Reluctant acceptance of the literal truth: Eye tracking in the Covered Box Paradigm

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Aspects of Meaning: Theory and Processing

- **Overall conveyed meaning** results from conglomerate of inferences

- **Theoretical Question:**
  What aspects of meaning are there?
  (and what are their properties?)

- **Processing Question:**
  How do these aspects of meaning arise in online processing?

- How do answers to each of these questions constrain answers to the other?

Scalar Implicatures vs. Literal Meaning

- **Some N VP**
  commonly, but not necessarily, conveys that
  Not all N VP

- **Two** ingredients:
  Literal, conventional meaning:
  [[**[Some N] VP**]] = $\exists x[N(x)\ \&\ VP(x)]$

  Additional inference (scalar implicature):
  Not all N VP

  —> Based on **contrast** with stronger alternative
      All N VP

- Implicatures can be **cancelled** or **fail to arise**:
  Some N VP, in fact they all did.

Implicature Processing

- Two prominent **processing models**:

  - **Literal First**:
  start with literal, effortful reasoning derives implicature
  —> **Literal < Implicature**

  - **Default**:
  implicatures pre-encoded, literal via cancellation
  —> **Implicature < Literal**

- **One line of work**: Implicatures **slower than** literal

  - Response Times: Bott & Noveck (2004)
  Some elephants are mammals.   RTs: T (Lit) < F (Prag)

  - Visual World: Huang & Snedeker (2009)

- **Another line**: implicatures available immediately
  (Grodner et al. 2010, Breheny et al. 2013, Degen & Tanenhaus 2011)

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Background for present study

- Previous work: **literal** RTs based on True responses, **implicature** RTs based on False responses

- Different take: **How easy** are literal acceptances relative to implicature-compatible acceptances?

- **Romoli & Schwarz 2015**:
  Implicatures and presuppositions **under negation** in picture matching paradigm

  —> **Implicature** (& presupposition) acceptances faster than literal

- **Schwarz, Romoli & Bill 2015**:
  sometimes vs. **not always** -
  comparing both acceptances and rejections

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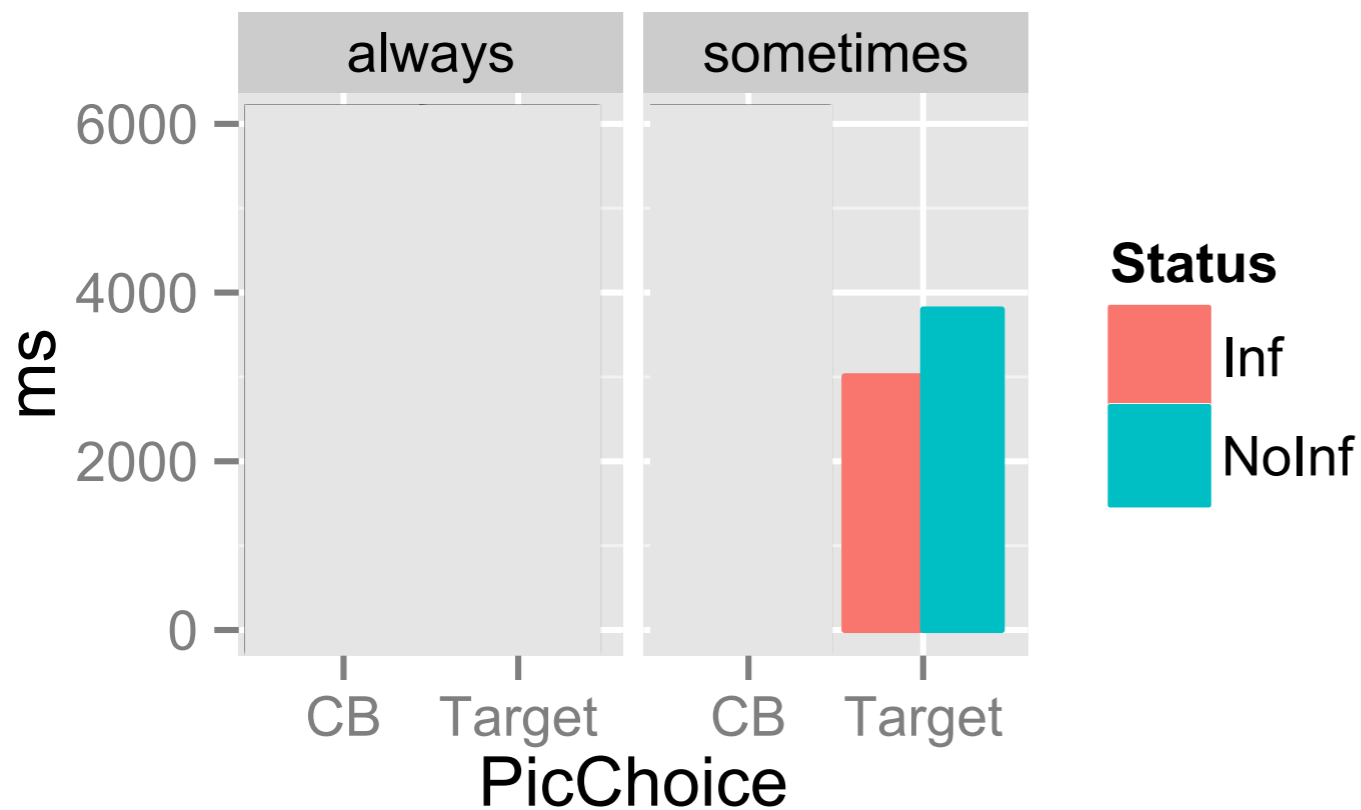
Calendar Strip + Covered Box
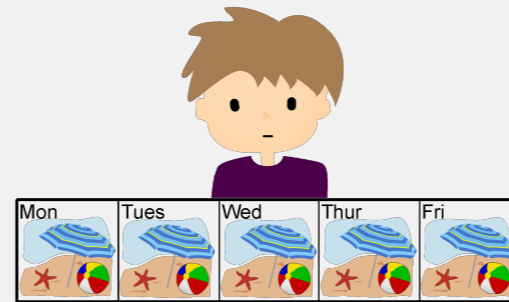
- Iconic **representation of events** in time (versatile format for various triggers)

- **Instructions**:

  - Multiple pictures shown - one hidden.

  - Sentence describes exactly one of them.

  - Which one is the sentence about?

Like Responses - **Sometimes**

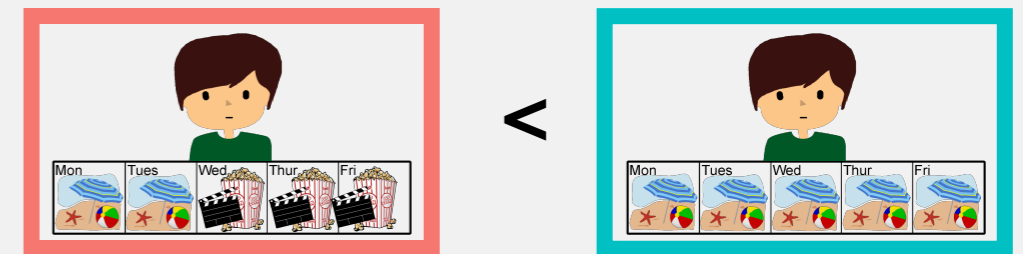● Looking at both **Target** and **Covered Box** choices

Target Choices

NoInf:
Sometimes Or Always

Henry sometimes went to the <u>beach</u> this week

Inf:
Only sometimes

CB Choices

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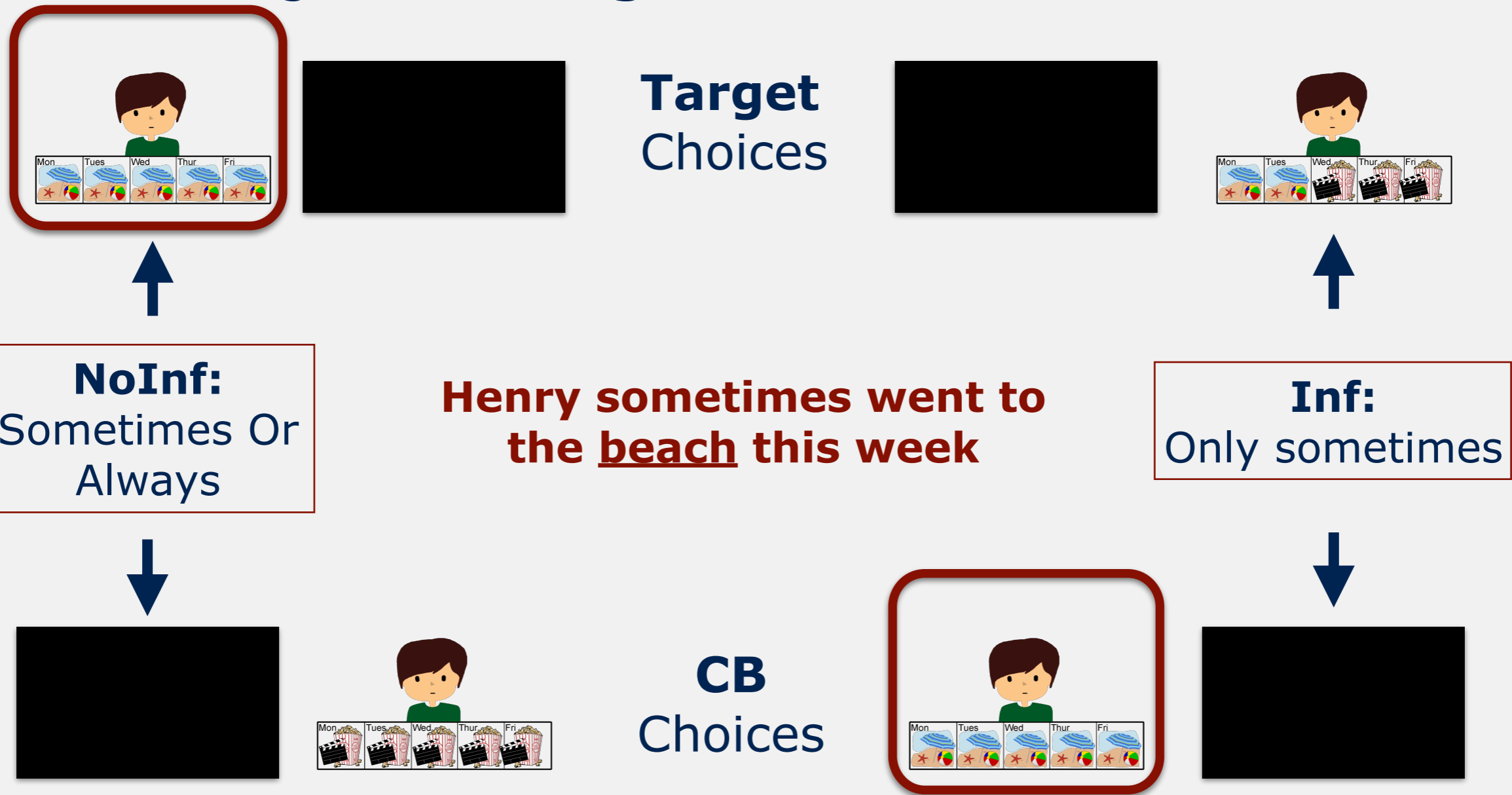
Response Times

Acceptances

sometimes

Rejections

sometimes

- 2x2 **Interactions** (Pic : Status)
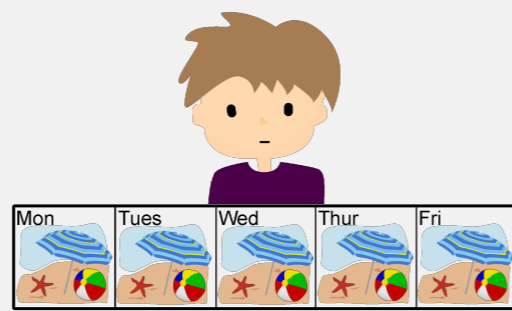
- **Simple effects** of
  Rejection vs. Acceptance

- Acceptance (Target) comparison: **Inf** < **NoInf**

- Rejections (CB choices): **NoInf** < **Inf**

8

Descriptive RT Pattern

- **Delays** come with trials where you could choose **either** Target or CB

- **Different Pressures** favor each

- **Proposal**:
  Delay is due to **resolving conflict** between these different pressures

Opposing Pragmatic Pressures

- Two opposing pressures:

  - **Preference** for **Implicature** readings   (—> CB)

  - **Charity**: preference for overt picture   (—> Target)

- **Slow downs** when these two conflict

- **No appeal** to costly implicature computation required

  (but also not incompatible with this)

- **Beyond RTs**: Time course in the Visual World

Next: Evidence for Competition?

- Can we find **more direct evidence** for competition effects?

  —> **Visual world** eye tracking + Covered Box

- Compare **eye-movement patterns** based on responses & picture types

- **Additional manipulation**:

  temporary conditions: implicature vs. literal ultimately has **no crucial role** in decision

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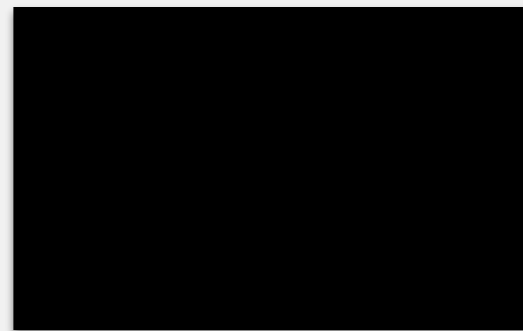UNIVERSITY of PENNSYLVANIA

Task Illustration: Literal vs. Imp

Some of the giraffes have scarves

Target

Distractor

CB
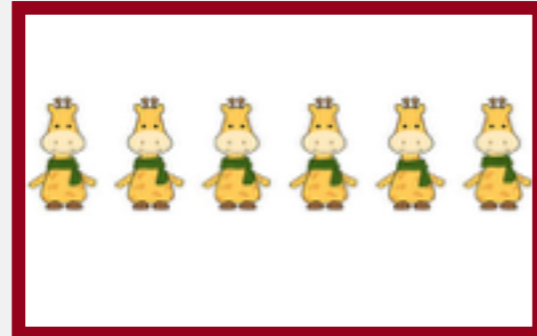
- **Implicature-compatible** condition   (Some-Pic)

- **Literal-only** condition   (All-Pic)
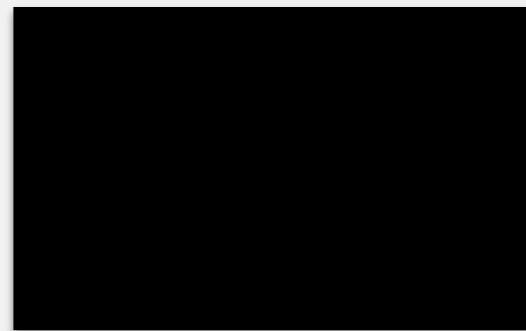
Literal —> **Target**   Implicature —> CB

Task Illustration: Global vs. Temp

Some of the giraffes have scarves

Target

Distractor

CB
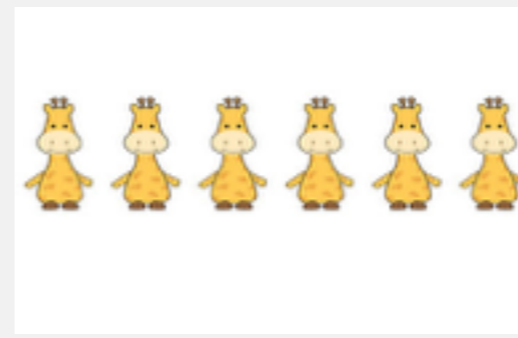
- **Implicature**-compatible up to **scarves** (Some-Pic)

- **Literal-only** up to **scarves**   (All-Pic)
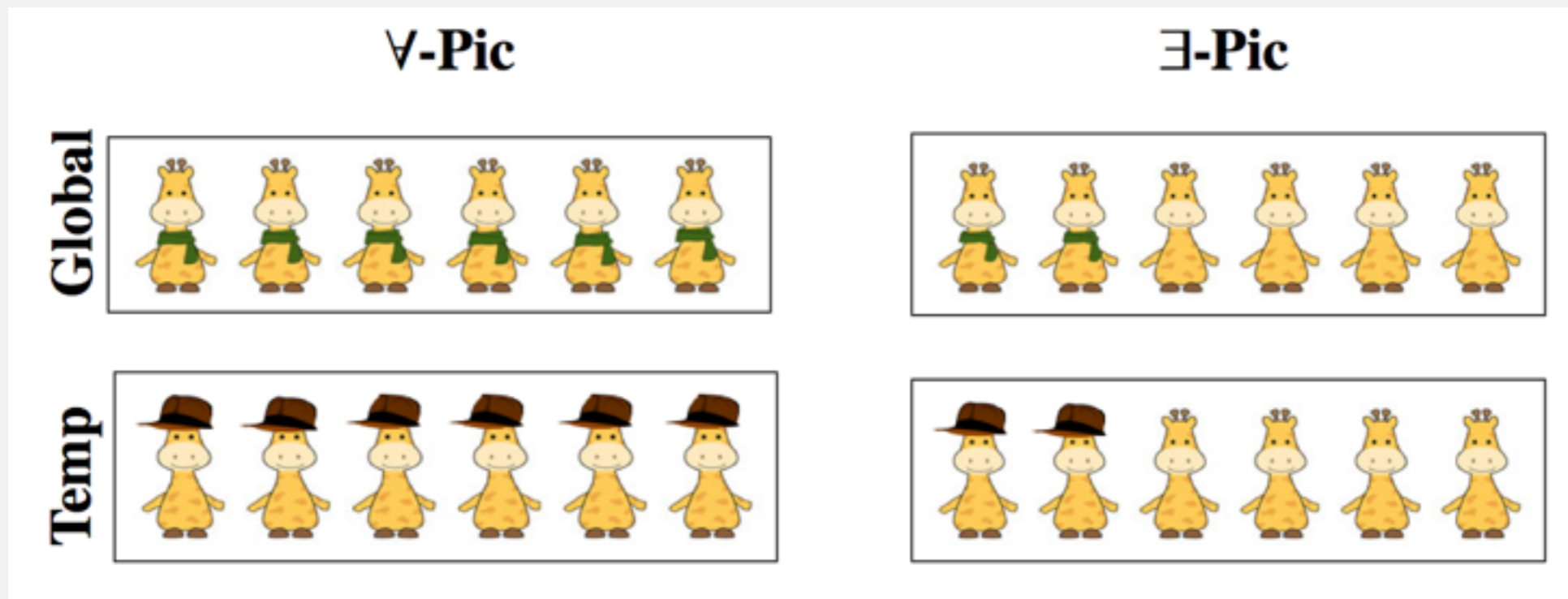
- Correct choice **always** is **CB**

Design Overview

- **Two Factors**:

- **Some-Pic**ture vs. **All-Pic**ture

- NP2 match vs. mismatch:
  Global vs. **Temp**   (blocked, counterbalanced)
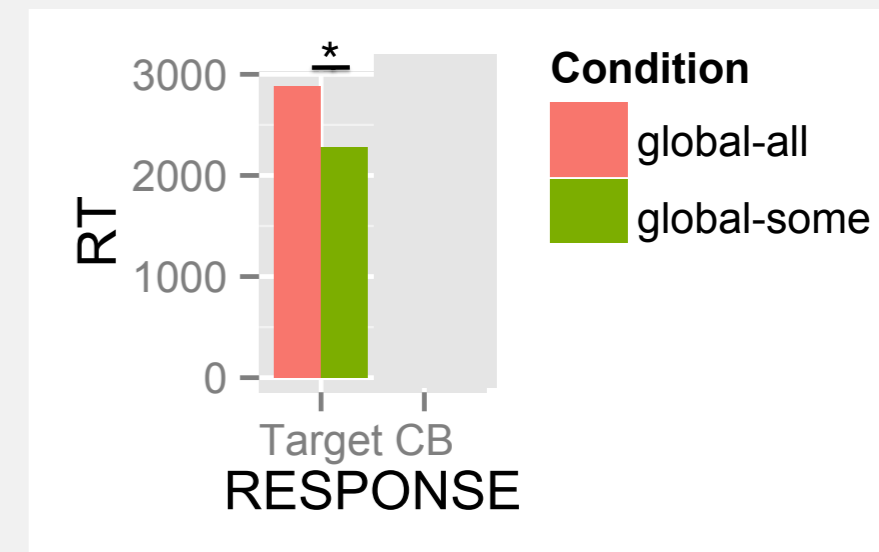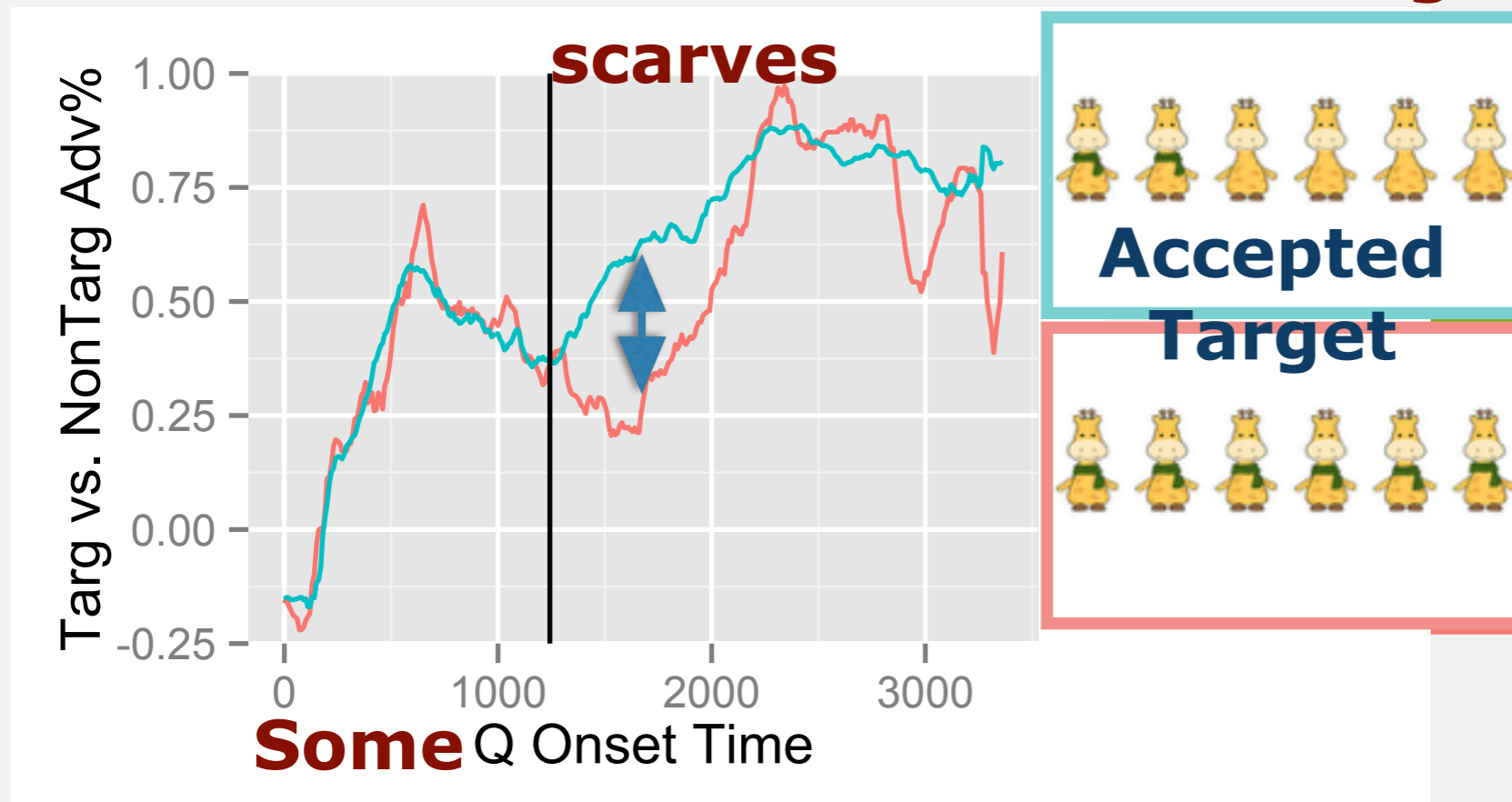
Some of the giraffes have scarves

Target Pic Variations

More Design Details

- **16 critical** items with some (4 per condition) [Temp vs. Global blocked]

- **8 fillers** with **some** [4 True, 4 False with Some-Pic]

- **16 None** fillers [True, same Pics as critical —> Distractor]

- **16 definite plural fillers** [8 True / 8 False] (Maximality never an issue)

- **Notes**:

    - **No All** items! [scalar alternative not made prominent]

    - **Only 4 items** where implicature mattered for response

- 78 subjects for course credit at Penn

Global: All-Pic vs. Some-Pic Acceptances
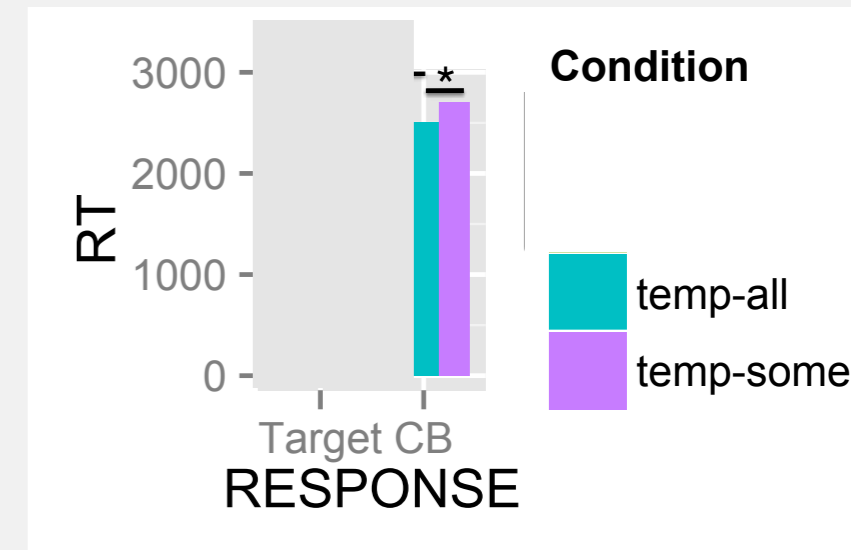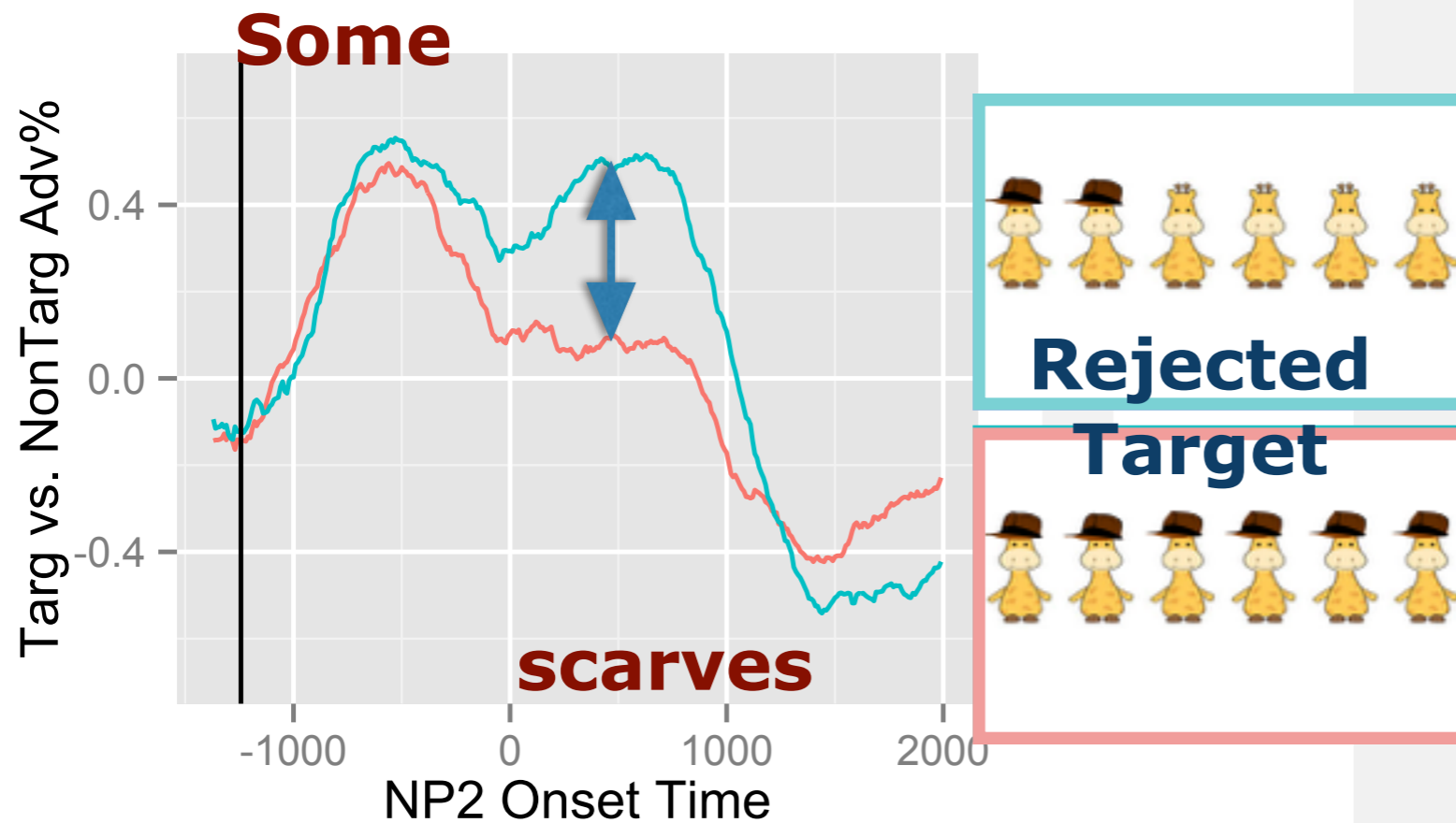
Some of the giraffes have scarves

RTs: Literal Acceptances delayed

- Even **literal response** trials:
  eye movements away from **All-Pic** Target!

- Suggests **consideration of implicature**!
  —> Indication of 'cancellation'

Temp: All-Pic vs. Some-Pic

Some of the giraffes have scarves


RTs: Temp Some-Pic rejection delayed

- **Temporary implicature**-compatibility: scrutinize picture after hearing **NP2 (scarves)**!

- **Implicature clearly present** and able to speed up **Temp-AllPic** rejection

Summary: Implicature presence

- **Implicature** clearly present even when

  - **ultimate** response is literal

  - it's **irrelevant** due to NP2 mismatch

- **Default** consideration of implicature, and

- '**Cancellation**' in case of literal responses

Literal present: All-Pic - Global vs. Temp

Some of the giraffes have scarves
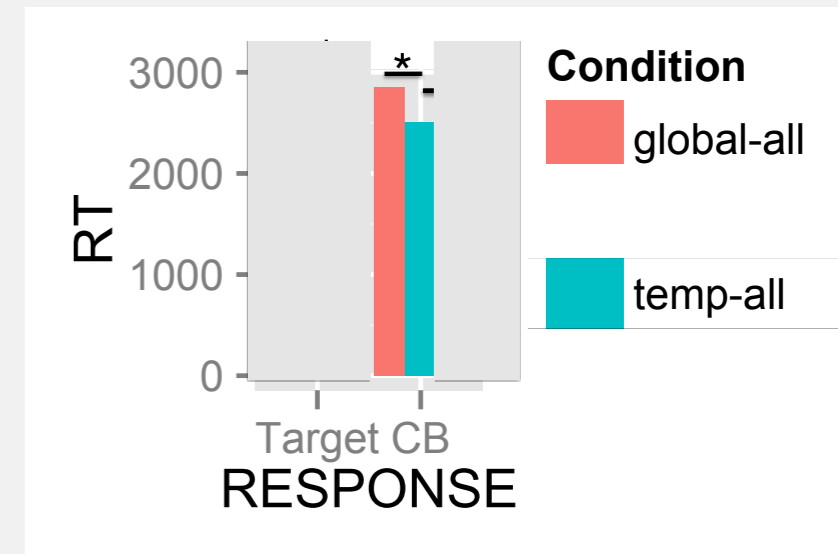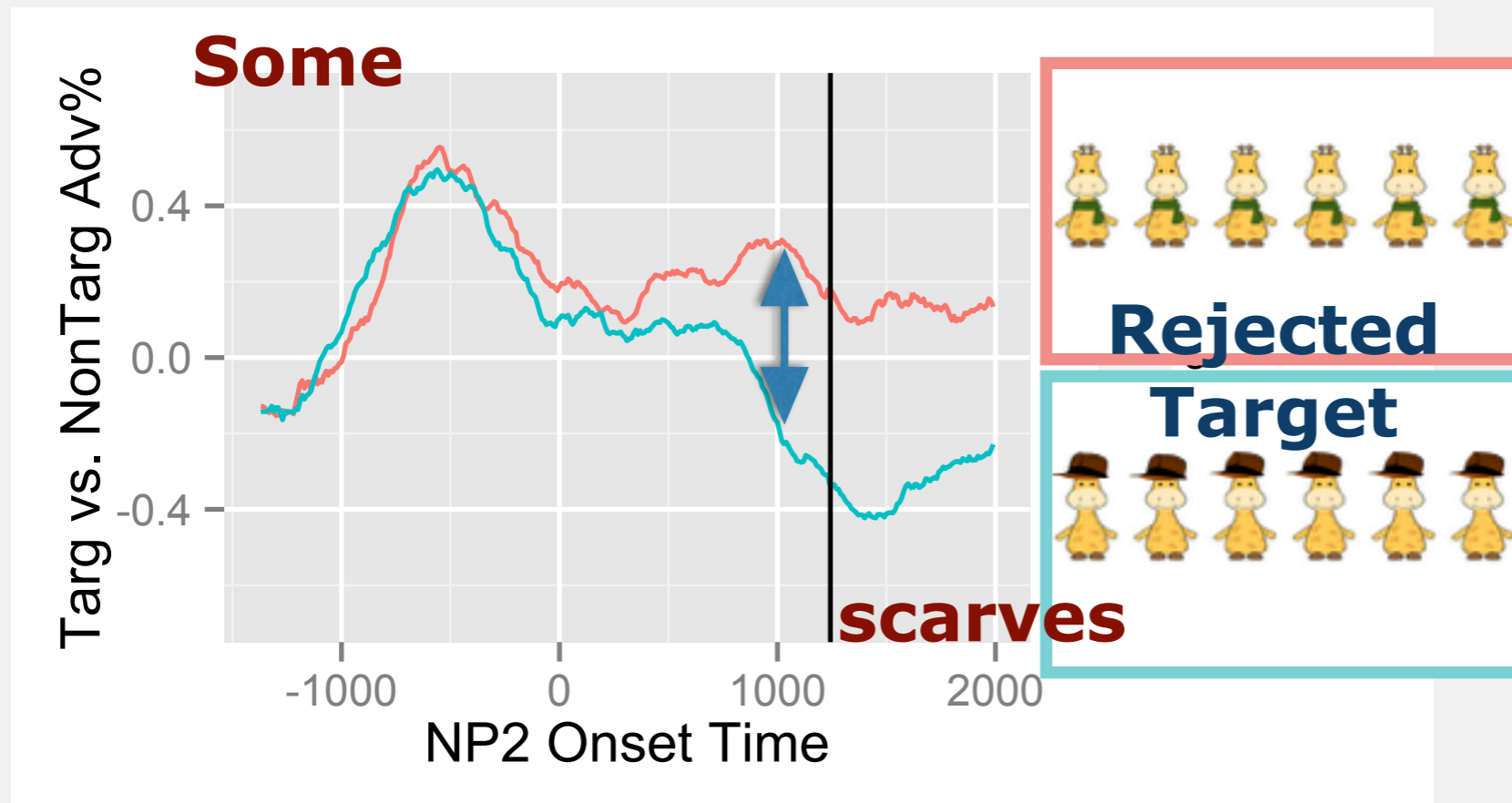
RTs: NP2 mismatch rejected faster than Literal interpretation

- Sustained looks to Target in **Global-All-Pic** CB trials (> Temp from 800ms on)

- Indicates **awareness** of literal alternative

Discussion

- **Implicature** interpretation considered on literal response trials

- **Literal** interpretation considered on implicature response trials as well!

- **Support** for 'Opposing Pressures' interpretation: **Eye movements** seem to reflect subjects' wavering

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`Ambiguity' is real

- Much of the literature is **framed in terms of only one reading** being present at different time points:

  Literal < Implicature OR **Implicature < Literal**

- Our data clearly show that **there is a time window** where both readings are considered in parallel

  —> A matter of **choice between them**, NOT whether one or the other is available!

- In line with **Opposing Pressures** interpretation

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Conclusion

- **RT delay data** is **not** indicative of time course of availability

- Once we look at **alike responses**, delays arise when you could answer either way

- **CB Eye tracking** data reveals that regardless of response the respective other interpretation is also present

  (—> Useful methodological tool!)

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Thank You!

Acknowledgments

- **RA's**:

  - Robert Wilder

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  - Amy Goodwin-Davies

  - Dorothy Ahn (images!)

- **Financial Support**:
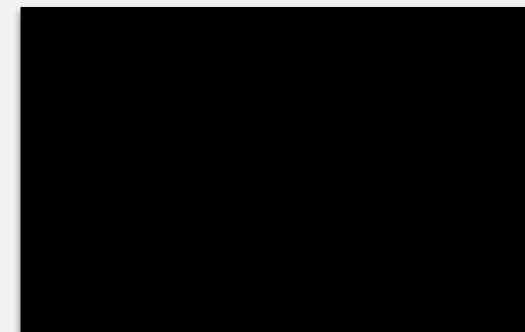
  - Penn's University Research Foundation

  - BCS-1349009

Some Fillers

- **4 Temp block:**

Target
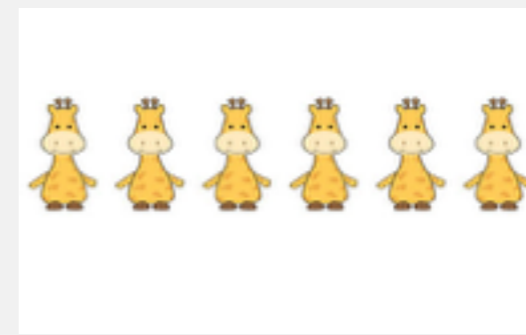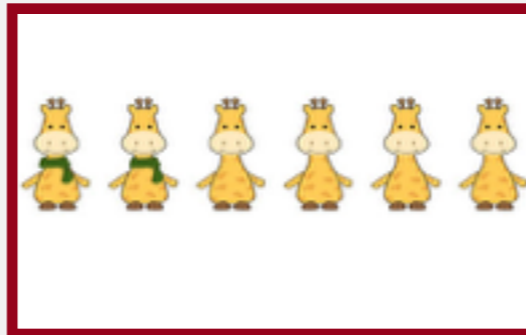
Distractor

CB

Some of the giraffes have scarves

- **4 Global block**

Target

Distractor

CB

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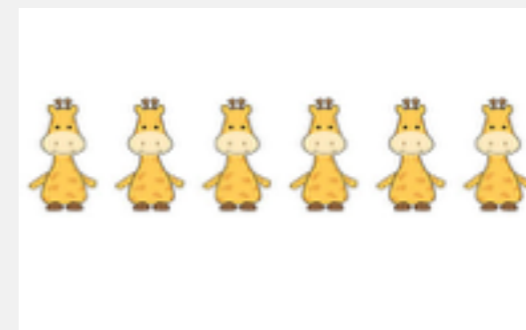
None Fillers

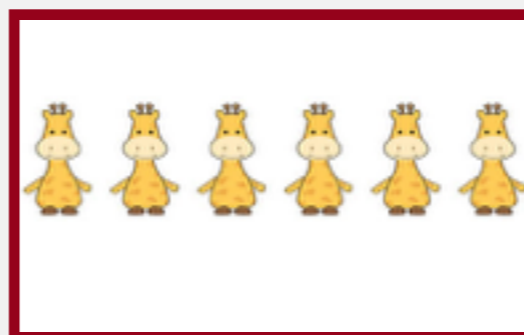● **8 Some-Pic False**

Target
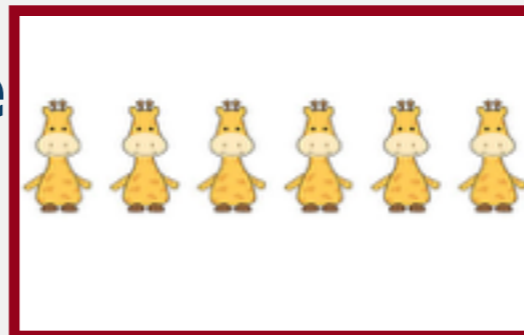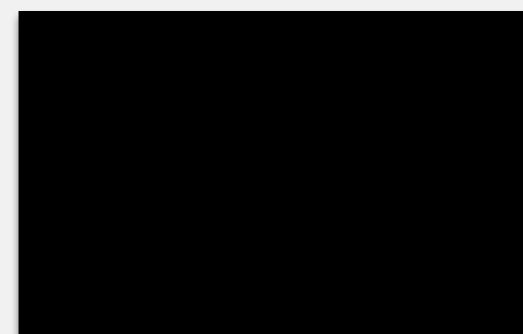
Distractor
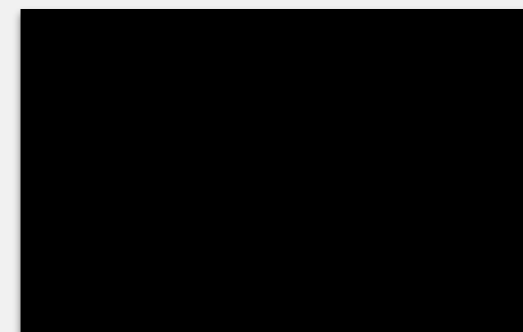
CB

None of the giraffes have scarves

● **8 All-Pic False**

Target

Distractor

CB

Definite Plural Fillers

- **8 Def. Pl. True**

Target
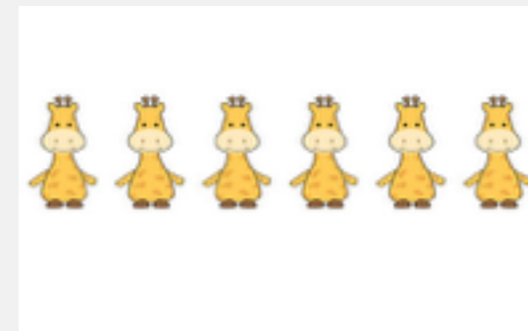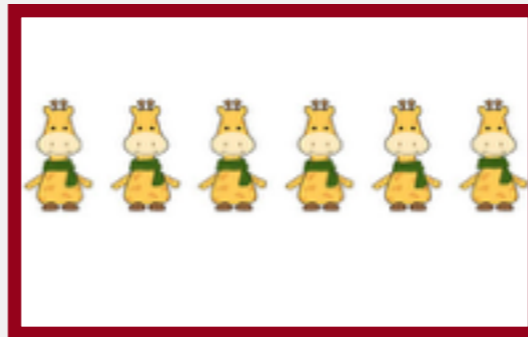
Distractor
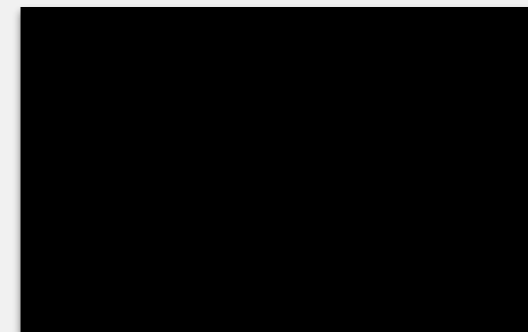
CB

The giraffes have scarves

- **8 Def.Pl. False**

Target

Distractor

CB

Instructions

In this experiment, you will see a number of pictures displayed on the screen. You then will hear some instructions with a description. Your job is to select the picture that matches that description. There is one complication, though: one of the pictures is hidden from view. But since there always is exactly one picture in a given display that matches the sentence, you can safely select that picture if none of the visible pictures is a good fit.

Before each trial, you see a dot in the middle of the screen. Please look at this dot while it's being displayed, so that the trial can begin. Once the pictures are shown, you can look around at the images at your will.
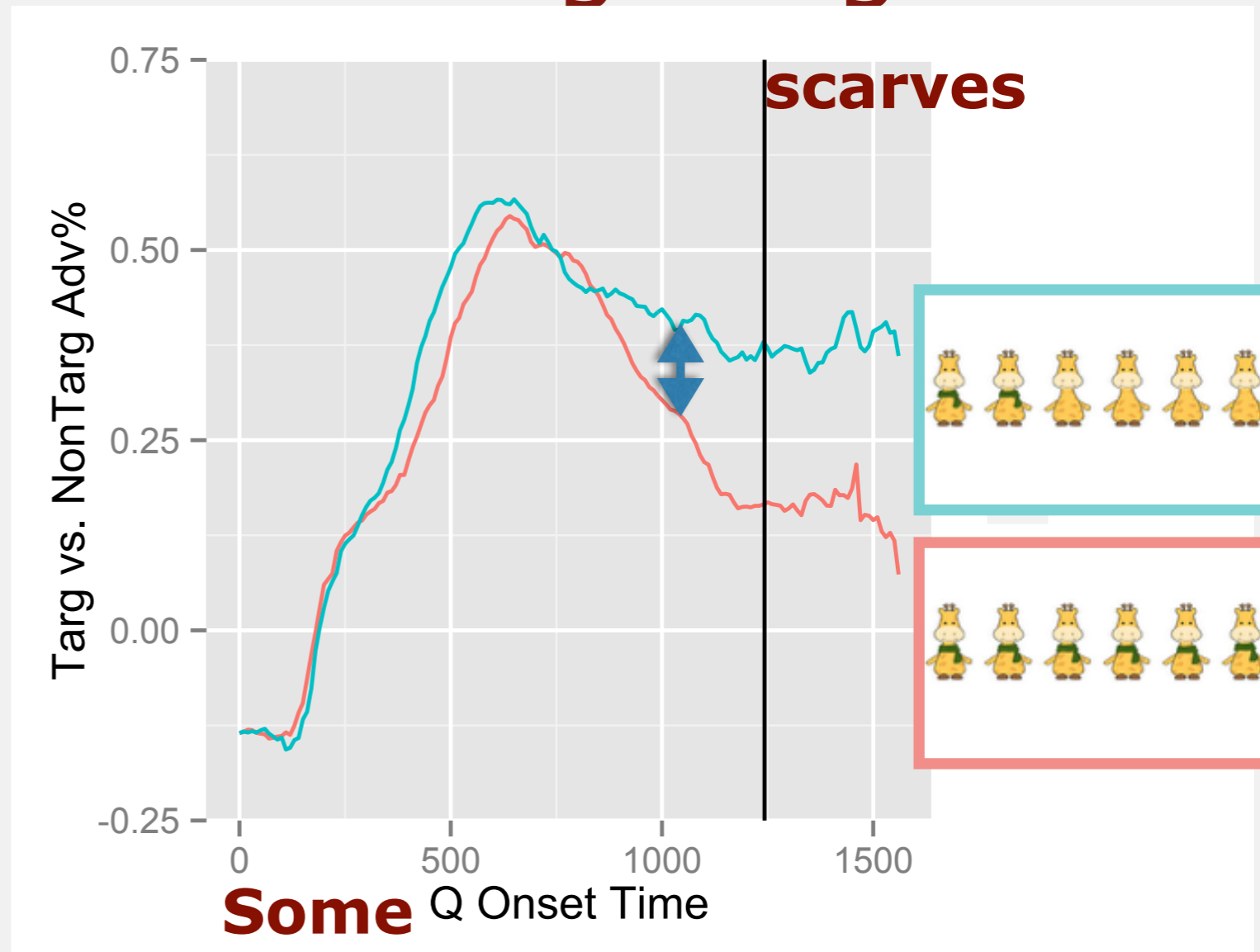
Priming Effect

Some of the giraffes have scarves

- **All-Pic Temp** rejections faster after **Global All-Pic** (i.e., in 2nd block) (compared to before Global All-Pic)

- **Seeing Global All-Pic** seems to facilitate early rejection based on implicature

- '**Implicature priming effect**'?

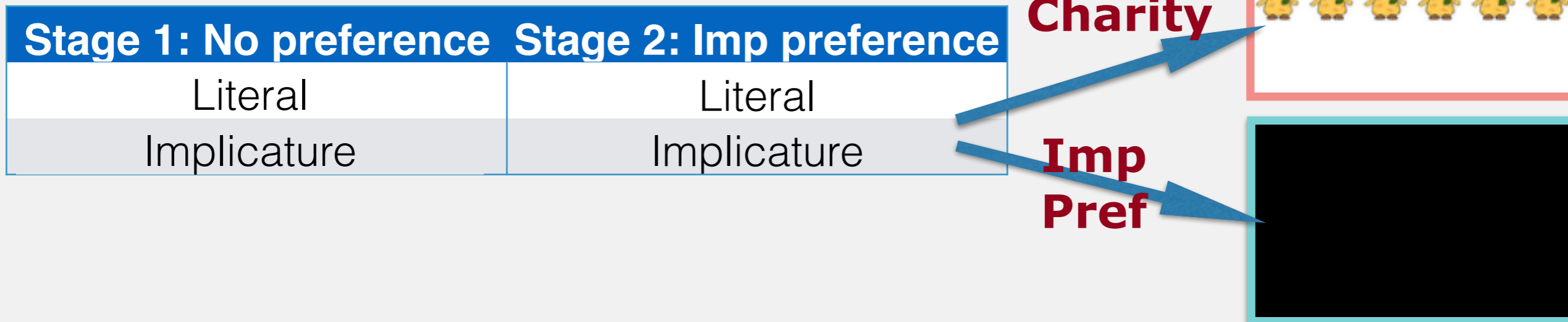- **In our terms**: speed-up of conflict resolution

Early vs. Late Processing Stages

- All our **effects** are quite late

- What happens **early on**?

- **Decrease** in looks to All-Pic after 1000ms

  —> ≈ Huang & Snedeker (but quite different task!)

- **Consistent** with

  - online delay in implicature calculation

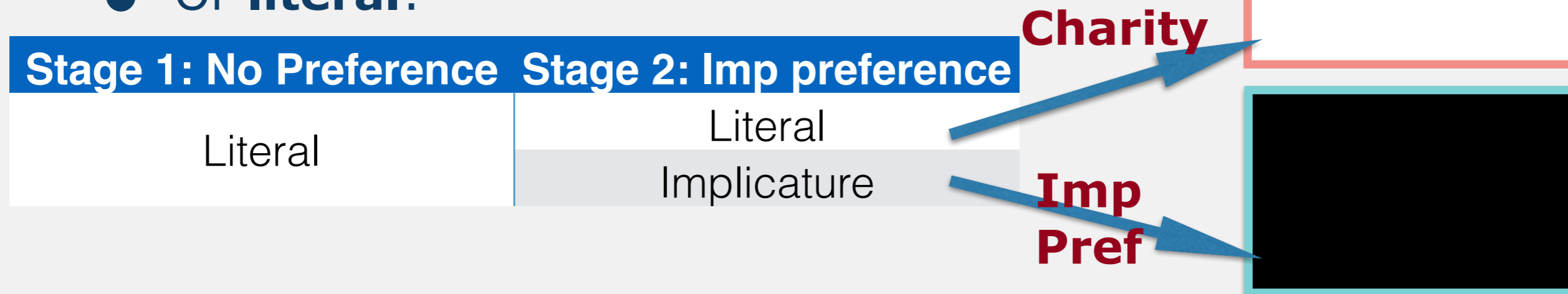 - parallel access to both meanings with **preference emerging** after delay

Meaning(s) During Initial Stage

- **Initial stage** could be **ambiguous**:

Stage 1: No preference	Stage 2: Imp preference
Literal	Literal
Implicature	Implicature

Charity

Imp Pref

- Or **literal**:

Stage 1: No Preference	Stage 2: Imp preference
Literal	Literal
	Implicature

Charity

Imp Pref

- Based on our data, **early time-window** effects could be due to
  delay in implicature availability
  OR
  delay in preference unfolding