Converging evidence from experimental and corpus data: the dative alternation in learner English

Stefan Th. Gries
Department of Linguistics
University of California, Santa Barbara
http://tinyurl.com/stgries

Corpus data and its role in Construction Grammar

- Corpus data and methods have by now become accepted in theoretical linguistics, in particular in usage-based linguistics & Construction Grammar (CxG)
  - the main building block: units or constructions
    - pairings of form and function (broadly understood)
    - may involve lack of complete predictability of form/function
    - may involve "sufficient frequency" of unit
    - range from simple morphemes to abstract sentence-level cxs
- but much work in CxG was narrow
  - methodologically: much introspective work (as in GG)
  - 'areally': much work on synchronic adult L1 speakers
- this has changed: usage-based linguistics is now not just theoretically, but also empirically usage-based

The present paper

- For a theory that claims that
  - linguistic knowledge is knowledge of constructions
  - linguistic structure/representation emerges from use
- maybe obvious questions are
  - whether NNS build up their constructicons as NS do
  - whether non-native speakers' constructicons are different from those of native speakers
  - are differences quantitative tendencies or qualitative?
- this paper looks at the dative alternation (with *to*)
  - *Picard gave* [$_{\text{NP REC}}$ *the Borg*] [$_{\text{NP PAT}}$ *his phaser*]
  - *Picard gave* [$_{\text{NP PAT}}$ *his phaser*] to [$_{\text{NP REC}}$ *the Borg*]
- specifically,
  - do German learners of English exhibit structural priming effects comparable to English NS?
  - what affects priming effects of German NNS?
  - are priming effects of NNS correlated with the verbs' distributional preferences in NS corpus data?

Previous work on this

- Gries & Wulff (2005) replicated a series of priming experiments from Pickering & Branigan (1998) and indeed found a priming effect
  - odds ratio for priming: 2.57 (95% CI: (1.85, 3.58))
  - chi-squared=34.55, *df*=1, *p*<0.0001
- also, they found an overall correlation between
  - the verbs' constructional preferences in the NNS' sentence completions &
  - the verbs' constructional preferences in NS corpus data
- however, according to today's standards, their statistical analysis was insufficient
  - they conflated prime & target frequencies from different experimental conditions for one overall test (Bock 1986)
  - they did not account for speaker-specific variability in the data
  - they did not control for within-experiment learning/ habituation effects
- so, let's do better than that …

Experimental design and its statistical analysis

- Subjects
  - 64 subjects, NS of German, learners of English, mean years of English instruction: 11.1 years (IQR=2.6)
- questionnaire (32 items)
  - 16 experimental stimuli: 8 prime-target pairs
    - *The racing driver showed the help mechanic* _____ (prime1)
    - *The racing driver showed the torn overall* _____ (prime2)
    - *The kidnapper sent* ____ (target)
  - 16 filler items
    - intransitives, NP fragments, complete clauses, …
- statistics: GLMEM w/ TARGETCX as binary response
  - fixed-effects predictors & controls
    - PRIMET, PRIMEA, PRIMEN, PRIMEPREF, PRIMECOMPLETION, PRIMEV, TARGETV, ITEM#, and potentially all pairwise interactions
  - random effects structure
    - varying intercepts for PRIMESTIM & TARGETSTIM, plus EXPERIMENT (1:5, manipulating TAN)
  - bidirectional model selection (using *AIC* & drop1/add1 (no *other*-completions, prm w/ *offer*/*throw*), trg w/ *sell*)

Corpus-linguistic design and statistical analysis

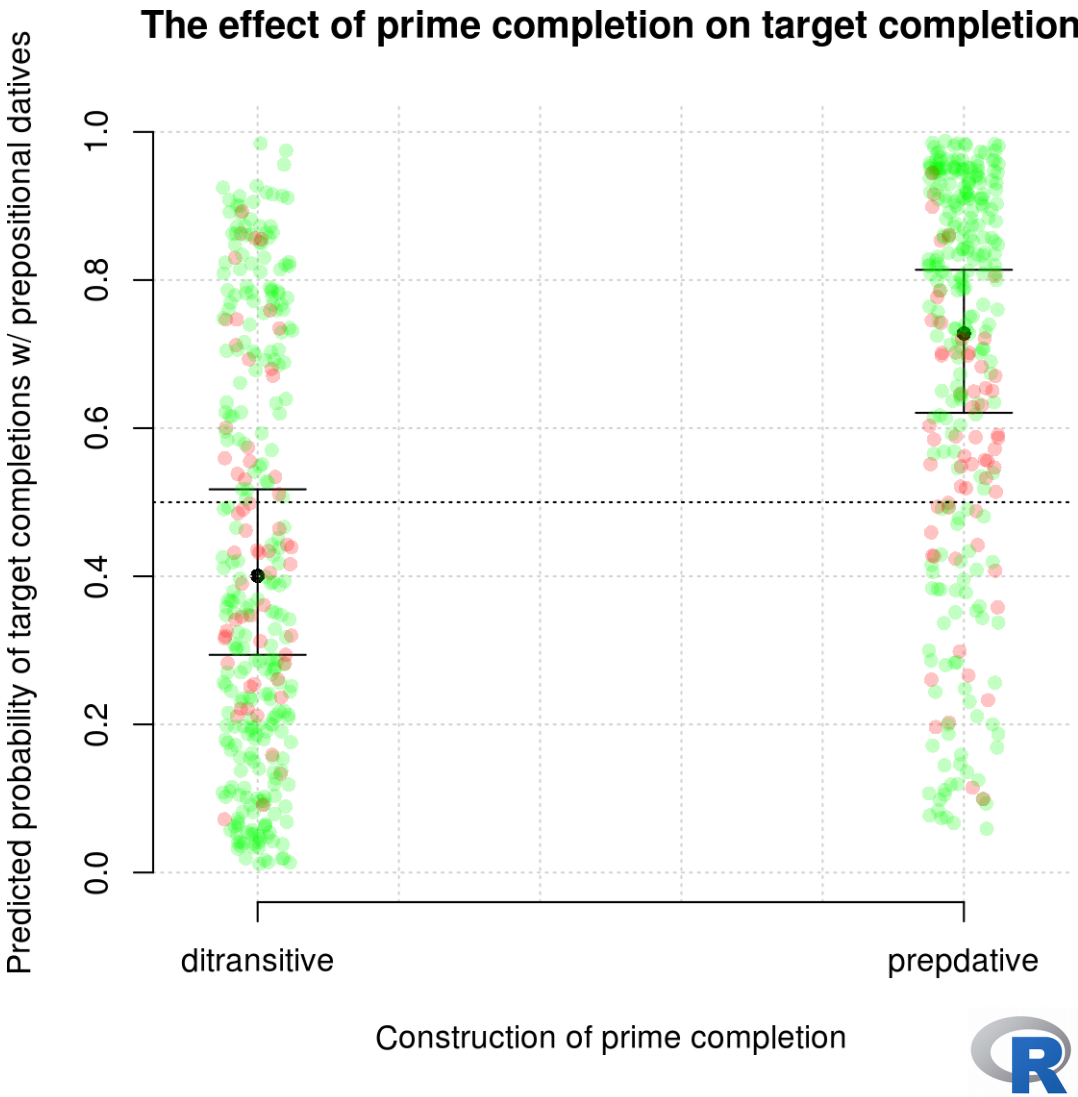
- Corpus data
  - British Component of the International Corpus of English
    - 60% spoken, 40% written
  - 1035 ditransitives, 1919 prepositional datives
  - for each verb attested in the dative alternation, I computed an association measure (AM) quantifying how much the verb 'likes' the prep. dative: $\Delta P_{\text{PrepDat|V}}$
  - differences to nearly all traditional work?
    - most AMs are bidirectional
    - most AMs combine association & co-occurrence frequency
  - I then correlated the $\Delta P_{\text{PrepDat|V}}$-values with the predicted probs of prep. datives from the model in the experiment
    - measure: Spearman's *rho*

Results of the sentence-completion experiment

- Overall summary statistics
  - R^2m=0.192, R^2c=0.523
  - classification accuracy=0.811, C=0.89
- random effects
  - subjects accounted for most variability, much more than prime stimuli or target stimuli
- fixed effects
  - PRIME_COMPLETION_CX: LR-chi^2=39.09, df=1, p<0.001
  - TARGET_STIMULUS_V: LR-chi^2=41.35, df=6, p<0.001
  - ITEM#: LR-chi^2= 2.45, df=1, p=0.117
  - TARGET_STIMULUS_V x ITEM#: LR-chi^2=14.89, df=6, p=0.021

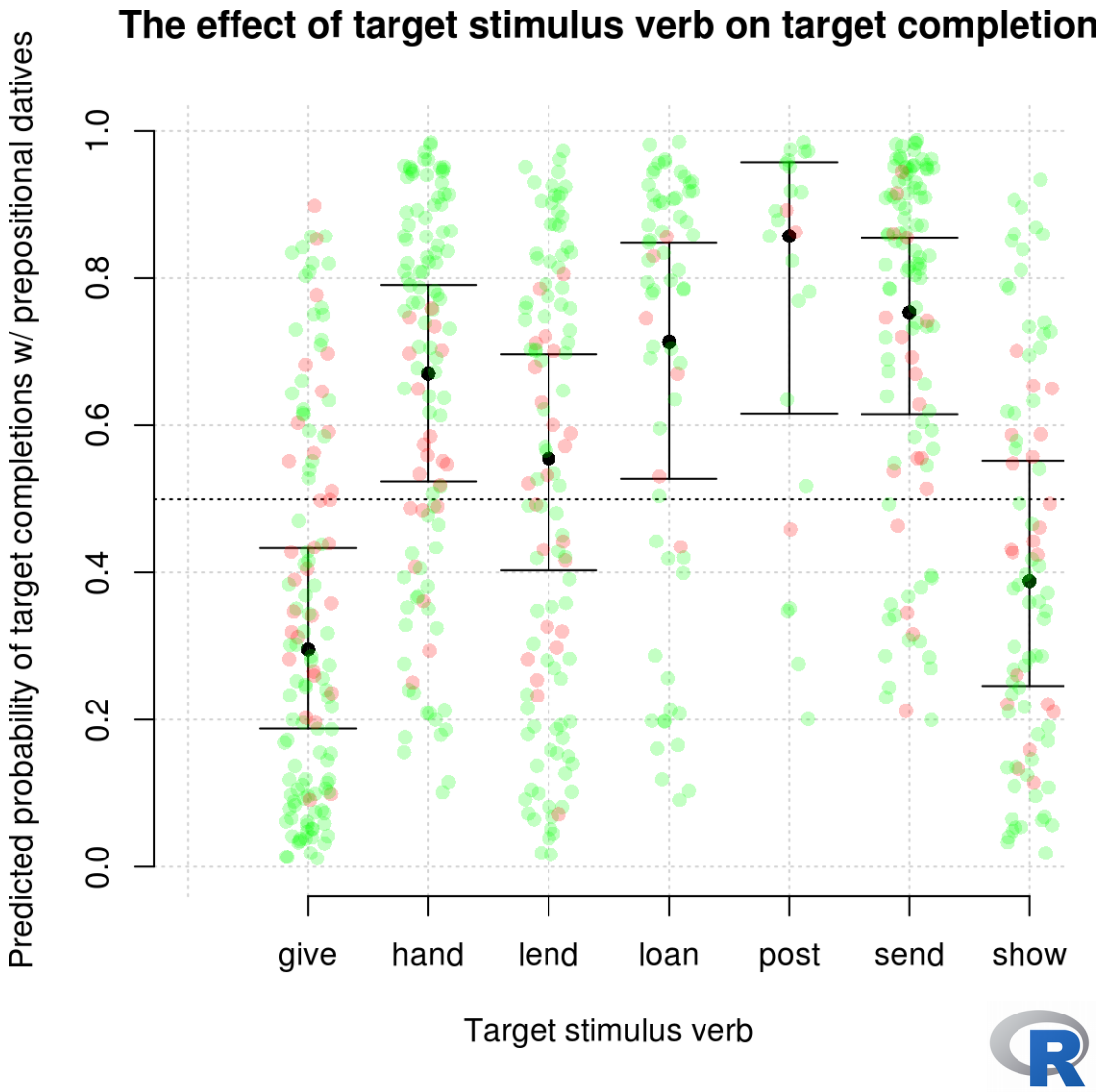
The main effect of PRIME_COMPLETION_CX

- The effect of this predictor PRIME_COMPL_CX is straightforward
  - when the subjects completed a prime with a prep. dative, they are much more likely to also complete the target that way, and vice versa (*OR*=4, 95% *CI*=(2.4, 6.18, *nsim*=50))



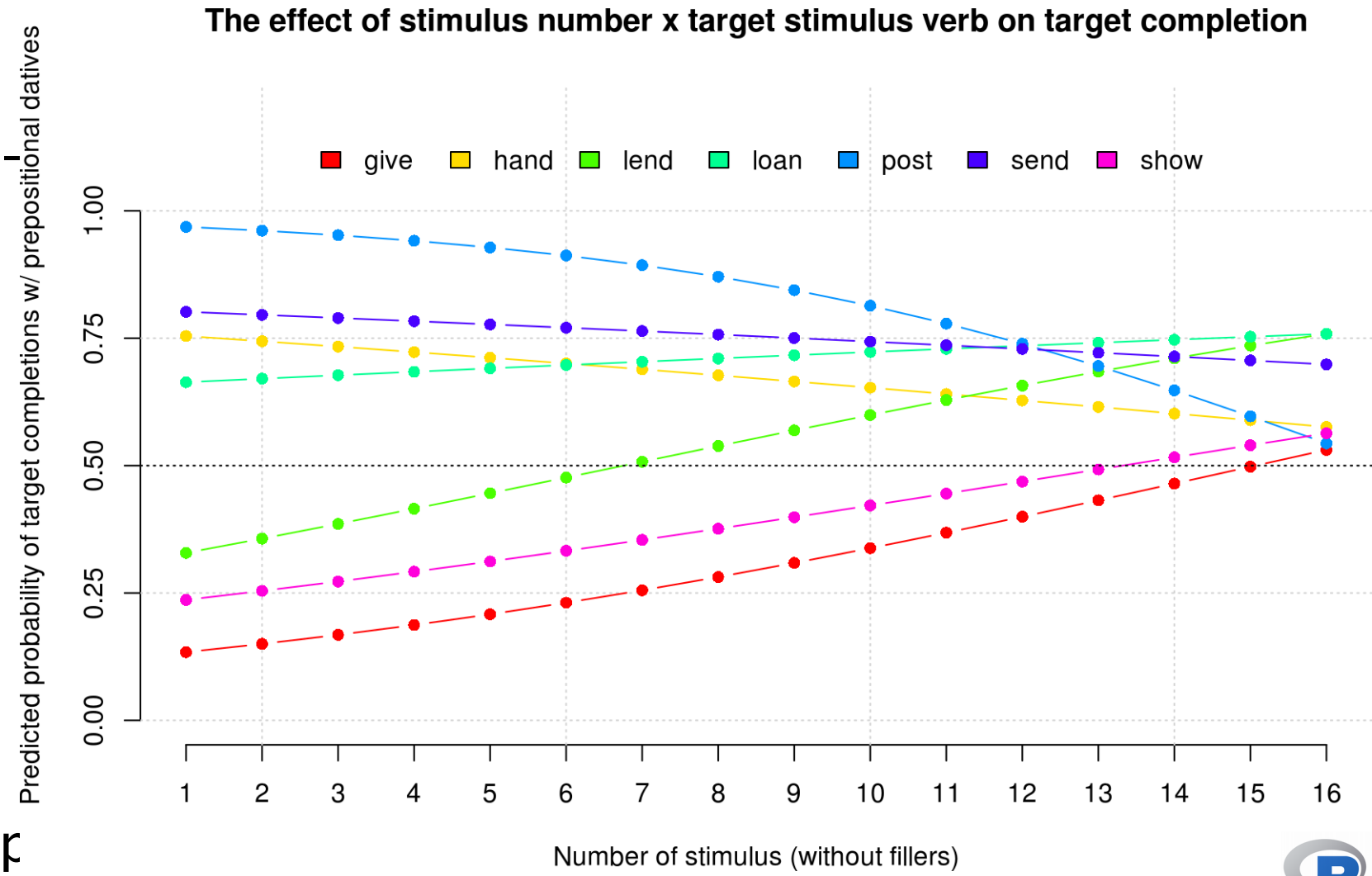
The main effect of TARGET_STIMULUS_V

- The effect of this predictor is a bit more complex
  - *give* has the highest dis-preference for prep. dat.
  - only verb coming close to that: *show*
  - verbs 'liking prep. dat.: *post*, *send*, *loan*
  - these results support iconicity analyses (e.g., SAT/YK 1987)
- however, note that this predictor was actually part of an interaction with ITEM#



The interaction of TARGET_STIMULUS_V x ITEM#

- Over the course of the experiment, the subjects' completion preferences change
- this shows how useful such controls are even/esp. in carefully planned exp



How do these NNS experimental results relate to the NS corpus data?

- For each verb,
  - the experimental NNS results provided us with
    - observed percentages of prep. datives in the completions
    - predicted probabilities of prep. datives from the model
  - the corpus NS data allowed us to compute $\Delta P_{\text{PrepDat|V}}$
- the observed pairwise correlations are really high
  - Spearman's *rho* of obs. perc. of prep. datives with ΔP is 0.9 ($p_{\text{1-tailed}}$=0.007)
  - Spearman's *rho* of pred. prob. of prep. datives with ΔP is 0.83 ($p_{\text{1-tailed}}$=0.029)
- the German learners' overall completion preferences are strongly correlated with the English verbs' subcategorization preferences

Concluding remarks 1: the research questions

- Do NNS constructional choices exhibit the same kind of priming effects as NS?
  - there is significant production-to-production priming
  - the strength of the priming is ≈ that of Bock (1986)
  - Gries & Wulff (2009) also report priming effects for *to*/*-ing* complementation patterns/constructions
- what affects the NNS' priming?
  - both prime-related (PRIME_COMPLETION_CX) and target-related (TARGET_STIMULUS_V) predictors affect priming – comparing the effect sizes is not straightforward, though, because of the interaction w/ ITEM# (also, see the correlation with the NS corpus data)
- do the NNS exhibit NS-like verb-subcat. effects?
  - yes, NNS' completions are correlated with NS verb-construction associations (esp. more w/ the directional measure ΔP than w/ p_{FYE})

Concluding remarks 2: on methodological triangulation

- The results hold valuable lessons
  - experimental designs need better statistical analysis than is often employed
    - multifactorial, random-effects structures, statistical control for learning/habituation, R^2s are not always used
    - although we know how many factors can conspire and thus need to be controlled
      - for instance, priming is also affected by prime-target similarity, surprisal, and others (not * here)
    - although we know how quickly subjects learn in an experiment
  - corpus studies need better statistical analysis than is often employed
    - if an experimental design employs a V→Cx direction, maybe one's AM should, too
    - it is necessary to also always at least consider keeping frequency & association/contingency separate
  - methodological triangulation can be useful (duh)
    - esp. since the control of experimental data poses problems
    - esp. since the noise of observational data poses problems
  - we need both!

Thank you!

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