No filled gap effects in coordinated wh-questions

Shevaun Lewis
Dave Kush
Bradley Larson

ICL 19
What and when will we eat?
Our claims

1. In coordinated *wh*-questions, the dependency between the first *wh*-word and the gap has **no syntactic component**.

*What* and when will we eat __?
Our claims

2. Since filled-gap effects reflect the syntactic component of long-distance dependencies, there are no filled-gap effects for non-syntactic dependencies.

*What and when will we eat lunch?
Outline

• Review: active dependency formation, filled gap effects
• Coordinated *wh*-questions
• Experiment 1
• Experiment 2
• Conclusion
Long-distance dependencies

What did John say we will eat __?

• **Syntax:**
  – *wh*-word c-commands the gap position
  – Gap position cannot be inside an “island”

• **Semantics:**
  – *wh*-word takes scope over the gap position
  – *wh*-word binds a variable in the gap position
Active dependency formation

- In real-time comprehension, long-distance dependencies are posited *before* there is bottom-up evidence for them.
Evidence for active “gap-filling”

• **Filled-gap effects**
  My brother wanted to know who Ruth would bring us home to __ at Christmas.


• **Implausibility effects**
  That’s the {garage/pistol} with which the heartless killer shot the hapless man __...

Evidence for active “gap-filling”

- Filled-gap effects reflect restrictions on the *syntactic* dependency.

- Implausibility effects reflect *semantic* consequences of the dependency.
Evidence for active “gap-filling”

• Filled gap effects are syntactically sophisticated
  – They hold up over very long distances. (Wagers & Phillips 2011)
  – They do not occur inside islands. (e.g. Stowe 1986, Traxler & Pickering 1996)
Today’s experiments

Do filled gap effects arise for coordinated wh-questions?

*What and when will we eat lunch?
Why coordinated-*wh*?

- Only the final *wh*-word is part of a syntactic dependency.
- Non-final *wh*-words have their dependency represented at some other level.

*(Larson, Lewis & Kush, submitted)*

*What and when will we eat __?*
Analysis of coordinated-
wh questions

Only optionally-transitive verbs—verbs which do not require an overt syntactic object—are acceptable in argument-first C-Wh questions.

✓ What and when did John eat?
* What and when did John fix?

(Whitman 2002)
Analysis of coordinated-\textit{wh} questions

Judgment studies confirm the following pattern:

✓ What and when did John \underline{eat}?
* What and when did John \underline{fix}?
✓ When and what did John \underline{eat}?
✓ When and what did John \underline{fix}?

(Larson, Lewis & Kush, submitted; Larson, Kush & Lewis, 2012)
Analysis of coordinated-
\textit{wh} questions

• Possible syntactic accounts:
  – Mono-clausal movement
  – Multidominance (Citko & Gracanin-Yuksek 2012, Gracanin-Yuksek 2007)
Analysis of coordinated-\emph{wh} questions

• Problems with all accounts:
  – Mono-clausal movement:
    The \emph{wh}-words are not a constituent and could not have moved separately (in English).
  – Backwards ellipsis:
    Makes incorrect predictions (swiping, overt indefinites); cannot account for acceptability of ‘fix’-type verbs.
  – Multidominance:
    Cannot account for effects of \emph{wh}-order.

(Larson, Lewis & Kush, submitted)
Analysis of coordinated-\textit{wh} questions

• Options:
  – Preserve the isomorphism between syntactic structure and interpretation.
  – Keep the syntax clean.
Syntactic Analysis

What and when did Ivan eat?
Syntactic Analysis

\[ \text{What}_i \text{ and when}_j \text{ did } \text{Ivan eat-}x_i \ t_j? \]
Experiment 1

Do filled gap effects arise for coordinated wh-questions?

*What and when will we eat lunch?
Experiment 1

When is the unacceptability of *fix*-type verbs in C-Wh questions detected?

• Immediate detection could suggest a predictive mechanism.
• Delayed detection could suggest a slower mechanism for building non-syntactic dependencies

*What and when will we fix __?
Experiment 1: Design

• Self-paced reading

• Design:
  – Verb Type: optionally vs. obligatorily transitive
  – What-Gap: filled (‘something’) vs. empty
  – WH type: ‘what’ vs. ‘when’ vs. ‘what and when’

• 42 participants
Design: Optionally-transitive verbs

The diplomat had to make a schedule of...

**Empty gaps**
- ✓ what his lazy assistant would translate
- ✓ when his lazy assistant would translate
- ✓ what and when his lazy assistant would translate

**Filled gaps**
- ✗ what his lazy assistant would translate something
- ✓ when his lazy assistant would translate something
- ✗ what and when his lazy assistant would translate something

...during the work week.
Results: Optionally-transitive, empty gap
Results: Optionally-transitive, filled gap
Summary: Optionally-transitive verbs

*What and when will we eat something?

- No cost for filled gap in argument-first C-\textit{wh} questions
- Consistent with the hypothesis that these dependencies are non-syntactic, and filled gap effects track syntactic properties of the dependency
Summary: Optionally-transitive verbs

*What and when will we eat something?

• An illusion of grammaticality: No evidence for disruption at any time point.
Experiment: Design

Obligatory-transitive verbs

The busy executive was especially worried about...

Empty gaps

✓ what his lazy assistant would overlook
✗ when his lazy assistant would overlook
✗ what and when his lazy assistant would overlook

Filled gaps

✗ what his lazy assistant would overlook something
✓ when his lazy assistant would overlook something
✗ what and when his lazy assistant would overlook something

...during the important deal.
Results: Obligtorily-transitive, empty gap
Results: Obligatorily-transitive, filled gaps

Obligatory transitive verbs, Filled gaps

Mean RT (ms)

Region

WhType
- What and when
- What
- When
Summary: Obligatorily-transitive verbs

- Delayed detection of ungrammaticality in ‘what and when’ sentences with empty gap
  - The verb type is not predicted.
  - The dependency must be attempted before it can be rejected?
Summary: Obligatory-transitive verbs

- Immediate detection of ungrammatical in ‘what and when’ sentences with filled gap, but cost is short-lived

2 possible explanations:
- Earlier detection of unacceptability of \textit{fix}-type verb
- Short-lived filled-gap effect
Summary: Obligatory-transitive verbs

- Immediate detection of ungrammaticality in ‘what and when’ sentences with filled gap, but cost is short-lived

→ Short-lived filled-gap effect?
  - ‘what and when’ suggests semantic dependency
  - ‘fix’ suggests syntactic dependency
Illusion of grammaticality

*What and when will we eat something?

Rejected less often than adjunct-first C-wh questions with filled gaps:

*When and what will we eat something?
Experiment 2

• Maybe the lack of filled gap effects was due to the particular filler, ‘something’

• Will we still see an illusion of grammaticality with a definite filler?
Experiment 2: Design

• Speeded acceptability judgment

• Design:
  – **WH-type:** adjunct-only vs. argument-first vs. adjunct-first
  – **Filler-type:** indefinite (‘something’) vs. plural definite (‘the cookies’)

• All optionally transitive verbs

• 27 participants (recruited on Mechanical Turk)
Experiment 2: Example

Adjunct only:
The pastry chef tried to make clear when the new assistant should stir \{the ingredients/something\} into the batter.

Argument-first coordinated-\textit{wh}:
*The pastry chef tried to make clear what and when the new assistant should stir \{the ingredients/something\} into the batter.

Adjunct-first coordinated-\textit{wh}:
*The pastry chef tried to make clear when and what the new assistant should stir \{the ingredients/something\} into the batter.
Experiment 2: Results

No difference between ‘something’ and definite NP.
Experiment 2: Summary

• The illusion of grammaticality for filled gaps in argument-first C-\textit{wh} questions is robust even with definite fillers.
Conclusion

• No filled gap effects for the first conjunct of coordinated-
  \textit{wh} questions.

• Supports hypothesis that this dependency lacks a syntactic component.

• Consistent with previous evidence that filled-gap effects are highly sensitive to syntactic constraints.
Future directions

• Implausibility effects
  – The dependency must be represented at some interpretive level.
  – Timing of implausibility effects could be informative.

• Why the illusion of grammaticality?
  – Interpretation of “acceptable” filled gap sentences
Filled gaps in the wild:

Now I know what and when to eat the correct food combinations.

It allows you to basically pick what and when you want something to be inactive on your hard drive.

The AAAS benchmarks provide guidance for what and when we teach certain content areas...

What and when was something done to stop this from happening?

The projected shortfall could alter what and when things are built.

...serving up an array of information that lets women choose what and when they want financial advice.
Future directions

• Interpretation of “acceptable” filled gap sentences
  – *Wh*-word restricts the interpretation of the overt object?  
    *what* food combinations
    *what* content areas
    *what kinds of* things
    *what kinds of* financial advice
Thank you!

Thanks for helpful feedback on previous versions of this work:
• UMD Cognitive Neuroscience of Language Lab
• Norbert Hornstein
• Colin Phillips
• Alexander Williams

This work was supported by NSF IGERT grant DGE-0801465 awarded to Colin Phillips.