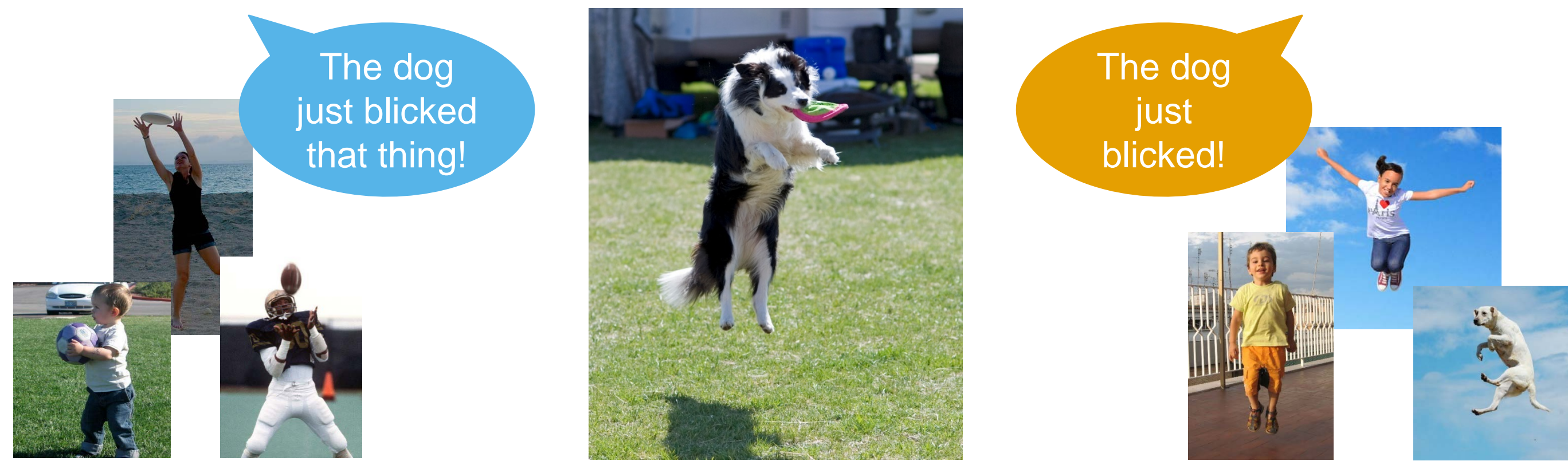


# A New Test of One-to-One Matching Between Arguments and Participants in Verb Learning

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## Syntactic Bootstrapping

Infants exploit relations between the syntax of sentences and the conceptual categories of events they perceive to infer the types of events a new verb can label [e.g. 1-3].



► How do infants represent the syntax of a sentence in order to draw these inferences, and what inferences are they drawing?

## A Spectrum of Bootstrapping Strategies

### Participant-to-Argument Matching (PAM)

Children expect the number of arguments in a clause to match one-to-one the participants in their view of an event it describes [2-6].

- Transitive clause names an event perceived with exactly 2 participants
- Intransitive clause names an event perceived with exactly 1 participant

► Requires only the ability to count the number of NP arguments in a clause, but does not generalize very far within or across languages

- (1) The girl stole the truck.
- (2) St'át'imcets:  
Qámt kwsqwimçxen  
hit.with.projectile det.NAME  
'Kwimçxen got beaned.' [7]



### Arguments Name Participants (ANP)

Children expect every argument in a clause to match a participant, but not necessarily vice-versa [8].

- Transitive clause names an event perceived with at least 2 participants
- Intransitive clause names an event perceived with at least 1 participant

► Much weaker number-based bootstrapping account than PAM: no one-to-one matching

### Thematic Linking

Children draw inferences not on the basis of the number of arguments and participants, but rather on the basis of argument positions and participant roles [8-15].

- Subjects of transitive clauses tend to name agents, and objects tend to name patients
- Clauses describing a change tend to realize the thing being changed
- Clauses describing an action tend to realize the agent of that action

► More robust generalization within and across languages, but requires richer initial representation of clause structure by the learner

## Research Question

### Which strategy?

How can we differentiate participant-to-argument matching (PAM) from other possible inferences children may be making in verb learning?

## Prior Work

Preferential looking/pointing studies have found PAM-consistent behavior with transitive clauses, but inconclusive behavior with intransitive clauses.

- Children who hear a transitive frame prefer a 2-participant event [2, 4, 5]
- Children who hear an intransitive frame do not reliably prefer a 1-participant event [4, 5, 16]

► Lack of preference for intransitives has been attributed to issues with experimental materials: children may not perceive the scenes or sentences under the intended structure [4, 17, 18, 19]

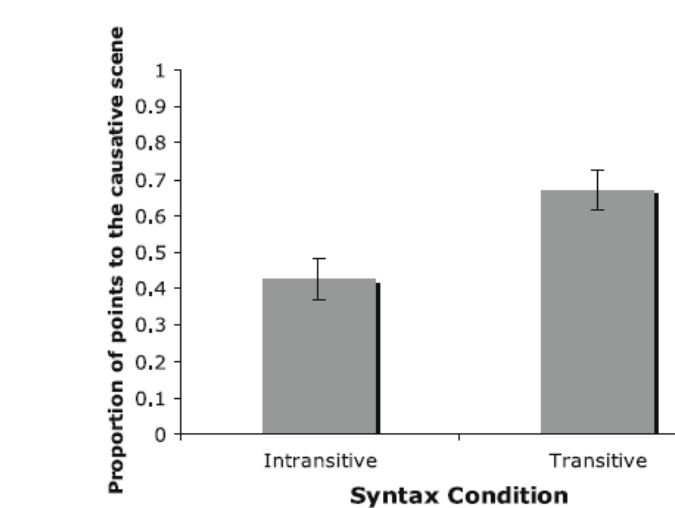
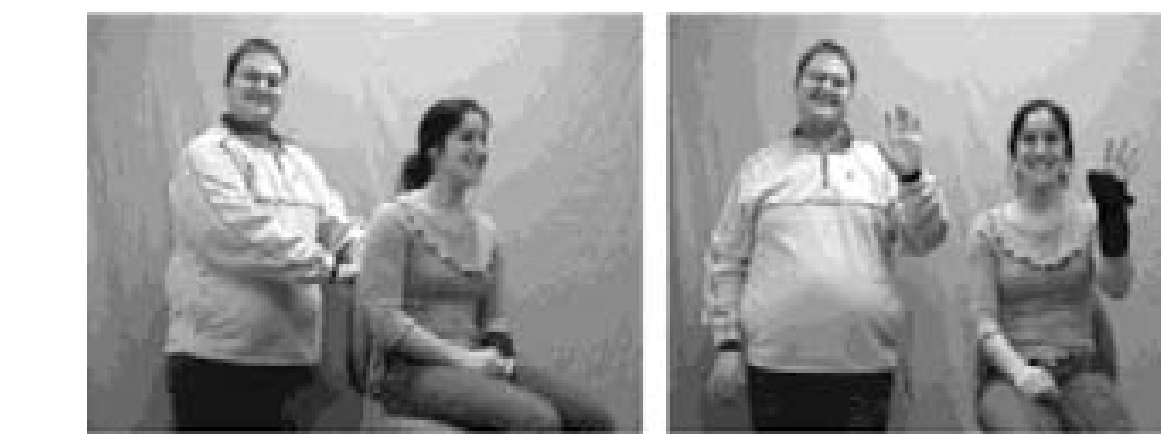
But these findings are also compatible with other bootstrapping strategies:

- ANP: intransitive clause names an event perceived with *at least* one participant
- Thematic Linking: transitive clause names an event with both an agent and a patient; sole argument of intransitive could name either an agent or a patient, so no preference predicted

► Prior work does not differentiate PAM from alternative hypotheses

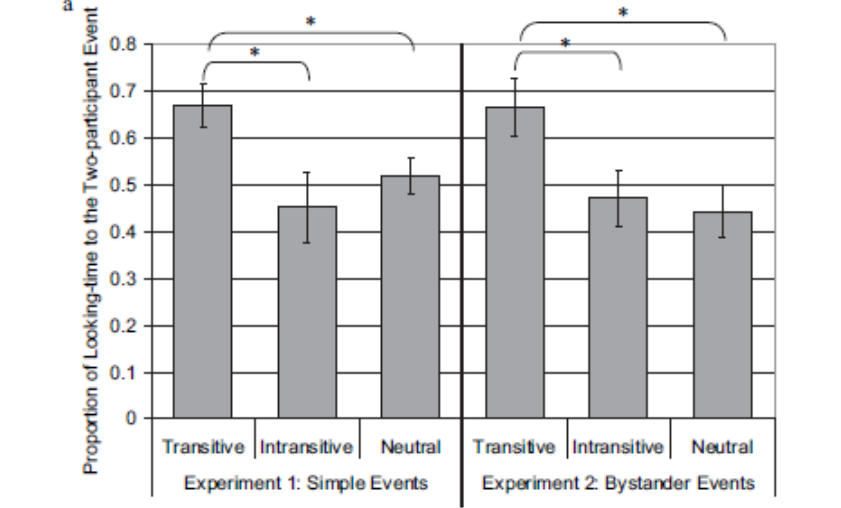
### Arunachalam & Waxman (2010)

- (3) The boy is going to moop the girl.
- (4) The boy and the girl are going to moop.



### Yuan, Fisher, & Snedeker (2012)

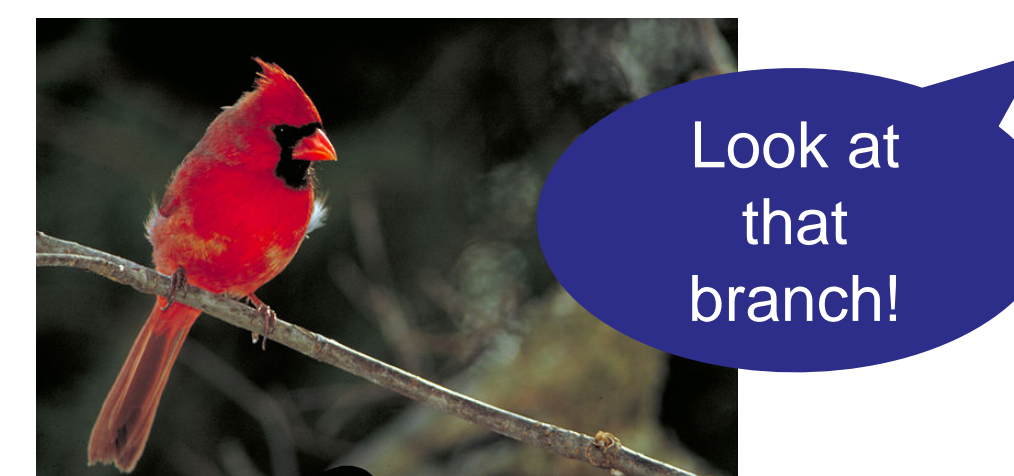
- (5) He's gorping him.
- (6) He's gorping.



## A New Method: Violation of Fit

Adapted from the Violation of Expectations Paradigm [20], tests compatibility between a particular scene and sentence

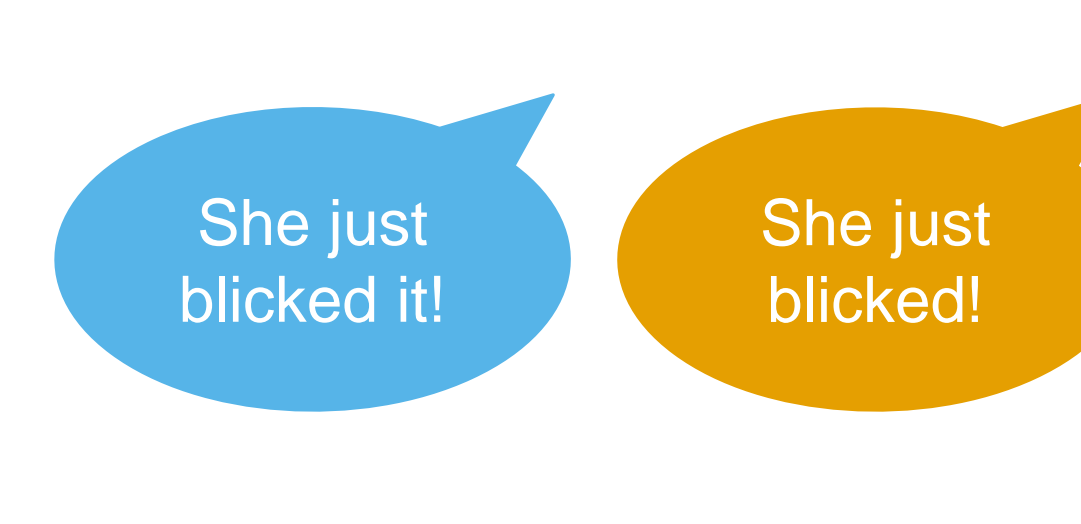
- Logic: if children find a description incompatible with their representation of a scene, or vice versa, it should take them longer to process



► PAM says that only a transitive clause will be a good fit for a 2-participant event concept. Can we find that children have this expectation?

### Version One: Scenes, then Sentences

- Familiarization: familiarize children to an event that we think they will most readily view with 2 participants, based on adult norming
- Test: measure surprise upon hearing a transitive or intransitive description containing a novel verb



### Version Two: Sentences, then Scenes

- Familiarization: dialogues containing a novel verb in transitive or intransitive frames [21]
- Test: measure surprise upon seeing a 2-participant event labelled by that novel verb



## An Initial Test

### Current Study: Scenes, then Sentences

42 19-to-22-month-olds tested in a 2x2 design: event type (KNOCK-OVER, TEAR) within-subjects, clause type (transitive/intransitive) between-subjects

- Each child separately tested on two events (KNOCK-OVER, TEAR) paired with different novel verbs (*blick*, *gorp*)
- Trial duration infant-controlled: trial stops after child looks away for more than 2 secs, or after 5 repetitions of event

Fig. 1 Task Structure

	Transitive Audio	Intransitive Audio	Video
Familiarization (4 trials)	Hey, wow! Wow, do you see that?		girl knocking over ring toys
Test (2 trials)	She's gonna blick it! She just blicked it!	She's gonna blick! She just blicked!	
Post-test (1 trial)	Look, snebbing! Do you see it snebbing?		flower bouncing

Fig. 2 Looking Time Predictions at Test

	Transitive	Intransitive
PAM	Low	High
ANP	Low	Low
Thematic Linking	Low	High if subject is understood as agent

### Results and Discussion

Analyzed mean looking time during first test trial with a 2x2 ANOVA (clause type \* event):

- Significant interaction ( $F(1,38)=5.82, p<0.02$ ), no main effects
- Children looked longer when they heard an intransitive than a transitive description for KNOCK-OVER, but not TEAR

Effect of clause type for KNOCK-OVER: are children using a stronger strategy than ANP for this event?

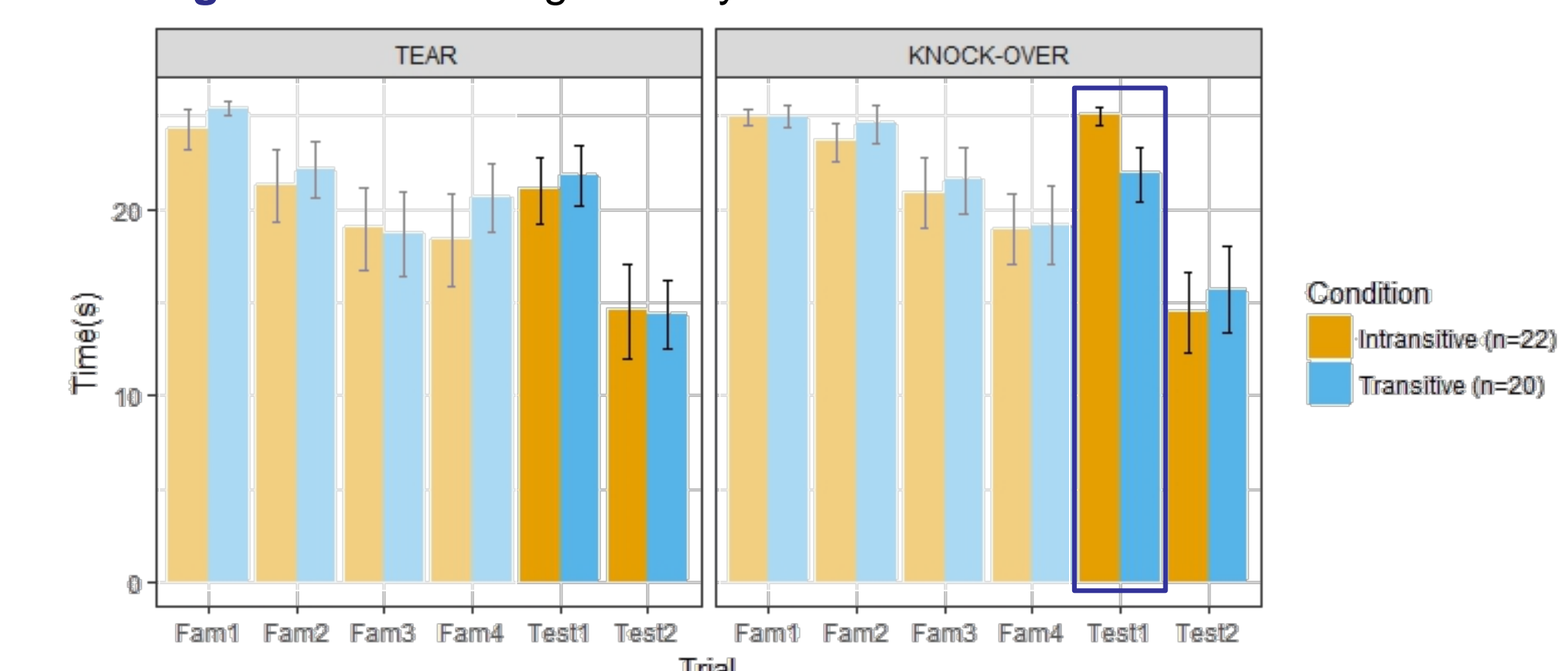
- Compatible with not only PAM but also Thematic Linking: intransitive with an agent subject a poor fit for a change
- But we need to determine whether this effect stands up under scrutiny: not replicating in an ongoing follow-up study

No effect of clause type for TEAR: support for ANP, or methodological issues?

- Children disliked the TEAR video, more variable looking time
- Potential for variability during familiarization to mask any effect of linguistic stimulus at test

► New method requires further refinement to differentiate PAM from alternative hypotheses

Fig. 3 Mean Looking Time by Trial and Event



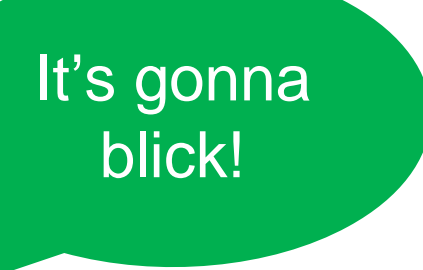
### Future Directions

Develop method to be sensitive to linguistic stimuli

- Version 2: Sentences, then Scenes foregrounds syntactic manipulation, so may be more sensitive

Differentiate PAM not only from ANP, but also from Thematic Linking

- Test an intransitive with a patient subject, which should be a better fit for an event of change under Thematic Linking



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