Message Formulation is multi-factorial and competitive: Evidence from real-time production of *wh*-questions in two languages

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How do we go from thoughts to sentences?

- **Production is incremental:** Only some parts of our sentences are planned before speaking. The rest is planned on the fly!! [1]

The nurses tickled the chefs.

[1] Levelt, 1989

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Why did we start with 'the nurses?'

The nurses tickled the chefs.

Linearly first	Subject	Agent
Needs to be said first	Subjects known to hold special status[1]	Agents highly salient concepts[2] Agenthood **not** defining reason[3] • Passives: Subjects planned first whether they're the agent or patient

[1] Kaiser, 2011 [2] Bock & Warren, 1985 [3] Griffin and Bock, 2000

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Why did we start with 'the nurses?'

The nurses tickled the chefs.

Linear Hypothesis[1]	Structural Hypothesis[2]
• It's the **linearly first phrase** • Start with most conceptually accessible item • Build syntactic representations from those conceptual items	• It's the **subject** • Start with a structural representation of the event • Slot conceptual items into the syntactic structure after

These hypotheses are not mutually exclusive: Speakers can vary message formulation strategies depending on multiple factors.[3]

[1] Brown-Schmidt and Konopka, 2008 [2] Griffin and Bock, 2000 [3] Konopka, 2012

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How do those factors interact?

- **Teasing apart** the linear and structural hypotheses is difficult
  - Declaratives not super helpful

- Looked at languages where **subject is not linearly first**
  - **Free word order** languages (Russian, Finnish)[1] or **verb-initial languages** (Tzeltal, Tagalog)[2]
  - **But, results potentially complicated** by discourse-pragmatic and/or morphological factors

[1] Myachykov, 2011 [2] Norcliffe et al., 2015

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The Current Study

- A first look into real-time production of questions
- **Research Question:** How do **linear word order** and **subjecthood** – two factor(s) that can inform the starting point of message formulation – interact?

Grammatical Subject

Object *wh*-Questions: "Which chefs did the nurses poke?"

Linearly First Word

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Hypothesis & Predictions

What do we plan first?		
	In **Declarative** Sentences The nurses tickled the chefs.	In **Object Wh-Questions** Which chefs did the nurses tickle?
Linear Hypothesis: Linearly first word	**Subject** The nurses	**Object** Which chefs
Structural Hypothesis: Subject	**Subject** The nurses	**Subject** The nurses
Multi-Factorial Both things are important	**Subject**	**?????**

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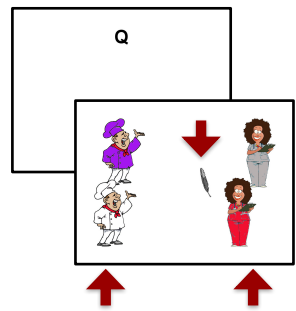
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Experiment 1: Methods & Design

Q

- **Visual World Eye-Tracking**
  - Speakers gaze correlates tightly with attention
- **2 Sentence Types**
  - S → Declarative
  - Q → Object wh-question
- **Critical Image**
  - **2 sets of characters**
  - **Verb** denoted by instrument
  - **Verb's location** indicated subject character
- **Participants (n=30) familiarized** with characters and verb names prior to experiment

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Exp 1: Eye Movements at Image Onset

D: The nurses tickled the chefs.   **Q:** Which chefs did the nurses tickle?   Region — Subj — Obj

Competition between subject and linearly first object emerges in object *wh*-questions

(Graph: Proportion of Fixations vs. Time(ms) from Image Onset, with Declaratives and Questions panels)

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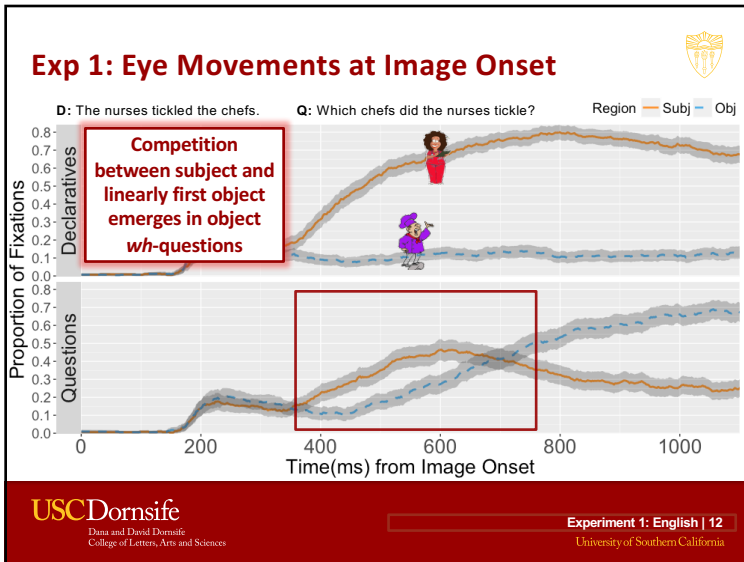
Exp 1 Discussion: *wh*-Questions in English

- **How do linear word order versus subjecthood affect the starting point of message formulation?**
  - **Through a hierarchy of factors:** Subjecthood is privileged over linear word order during message formulation
  - **But, linear word order is not ruled out:** It competes simultaneously with subjecthood

- **Linear Word Order or Information Focus?**
  - *wh*-words are **informationally focused** elements
  - **Alternative Account:** Information focus drove competitive looks to object wh-phrase in English questions.
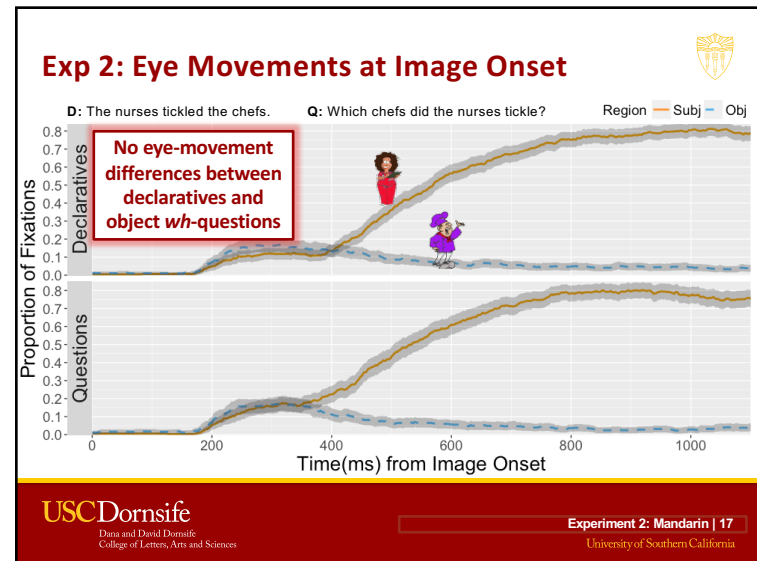
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Experiment 2: Information Focus

- **Research Question:** To what extent did information focus drive competitive looks to the object in Exp 1?

- **Mandarin Chinese (n=35)**
  - Wh-questions and declaratives have the **same linear word order**

    Declarative: 护士们   枪毙了 厨师 。
                          The nurses   shot   the chefs.
    Object Wh-Question: 护士们   枪毙了 哪个厨师?
                          The nurses   shot   which chefs?
  - Differences in eye-movements **cannot** be due to surface word order

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Exp 2: Eye Movements at Image Onset

D: The nurses tickled the chefs.   **Q:** Which chefs did the nurses tickle?   Region — Subj — Obj

No eye-movement differences between declaratives and object *wh*-questions

(Graph: Proportion of Fixations vs. Time(ms) from Image Onset, with Declaratives and Questions panels)

Exp 2 Discussion: wh-Questions in Mandarin

- **Did information focus confound results in Exp 1?**
  - **No:** When linear word order and structure are held constant, we find no differences in eye-movements when speakers plan object wh-questions vs declaratives
  - **In line with prior work** showing late emergence of discourse-pragmatic effects in production[1]

[1] Ganuschak et al., 2014, 2017

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What do we plan first?

	An Answer	
	In **Declarative** Sentences **The nurses** tickled the chefs.	In **Object Wh-Questions** **Which chefs** did the nurses tickle?
Linear Hypothesis: Linearly first word	**Subject** **The nurses**	**Object** **Which chefs**
Structural Hypothesis: Subject	**Subject** **The nurses**	**Subject** **The nurses**
Multi-Factorial Both things are important	**Subject**	**Subject > Object**

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How do we go from thoughts to sentences?

- Through a **hierarchy of factors:**

| Subjecthood is privileged | **Subject** | But not all in the same way |
| Some other factors can still play a role | **Agent** **Linear word order** | **Information focus?** |

- Planning is **structurally** incremental
- **Syntactic structure plays a (surprisingly) important role**
  - Speakers build syntactic representations even when it's not necessary to do so.

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