The generalization of abstract verb meaning: Adults and 4-5 year old children show plasticity in verb biases that extend across semantic fields

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Author Note

These would be my acknowledgements when the paper was finished.

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Abstract

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How do we break down representations of events to encode them in language? Across languages, most verbs encode either Ends (e.g. what happens, crossing the floor) or Means (e.g. how it happens, by dancing) of an event, but not both (cf. Talmy, 1985). Havasi et al. (2014) showed these biases are not fixed but malleable – when adults and 4-6yos learn several verbs in a row with path meanings (rise, cross), they begin to guess subsequent novel verbs will refer to path as well. For adults, these biases are very abstract: after adults learned a path bias for motion events, they preferred Ends verbs for change-of-state scenes as well (Geojo 2015). Accomplishing this requires some kind of very general representation of events that can account for hitting (manner-of-action) being more like running (manner-of-motion) than like entering (path).

Pre-linguistic infants are sensitive to a non-linguistic means/ends distinction (Phillips & Wellman, 2005; Woodward, 1998, Gergely et al. 2002), but we do not know whether this early conceptual framework provides a foundation for learning verb semantics. Are parallels between means/end structure across domains a late-learned cognitive skill, or do they emerge early in development? 4-6-yo children (N=58) were presented with a repeating learning sequence (Figure 1):

Bias/new verb test: A word/event pairing is presented (e.g. comb-rip, gorping); children choose whether gorping means an event maintaining either action (comb-flatten) or effect (hammer-rip).

Training: 3 additional events provide evidence for one interpretation (e.g. effect, rip)

Same-verb Test: 2 new events matching either action (comb-open) or effect (plier-rip)

Children saw 8 trials in the same domain (change-of-state) and then 8 in a new domain, directed motion. Our key interest is ***not in the learning of individual verbs*** (measured at 3), but in the biases that children develop between verbs (measured at step 1 of each subsequent trial). We ask (a) if children's verb biases update with evidence within the

change-of-state domain and (b) whether these biases extend between domains, relying on an abstract means/end distinction.

We are just beginning to understand how the cognitive abilities children show in the first year of life help to organize language learning, and in particular how children conceptualize and break down their representations of events into verb and sentence meaning. These results suggest that children's verb meanings draw on very abstract lexical semantics from childhood, and that these have parallel structure – and may be related to – the fundamental cognitive representations available to infants.

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Introduction outline

I. Motivate the big question/effects

Why do we have the type of linguistic system we have? Beyond question of nature/nurture or particular syntactic theories, it's clear that langauges make distinctions between e.g. actions and objects. Fundamental, built in. Why? Because they matter for cmmunication, either how we talk about or what we want to talk about. Meets our needs.

It MATTERS which representaitonal basis we have. Effects are everywhere. We make predictions about word meaning (Adult novel verb and "human simulation" stuff), subtly- or not so subtly - update meaning of words based on sentence structure ("Crash" effects and Wolf), find verbs natural or unnatural in sentences (some rating studies?), struggle or dont' struggle to access a word in a particular frame (Priming). Psycholinguistic theories assume that these effects are all driven by some shared underlying cognitive representations. Linguistic theories provide concrete proposals for the nature of these representations (they won't all agree that we're doing this.)

Empirical evidence for these is good for both psycholiinguistcs, linguistics, and rest of cognition, which often struggles to describe events and missing distinctions we believe to be important. IT PUTS A CONSTRAINT. WE REALLY WANT EMPIRICAL SUPPORT FOR REPRESENTATIONAL FORM. NOAH's CRYSTALLOGRAPHY METAPHOR.

Define resarch qurtion - usually talk about verb classes ("cummunication") but the proposal that they're broader and have general principles and cross cutting, we explore that.

II. Word meaning and conceptual structure.

A. What is the content of mental representaitons of verbs? WELL Nouns. They work like this. Conceptual components/dimensions - Take people on the Dedre Gentner ride.

Returning to nouns, mass/count distinction implies totally independent evidence for

Spelke Objets by age 1 - they might have them much earlier, but to the extent they really have adultlike mass count (debatable), they have the principle.

B. How are verbs different? WELL for one thing baseball example.

Is it everything goes as far as perpsectives? Seems like NO. Use give/receive. Or Use dimensions? CONTRAST nouns: they refer to knids, traits tend to cluster (mutually predictive borders and hang together). Check the cogsci version of Havasi paper 2013. Vber stend to spread, picka dimension of carem like cause or contact.

"mental representation of events" is a bit too broad for us; as with other cass the quyestion of whether noun representaiotn = object representaiton is HUGE, and we leave it aside. BUT, we see evidence for SOME kinds fo perspective taking, across langauges and theories

C. TWO PRINCIPLE OF LING THEORY TYPES vis a vis generalities. NEEDS TO STAY SHORT!

D. WHEN GENERAL, Proposals tend to return to some common themes (cause, agency) etc.; it's nota new idea that thesea re connected to early cognition. WHO CARES Which is true? WELL, Theories of early cognition also turn on questions of whether access to such representations. It could be independent, or not, BUT THEY MUST MAP TO EACH OTHER. Thus the linguistic achievements (if we're right about their representational forms) of young children are a key insignt to their conceptual structure, and the acquisition of these strucutres puts constraints on learning.

III. SPECIFIC REPRESENTATION TO TARGT: MANNER/RESULT

So, how we proceed? Now for the first time in the paper talk about Manner/Result. ANd which is it! Talmy goes here; talk about interest in xlinguistics BUT we move on. Say explicitly that readers (lang acq) with this background will get confused. That literature is important but not what we're talking about.

Jesse's first paper establishes it's coherent, AND that it's learnable. Nice, suggests we're talking about reasonable familira kinds of concepts not some weird langauage thing.

But what is the SCOPE? Put a diagram here, probably. Why think limited? SYNTAX. NOT OBVIOUS TO LANGUAGE USER! Why think broad? TWO INDEPENDENT STORIES, echoing the nouns again. IF WE CAN SHOW which it is, and developmental course, can understand basis for THIS representation, and also geenral way to understand event representation. Cite that Brent paper that annyos me.

IV. THIS STUDIES

We'll do 2 things. Establsih evidence for reality (replicated Havasi), show adult. Make predictions about kids afterwards (defer to then), but then look at developmental course. This is the roadmap.

SEPARATE FOR DISCUSION: See Behrend Farer Tomaello Gentner for this stuff, especially on wheter we like manner or result more, which learning ios thjere./ "Behrend wrote a second paper". Timeline is about 1977-185, then it goes away.

Experiment 0 Experimental Design

It's difficult! You need to understand it one time! In the epxeriments, we'll describe deviations.

TELL PEOPLE WHAT THEY ARE CONFUSED ABOUT AND HOW NOT TO BE.

GENERAL NOTE: In analyses, make sure that item effects don't treat an item in Causal and an item in MOtion as equivalent - there's no pairing!!

Experiment 1: Adults

–>For this experiment, I'm allowed to grab text from Amy's paper! yeyyyyy.

Robust and reliable practices. This data was previously reported as part of the second author's dissertation.

- Data is available at TOADD (Need to strip MTurk IDs and birthdays if present)
- Analysis pipeline from processing, post exclusions (based on record)

Methods

Data Cleaning (to be suppressed in submission). Data is loaded from cleaned scripts, post exclusion of subjects (??). Thus, we'll need to get the info on data exclusion from the text of Amy's dissertation...

Participants.

Material.

Procedure.

Data analysis. We used R (3.4.1, R Core Team, 2017) for all our analyses. ## Results ## Experiment 1 - Discussion

Experiment 2: 4-5 year olds

Now we do it with kids!

Robust and reliable practices. Way better! We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study.

Methods

Data Cleaning (to be suppressed in submission). Note that I need to account for the inclusion of Ss 75 and 76 (BOTH of whom's data has to be manually entered - 1.3.17 note need to code *from video*)

```
## Caught an error during read.table.
## MannerPathPriming_10.datCaught an error during read.table.
## MannerPathPriming_75.datCaught an error during read.table.
## MannerPathPriming_76.datCaught an error during read.table.
## MannerPathPriming_77.dat
```

Exclusions

```
## [1] 122
```

Participants. All told, the following number of participants included in each cell of the experiment(s) are:

```
## , ,  = Action
##
##
##         F  M
##   3  0  1  0
##   4  0  7  6
##   5  0  6 10
##   6  0  0  1
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## , ,  = Effect
##
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##         F  M
##   3  0  0  0
##   4  0  6  9
##   5  0  7  8
##   6  0  1  0
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## , ,  = Manner
##
##
##         F  M
##   3  0  0  0
##   4  0  7  9
##   5  0  5  6
```

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##   6  0  1  0
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## , ,  = Path
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##         F  M
##   3  0  0  0
##   4  0  6 12
##   5  0 12  2
##   6  0  0  0
##
## , ,  = Unk
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##         F  M
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##   4  0  0  0
##   5  0  0  0
##   6  0  0  0

##
## Action Effect Manner   Path    Unk
##     31     31     28     32      0
```

included in the study.

Materials.

Procedure.

Data analysis. We used R (3.4.1, R Core Team, 2017) for all our analyses.

Results

Experiment 2 - Discussion

General Discussion

205 ## References

206 R Core Team. (2017). *R: A language and environment for statistical computing*. Vienna,
207 Austria: R Foundation for Statistical Computing. Retrieved from
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