</u> (3x2x4 repeated measures design)
- Timed grammaticality judgment task (with masked priming of the intended head) with 2 conditions:
  (1) car key   (Grammatical word order)
  (2) *knife bread   (Ungrammatical word order)
- 4 types of semantic relation: FOR *(dog basket)*, FROM *(moon soil)*, MADE OF *(nettle juice)*, TYPE OF *(phone socket)*. N = 10 each.
- All items were endocentric, irreversible compounds instantiating a modification relation.
- Compound frequency estimated from Google N-grams (155 E+9 words)

<u>SPLIT VERB-PARTICLE STRUCTURES STUDY</u> (3x2 design)
- Timed grammaticality judgment task with 2 conditions: Split verb-particle structure (3) vs. Ungrammatical control sentence (4)
  (3) The magician took his hat off.   (split verb particle)
  (4) *The monkey fell the wall off.   (stranded preposition)
- All items superficially identical:
  [det] [noun] [verb] [det] [noun] [prep./ part.]

<u>STATISTICAL ANALYSES</u>: ANOVAS and mixed-effect modelling. The latter allows continuous variables (e.g. proficiency, frequency) and can control for random effects (e.g. participants, test items).

hypotheses

1. Do these advanced learners display residual indeterminacy in either of these core-grammar phenomena?
2. If so, is the phenomenon involving phrasal semantics proving harder than the "strictly" syntactic phenomenon?
3. Can L1 influence be detected, differentiating the 2 groups?

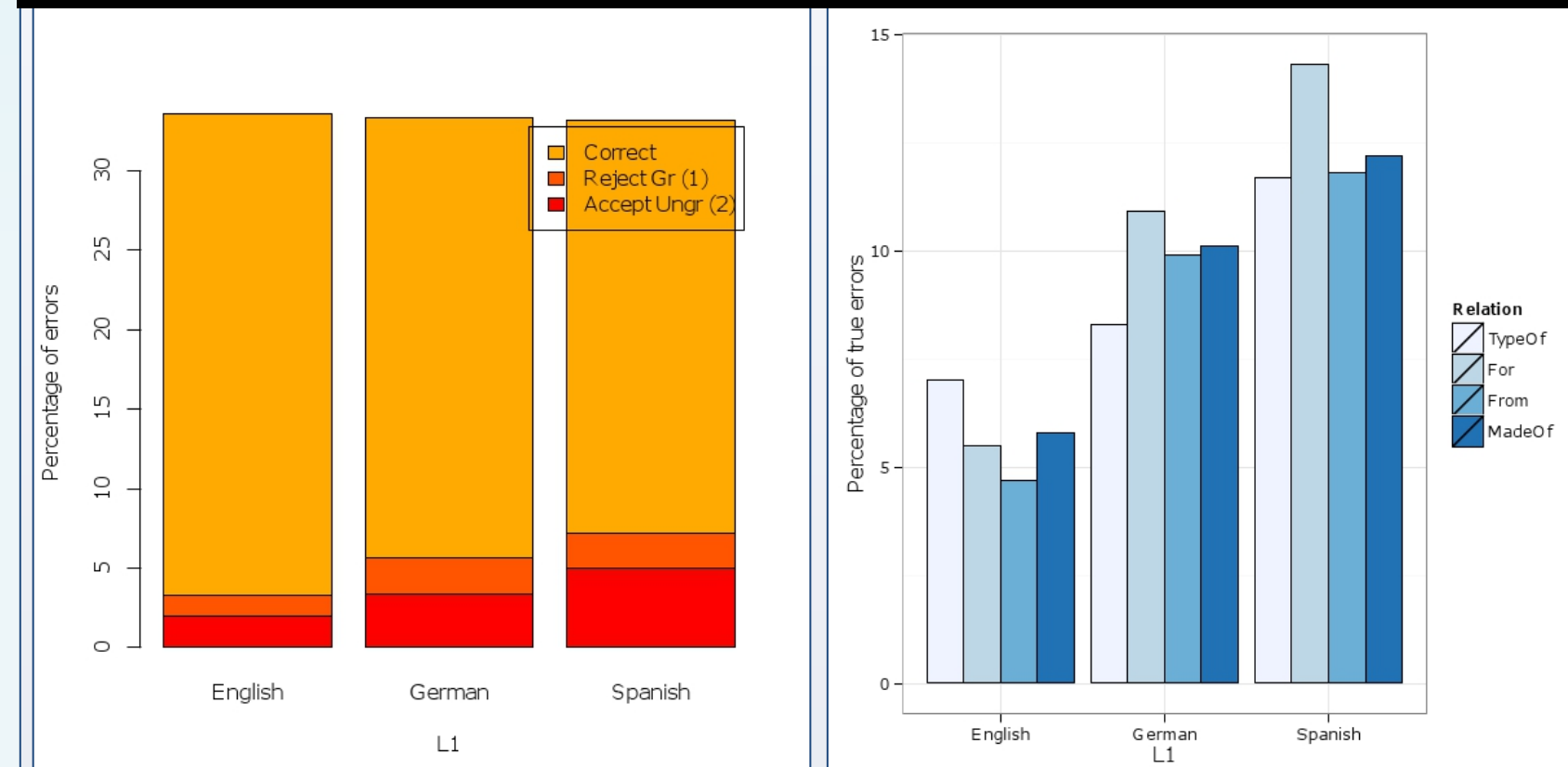## NOUN-NOUN COMPOUNDS: GRAMMATICALITY JUDGEMENTS (ACCURACY)

Fig 1: True errors by language group and error type (left) or relation (right)

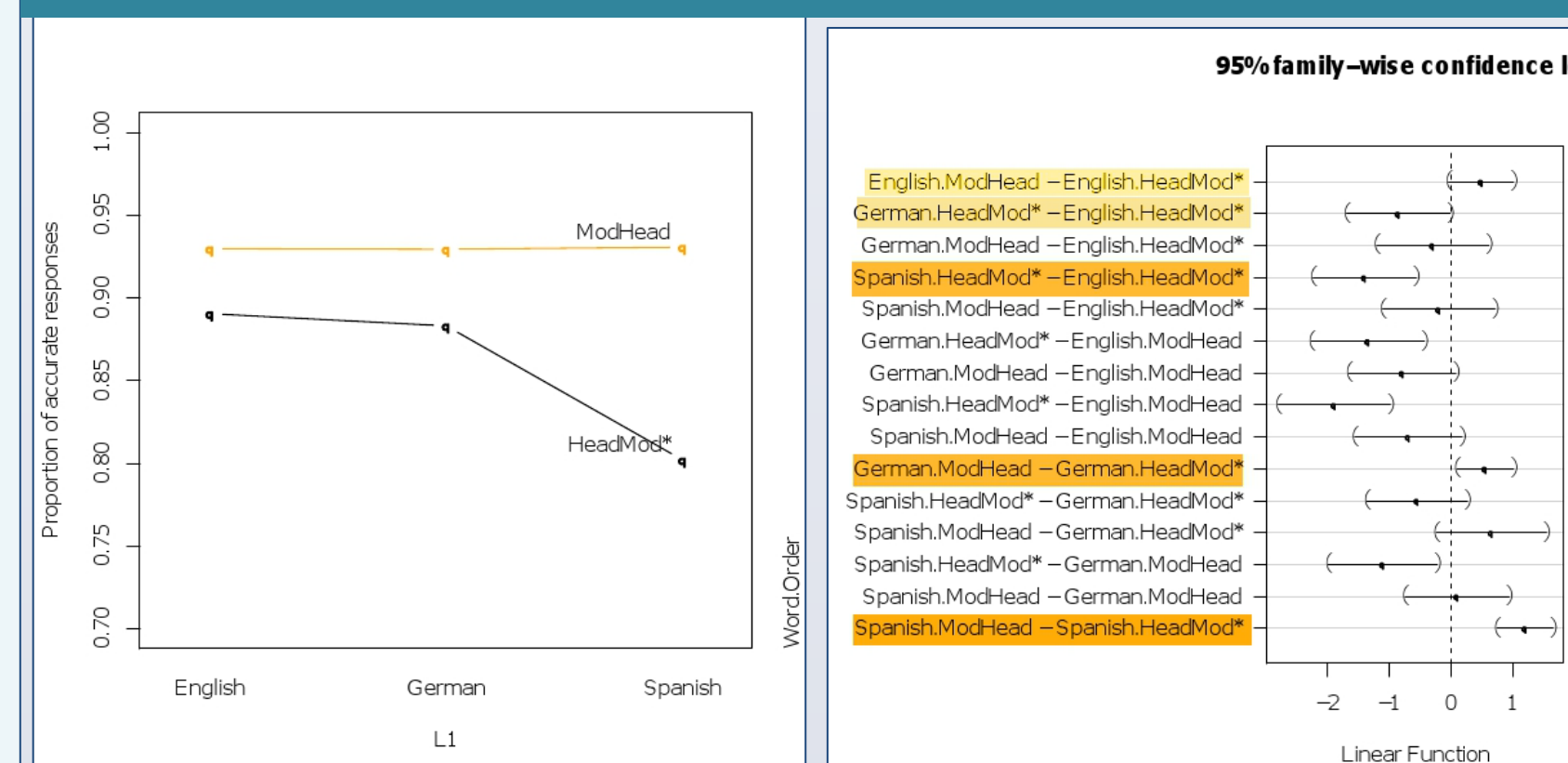**MIXED-EFFECT MODEL**: accuracy ~ (L1 * Word.Order) + (1|Subject) + (1|Item)

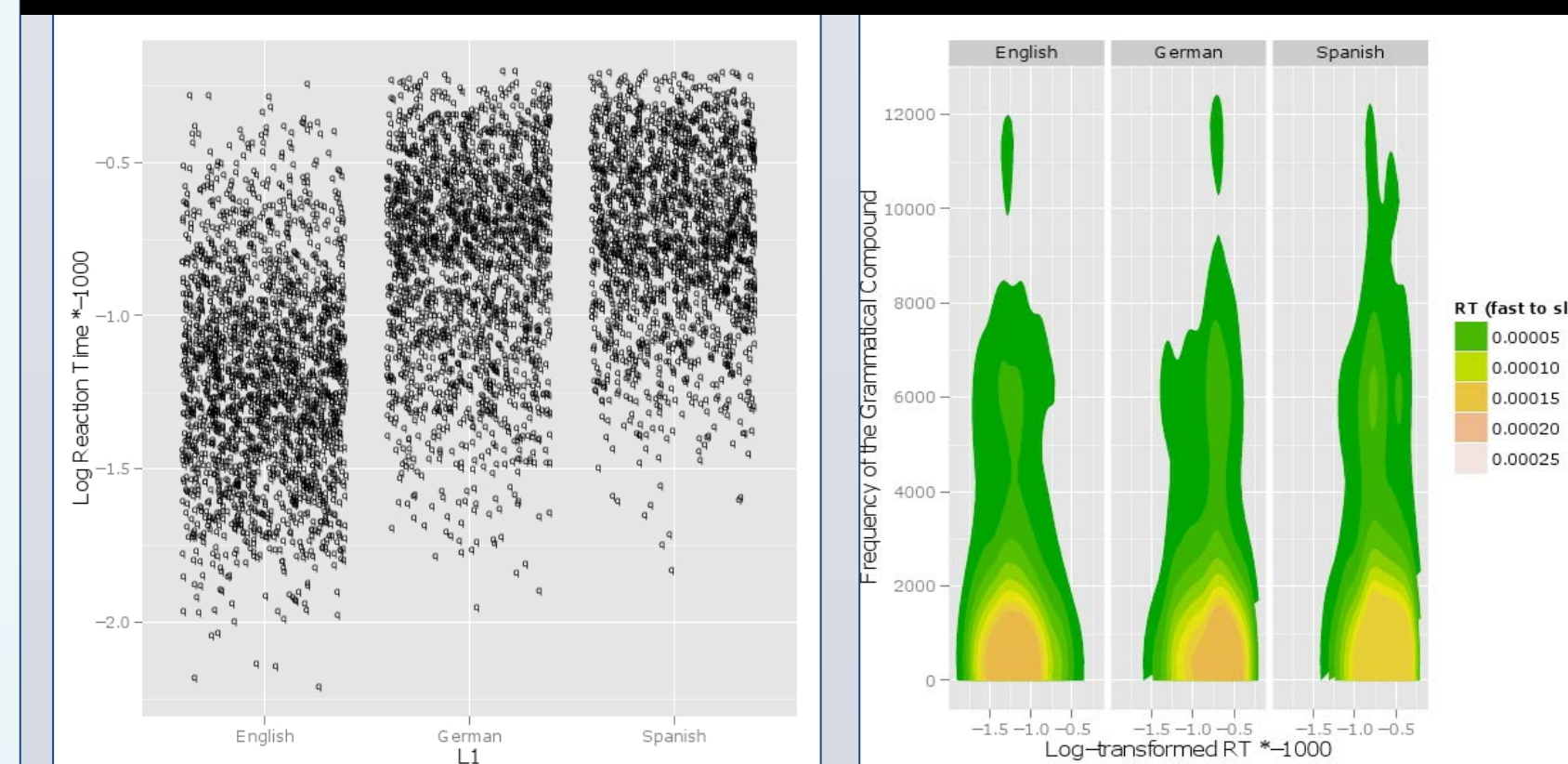Fig 2: Mixed-effect model visualisation   Fig 3: Tukey pair-wise comparisons

OBSERVATIONS AND ANALYSIS

- Controlling for the random effects of participant ("subject") and test item yielded a significant improvement of the model.
- The FOR relation tends to be harder for L2ers (Fig.1) but including Semantic Relation did not improve the model significantly.
- Controlling for proficiency did not improve the model significantly.
- There is an interaction of group (L1) and Word Order.
- Performance is equally good in the Grammatical Word Order condition for all groups (orange line in Fig.2 and "RejectGr" in Fig.1). The difference between word orders is significant for the Spanish and German groups and approaches significance for the English group (Fig.3). (Note: Relevant comparisons highlighted in dark yellow if significant and light yellow if approaching significance.)
- In the Ungrammatical Word Order condition (HeadMod* - black in Fig.2), Spanish participants did significantly worse than the controls (Figs.2-3) (with no significant difference between Spanish vs. German groups, and only a trend between German and English groups).

CONCLUSIONS:

1. Errors in all groups are mainly over-acceptance of the ungrammatical word order.
2. Non-native speakers tend to accept the ungrammatical word order more than the natives.
3. L1 influence significantly increases this tendency (presumably due to the need to "over-rule" the L1 word-order).

NOUN-NOUN COMPOUNDS: REACTION TIMES

Fig 4: Reaction Time by L1 group   Fig 5: Reaction time by Frequency and by L1 gr.   Fig 6: Mixed-effect model visualisation

OBSERVATIONS AND ANALYSIS

- All groups were faster in the Grammatical Word Order condition (orange line in Fig.6).
- All groups seem similarly influenced by the frequency of compounds (Fig.5: green = fastest). Controlling for Frequency did not improve the model significantly.
- Controlling for Proficiency improved the model significantly (as well as controlling for the random effects of participant and test item).
- There is an interaction of group (L1) and Word Order.
- Spanish group was the slowest in both word order conditions (Fig.6).

MODEL: logRT ~(L1 * Word.Order) + Proficiency + (1|Subject) +(1|Item)

CONCLUSIONS

1. L2 speakers are slower at processing Noun-Noun compounds, even if their L1 has the same word order and productive compounding.
2. Conflicting L1 settings (head-first; non-productive compounding) result in yet slower processing (cf. Spanish group).
3. L1 and L2 speakers process the grammatical word order faster.

Is this an effect of syntax, phrasal semantics, or both?
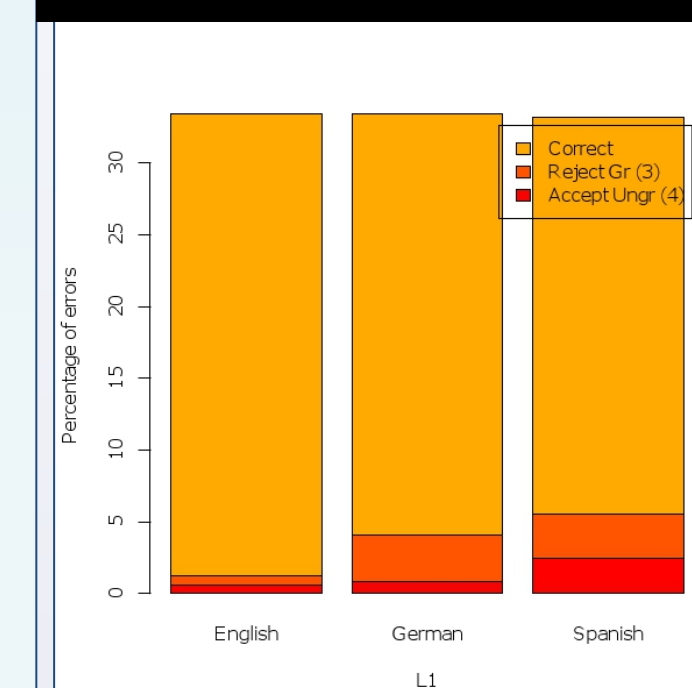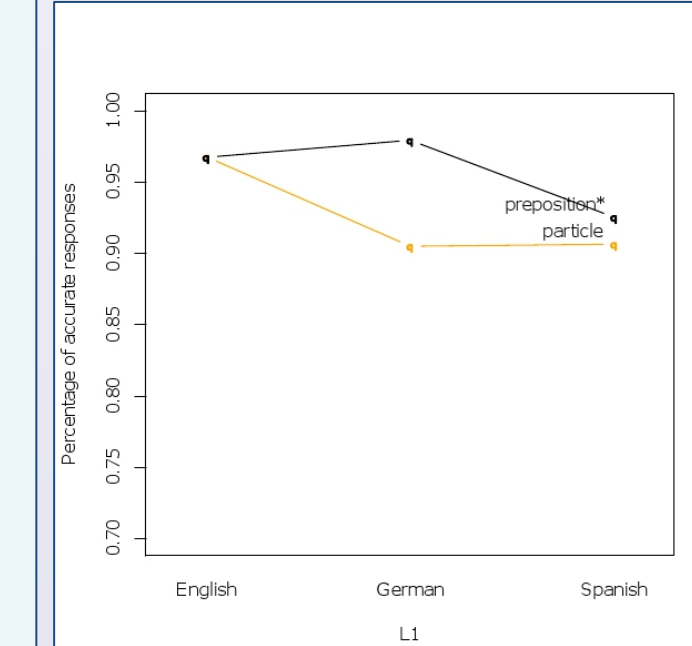
SPLIT VERB-PARTICLE STRUCTURES
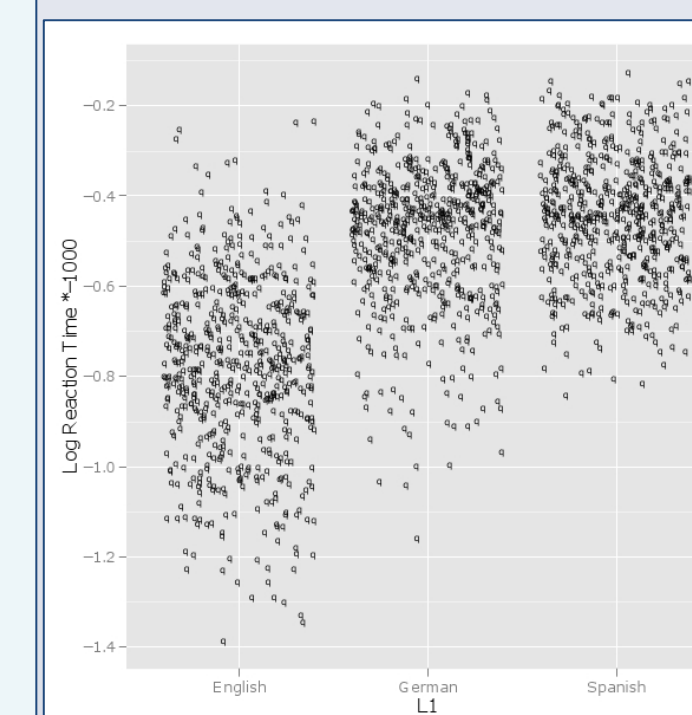
ACCURACY DATA (Figs.7-8)
- Ceiling effect in the English group.
- No significant difference between the L2 groups; English group significantly more accurate.
- The errors in *Preposition condition (Accept Ungr in Fig.7; black in Fig.8) are probably lexical in nature (wrongly treating P as particle).

Fig.7: True errors by L1 group

MODEL: accuracy ~ L1 * Condition + Proficiency + (1|Subject) + (1|Target)

REACTION TIME DATA (Figs.9-10)
- Slower processing by the L2 groups.
- No significant difference between L2 groups.
- Ungrammatical stranded preposition structures (4) (black line Fig.10) *tend* to be processed faster than grammatical split-verb-particle structures (3) (orange line) by L2ers but not by natives.

Fig.8: Model visualisation

MODEL: logRT ~ L1 * Condition + Proficiency + (1|Subject) + (1|Target)
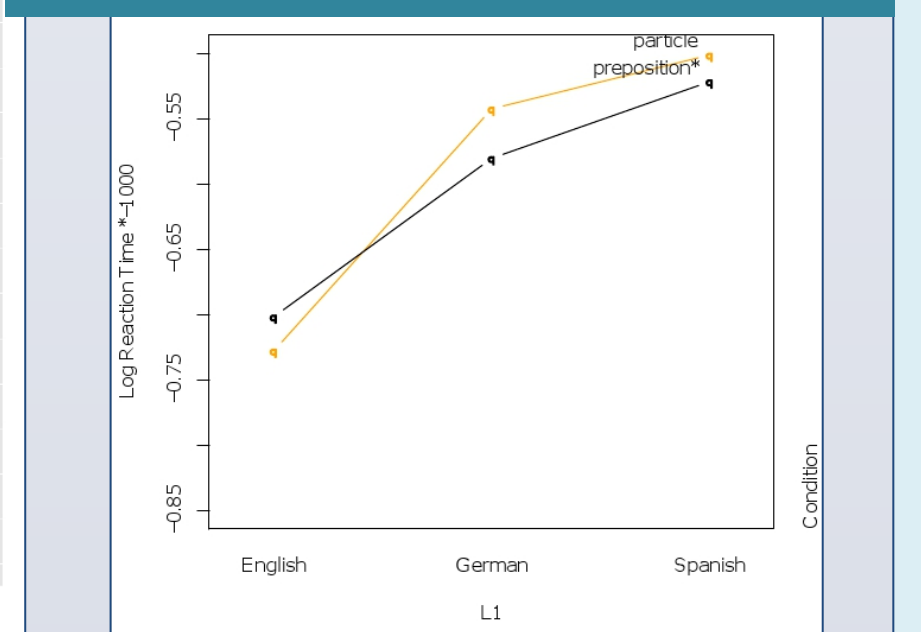

Fig 9: Reaction Time by language group   Fig.10: Model visualisation

conclusions

1. Residual indeterminacy observed in the processing of **core grammar** phenomena by advanced L2ers.
2. Effects of residual indeterminacy manifest themselves in terms of accuracy and speed.
3. Advanced L2ers remain slower at processing word-order phenomena, whether or not lexical semantics is involved.
4. The nature of the difficulty for L2ers remains unclear at this point.

<u>Implications</u>: A reappraisal of the Interface Hypothesis (Sorace 2011) and the Bottleneck Hypothesis (Slabakova 2008) is needed.
<u>Next step</u>: ERP study (in progress).

SELECTED REFERENCES: ● LIBBEN, G. & JAREMA, G. (Eds.) (2006) *The Representation and Processing of Compound Words*, Oxford, OUP. ● SLABAKOVA, R. (2008) *Meaning in the Second Language*. Berlin: Mouton De Gruyter. ● SNYDER, W. (2007) *Child Language. The Parametric Approach*. Oxford: OUP. ● SORACE, A. (2011) Pinning down the concept of "interface" in bilingualism. *Linguistic Approaches to Bilingualism*, 1, 1-33.

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