Syllogistic reasoning as communication

M. H. Tessler
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- intro – highlight: tendency to draw conclusions when there is no valid conclusion suggests probabilistic support may underlie *formalish* reasoning
- probabilistic model
  - P(conclusion | premises)
  - syll02 experiments (Figure 1 w/ A-C + Figure 4 w/ C-A conclusions; n=100)
    - these experiments are (logically) identical; the only difference is the premise order (there is a high correlation between the data sets)
    - use only the 4 conclusions (no "nothing-follows" [aka "mu"] conclusions, yet)
    - visuals: bar plots for the 16 syllogisms (data + model), scatterplot
    - r=0.91 with n-objects = 7, base-rate = 0.52
    - model shortcoming 1: "Prior" (conclusion only) model explains a lot, r=0.7. This suggests many syllogisms are uninformative (non-optimal experiments). Maybe run OED on the 16 syllogisms and pick the top-8 to distinguish conclusion-only from full probabilistic model? This is potentially a big takeaway from this research. If we do the OED stuff (which I think we should to make this point), then it might be good to introduce it early and then re-use this technique for later parts (e.g. pragmatic production vs interpretation)
    - model shortcoming 2: qualitative shortcomings—symmetry in valid syllogisms
    - model feature: distributions over situations updated by sentences (which are themselves: functions) allow flexibility to include any sentences
  - most and few oaksford & chater experiments (2 experiments)
    - visuals: 2 x scatterplot (1 per experiment)

would be nice to run OED on syllogisms to know which ones to highlight. particular, for O&C most & few sylll, for which I don't currently touch on any specific sylls

didn't follow up on "nonoptimal" experiments line of thinking

Shortcomings in the approach so far: symmetry in valid syllogisms; experiment 2 from OC fit is not so great... there are many "nothing follows" responses in that data set. This motivates "mu" response and pragmatics at once. I'm not totally certain on this (introducing pragmatics + "mu" together) given that each of these components is complicated.

- pragmatics + "mu"
  - reexamine data sets from first section
  - syll02 including "nothing follows"
    - visuals: bar plots, scatterplot
  - most and few oaksford & chater (2 experiments) including "nothing follows"
    - visuals: scatterplot

have not run most & few + mu… m&f generally take a lot more time to run than standard sylls (state space more complicated)

So far, we've assumed the content of the syllogisms have no correlational structure. Maybe talk about artists and bakers here... some bakers consider themselves artists (e.g. ACME bakery in San Francisco)

- background knowledge
  - syll00 (fugly priors) — "what happens when there is obvious correlational structure?"
  - syll03 (Figure 1 w/ A-C using 4 domains) — more subtle correlational structure... more like artists and chemists, and very much like Rips

have not run elicited "subtle" priors on syll03 sylls

At this point, we still haven't made the case for one of these models in the full syllogistic space. Here we could consider doing the full space (64 sylls). Alternatively, we could run OED on the full space and pick out the best 16 syllogisms to distinguish pragmatic production, pragmatic interpretation and base probabilistic (given some prior... maybe same priors as syll03)

- optimal syllogistic experiments?

didn't do any OED stuff

  - alternatively, use (a) Rips, (b) Roberts Newstead & Griggs, (c) Oaksford & Chater Meta or (d) Johnson-Laird Meta data

- relationship to other theories
  - probability heuristics

have not derived any PHM heuristics explicitly from our model yet

    * informativity — obviously
    * min heuristic — should be able to do a comparison pretty easily
    * probabilistic validity — this will be interesting to explore; I suspect it will have something to do with the OED analysis (or, deviation from prior, generally)
    * evidence for "not-all" (O) aversion? there is some literature debating this... I think we don't find evidence for it in our datasets.

or really done any of this PHM relations

w.r.t. belief bias: i thought about running some simulations using artificial priors (i.e., we write down the priors we think would reflect "believeable" vs. "unbelieveable" utterances) and see if we derive the belief X logic interaction

  - mental models
    * obvious relation to our situations
    * big contribution of mental models was: "single model" vs. "multiple model" syllogisms... these will be apparent in our data set as well (for the very same reason that mental models brings it out)
    * mental models and belief bias? (Oakhill et al. study) In this study, they are essentially testing the "conclusion-only" model against the probabilistic model, when the conclusion is made to be super likely a priori vs not. They used 6 syllogisms that they thought would be informative for this (I used the same 6 in syll00 [fugly priors]). We could replicate this. Or maybe run OED with some approximate priors (or measure the priors) and see how optimal their experiment was.

not sure exactly what to say about single vs multiple models

- conclusions
  - gradedness in responses implicates probabilistic support underlying reasoning in "formal" reasoning tasks
  - background knowledge is used to generate mental situations
  - "theory of the experimenter" (conversational pragmatics) needed to go all the way w.r.t. complex reasoning patterns (informativity type stuff)
  - previously it has been hard to distinguish good models from not-good models in syllogistic reasoning because the space of syllogisms is so large... What is the right experiment to run? OED gives us the optimal syllogisms to test

have not done any real hard statistical tests of anything; just correlations and qualitative assessments