The role of syntax and semantics on production planning

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1. Introduction

- **Language production, like comprehension, is incremental**[1]
  - **When describing an image, speakers:** (1) Apprehend Scene → (2) Formulate Message → **(3) Linguistically Encode Message** → (4) Phonologically Encode Message → (5) Begin Articulation
- **Griffin and Bock (2000):** Used visual-world eye-tracking paradigm to investigate whether linguistic encoding is semantically or syntactically driven
  Actives: The mailman is chasing the dog.
  Passives: The mailman is being chased by the dog.
  - **Found encoding driven by syntactic prominence:** Speakers encode the subject before the object, even when the subject is the patient
- **BUT,** other factors may complicate syntactic account
  - **Subjects were always more salient** human characters
  - **Planning of agent in passive by-phrases unknown**

2. Current Study

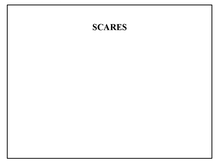
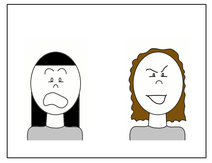
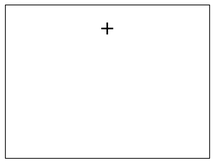
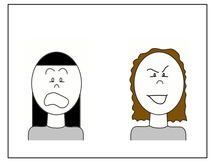
1. **Psych verbs separate syntactic from semantic structure**[2]
   Agent-Patient: 'blames', 'confronts', 'praises'
   Experiencer-Stimulus: 'fears', 'loves', 'hates'
   Stimulus-Experiencer: 'scares', 'amazes', 'confuses'
   Question: Does **linguistic encoding** start with the most **syntactically** (Subject) or **semantically** prominent argument (Agt >> Pat; Exp >> Stim)?
2. **Causal structure of psych verbs is different from action verbs**[3]
   Action verbs: 'who **did** what to whom'
   Psych verbs: 'who **caused** what in whom'
   Question: To what extent is **message formulation** sensitive to the causal structure of actions versus psychological states?

3. Hypotheses & Predictions

	Agt-Pat Leslie blames Ann	Exp-Stim Leslie fears Ann	Stim-Exp Leslie scares Ann
Message Formulation (200-400 ms)[4]			
Action vs Psych verbs differ	Agt-Pat don't behave like Psych verbs	Exp-Stim & Stim-Exp verbs behave similarly	
Linguistic Encoding (400-1000 ms)[5]			
Syntactic	**Subject**		**Subject**
Semantic			**Object**

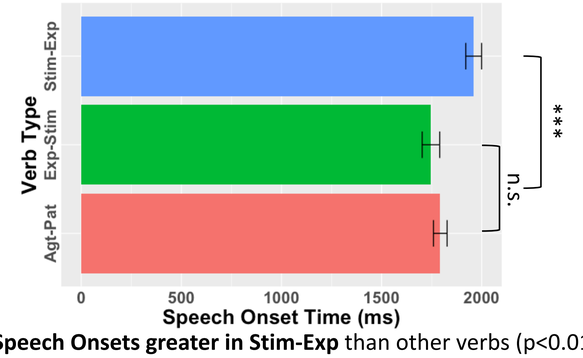
REFERENCES: [1] Levelt, 1989; Bock and Levelt, 1994 **[2]** Grimshaw, 1980; Jackendoff, 1987 **[3]** Brown and Fish, 1983; Corrigan, 1988 **[4-5]** Griffin & Bock, 2000 **[6]** Ferreira, 1994; Thompson and Lee, 2009 **THANKS TO:** Russell Endowed Fellowship (USC), A. Besserman (USC) for images

4. Experiment Designs

Experiment 1: Sentence Production	Experiment 2: Picture Inspection
24 targets, 36 fillers	
See-and-describe task (n=34): (1) See verb cue  (2) Produce a sentence using verb that describes image 	**No linguistic task (n=18):** (1) See fixation cross  (1) Inspect the "content" and "characteristics" of each image  (2) Intermittently rate aesthetic quality (e.g. 'ugliness', 'naturalness') of images using 5-point scale
Post-Experiment Questionnaires	
(1) Image Interpretability Identify images where it is 'unclear' who did what to who **(2) Salience** Rate emotiveness of each expression on a 5-point scale **(3) Autism spectrum quotient**	**(1) Salience** Rate emotiveness of each expression on a 5-point scale **(2) Autism spectrum quotient**

5. Exp 1: Speech Onsets

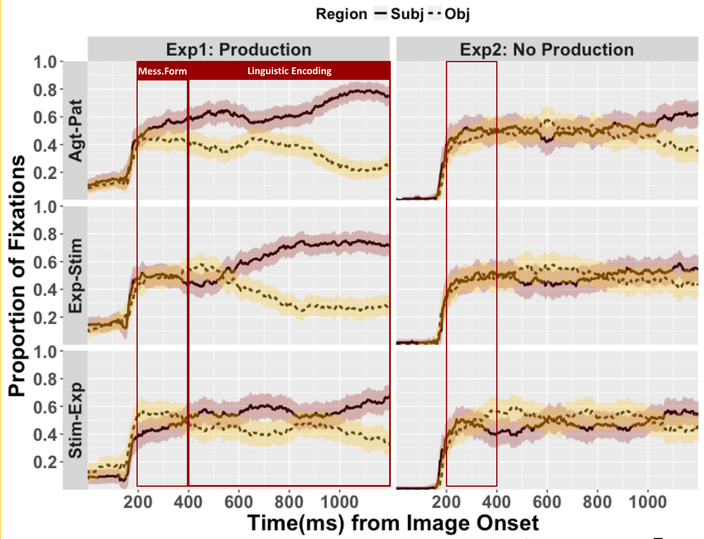
Speech Onset Times by Verb Type

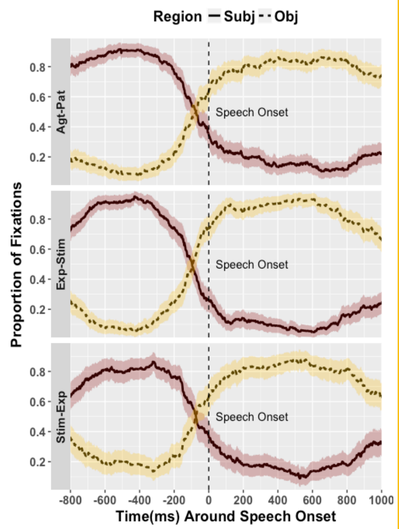


- **Speech Onsets greater in Stim-Exp** than other verbs (p<0.01)
- Onsets for **Agt-Pat & Exp-Stim don't differ** (p=0.481)

Take away: Speakers slower to start Stim-Exp, where syntactic and semantic prominence not aligned; this can't be due to 'surface' syntax.[6]

6. Exp 1 & Exp 2: Eye-Movements





Experiment 1: Sentence Production

- **Start of Message Formulation: (1)** More Subj-looks in Apt-Pat than other verbs (by-subj: p<.05, by-item: p=.18) **(2)** Fewer Subj-looks in Stim-Exp than Exp-Stim verbs (by-subj: p<.001, by-item: p=.08)
- **During Message Formulation:** Verbs don't differ in rate at which Subj preference emerges (all p>.07)
- **Start of Linguistic Encoding:** Looks to Subj for Stim-Exp do not differ from Agt-Pat or Exp-Stim verbs (p's>.33)
- **During Linguistic Encoding:** Subj preference emerges slower in Stim-Exp (by-subj: p<.01, by-item: p=.09)

Take Away: (1) Psych verbs do not behave as a class at message formulation **(2)** Linguistic encoding harder if syntactic and semantic prominence misaligned

Experiment 2: Picture Inspection

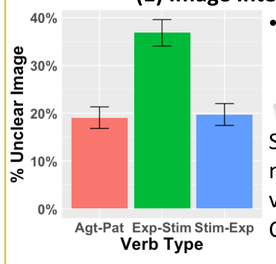
- **Picture Inspection:** No difference among verbs (p's>.2)

Exp 1 & Exp 2 Compared

- **Start of Mess.Form/Pic.Insp.: (1)** No clear differences between Agt-Pat versus other verbs across experiments (p's>.2) **(2)** Differences between Exp-Stim and Stim-Exp verbs vary across experiments (p's < .05)

7. Exp 1: Questionnaires

(1) Image Interpretability



- Significantly more unclear Exp-Stim images (p<.01)

Take Away: Slower Speech Onsets & Eye-movements in Stim-Exp verbs not due to Image Clarity

(2) Salience

- **No salience differences** between Agt vs Pat (p=0.126) or Exp vs Stim (p=0.895)

Take Away: No evidence eye-movements at Message Formulation due to imbalance in images

(3) Autism spectrum quotient

- **No correlations** between speech onset times and overall ASQ scores & ASQ subscales

8. Discussion & Conclusion

- **Stim-Exp verbs show linguistic encoding is not strictly syntactically control (contra Griffin and Bock, 2000):**
  (1) When syntactic and semantic prominence ***misaligned***, speakers are slower to begin their sentences
  (2) Eye-movements show relatively ***prolonged competition*** between syntactically prominent subject versus semantically prominent object
  (3) Competition is due to ***syntactic and semantic misalignment***, not difficulty interpreting Stim-Exp images
- Disjunction between Exp-Stim and Stim-Exp verbs suggest **message formulation and linguistic encoding are independent processes**
- **Causal structure of action versus psych verbs in message formulation unclear** from eye-movements: Some evidence suggesting message formulation begins with semantically most prominent argument, but evidence complicated by (un)interpretability of Exp-Stim images