

How the art of cinema interacts with the science of cognition to help us understand Seeing

Daniel Levin
Vanderbilt University



Origins of view integration: The close up



Mary Jane's Mishap (1903)
George A Smith

Origins of view integration: The close up



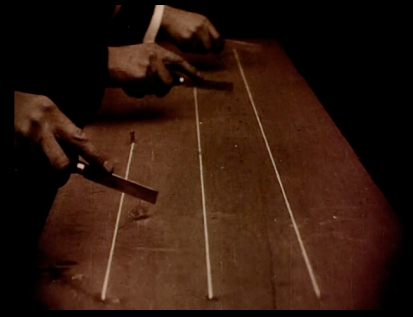
The Lonedale Operator (1911)
DW Griffith

Origins of view integration: The close up



Intolerance (1916)
DW Griffith

Origins of view integration: The close up



Intolerance (1916)
DW Griffith

Perceptual Continuity & Conceptual Integration

Levin, D.T., & Baker, L.J. (2017). Bridging views in cinema: A review of the art and science of view integration. *WIREs Cognitive Science*,
DOI: 10.1002/wcs.1436.

Perceptual Continuity – experience of unbroken series
of sensations

Perceptual Continuity – experience of unbroken series of sensations



Conceptual Integration – recognition that views depict the same event

Role of event familiarity in first-time viewers



Ildirar, S., & Schwan, S. (2015). First-time viewers' comprehension of films: Bridging shot transitions. *British Journal of Psychology*, 106(1), 133-151.

Conceptual Integration – recognition that views depict the same event



Key Questions

1. What forms of visual consistency support perceptual integration?

Properties, space, events

2. How does conceptual organization provided by events support perceptual and conceptual integration?



Change blindness for attended objects

Chris Jaeger





Change blindness for attended objects

Chris Jaeger



... But: Uniquely minimal processing ?

Social overload?

Artificial no-narrative movie with no goals?

...("just watch this video. We're going to ask you some questions after")

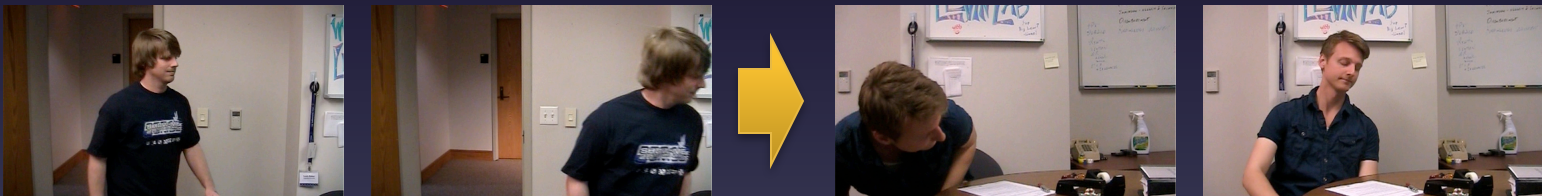
Experiment 1: Add explicit individuation task

Incidental Group: "watch the video"

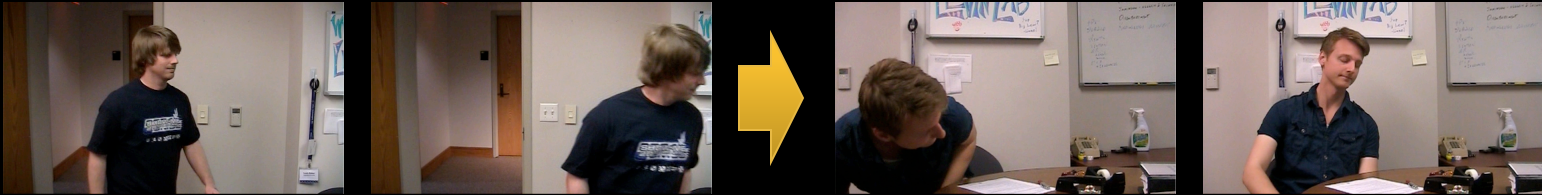
Count Group: "count the number of people"

Intentional Group: "look for actor swaps"

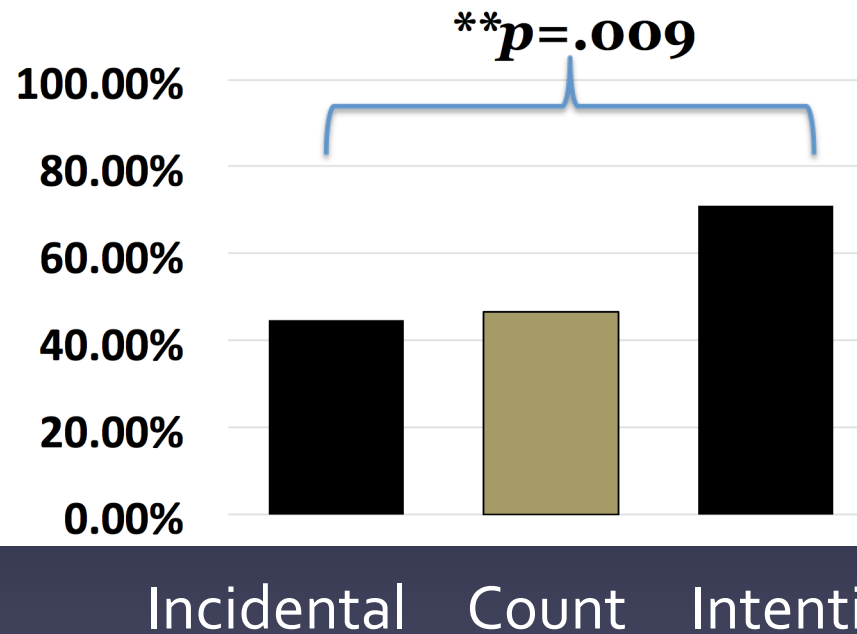
N=163 Mturkers; Each saw one video in one condition



Experiment 1: Results



Change Detection by Condition



Experiment 2: Representation-creation task

Incidental Group: "watch the video"

Pre-Change Freeze Group:

"remember the actor in the freeze"

-> Pre-change actor freezes

Post-Change Freeze Group:

"remember the actor in the freeze"

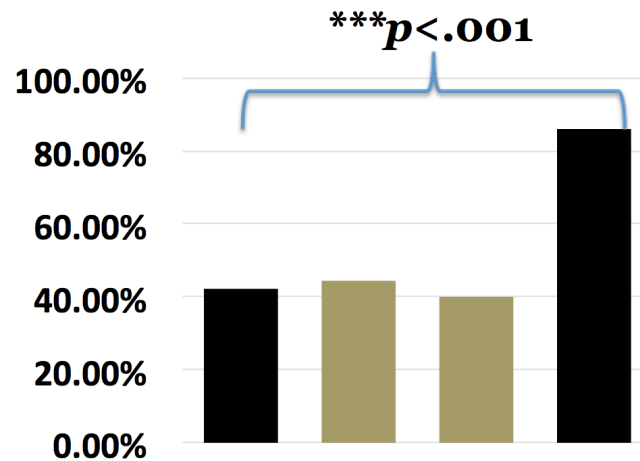
-> Post-change actor freezes

Intentional Group: "Look for actor swaps"

Experiment 2: Results



Change Detection by Condition



Incidental

Pre-freeze
and remember

Intentional

Post-freeze
and remember

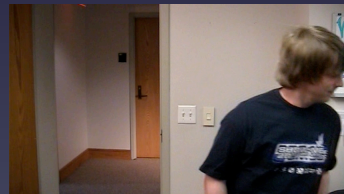
Experiment 3: Create and USE representation

Pre-change target - "Look for him":

Your job is to pay attention and see if the man pictured below appears in the video.

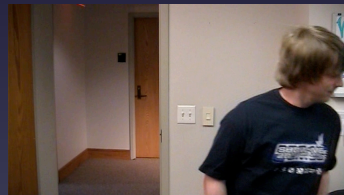


After the video ends, you will be asked whether the man appeared. Then you may be asked some additional questions about the editing and content of the film.



Experiment 3: Create and USE representation

Post-change target - "Look for him":



Experiment 3: Results

Incidental – "answer some questions": 48%

Pre-change target – "Look for him": 70%

Post-change target – "Look for him": 48%

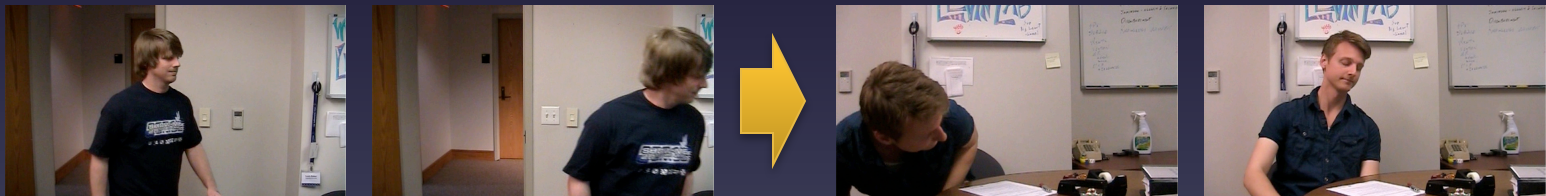
Intentional – "Look for change": 80%

Experiments 1-3: Summary

On-line individuation (counting) does not impact change detection

Target-identification does not impact change detection

Pre-event creation of a target-template of prechange actor increases change detection



Experiments 1-3: Summary

On-line individuation (counting) does not impact change detection

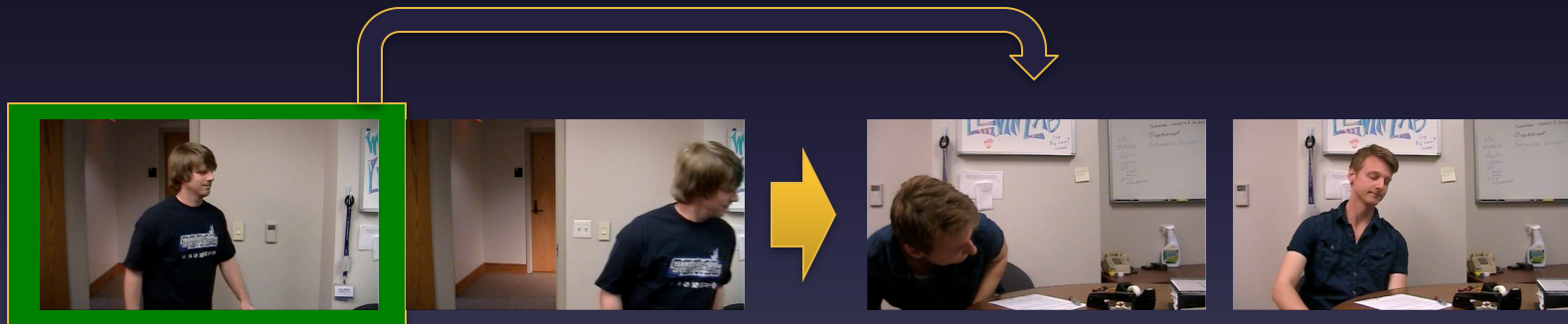
*Task demand to compare does not induce representation

Experiments 1-3: Summary

*Task demand to compare does not induce representation

On-line individuation (counting) does not impact change detection

*Task demand to represent does not induce comparison

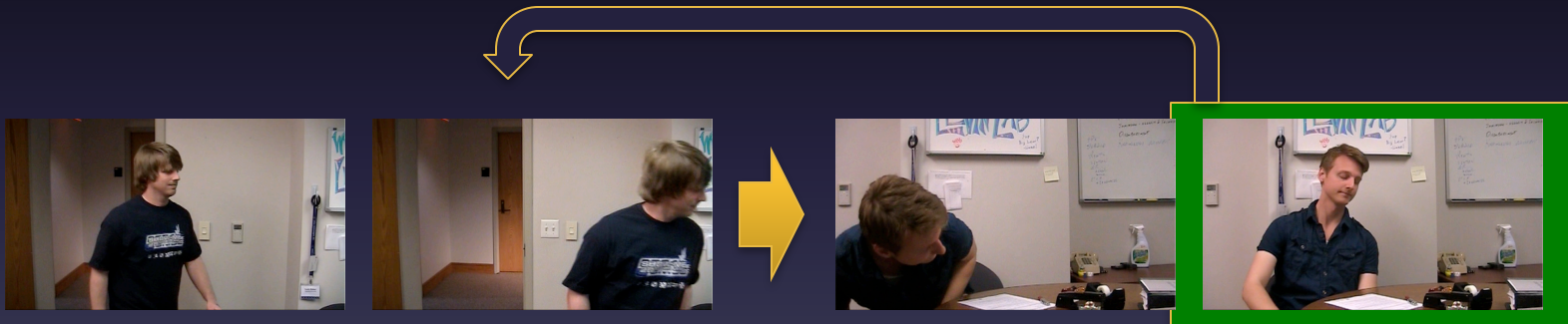


Experiments 1-3: Summary

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*Task demand to represent does not induce comparison

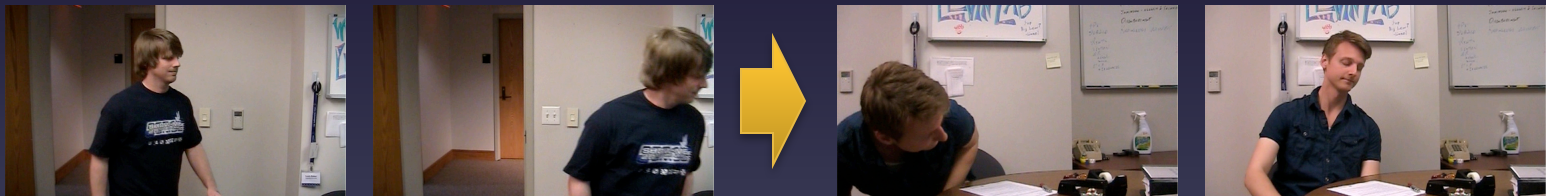


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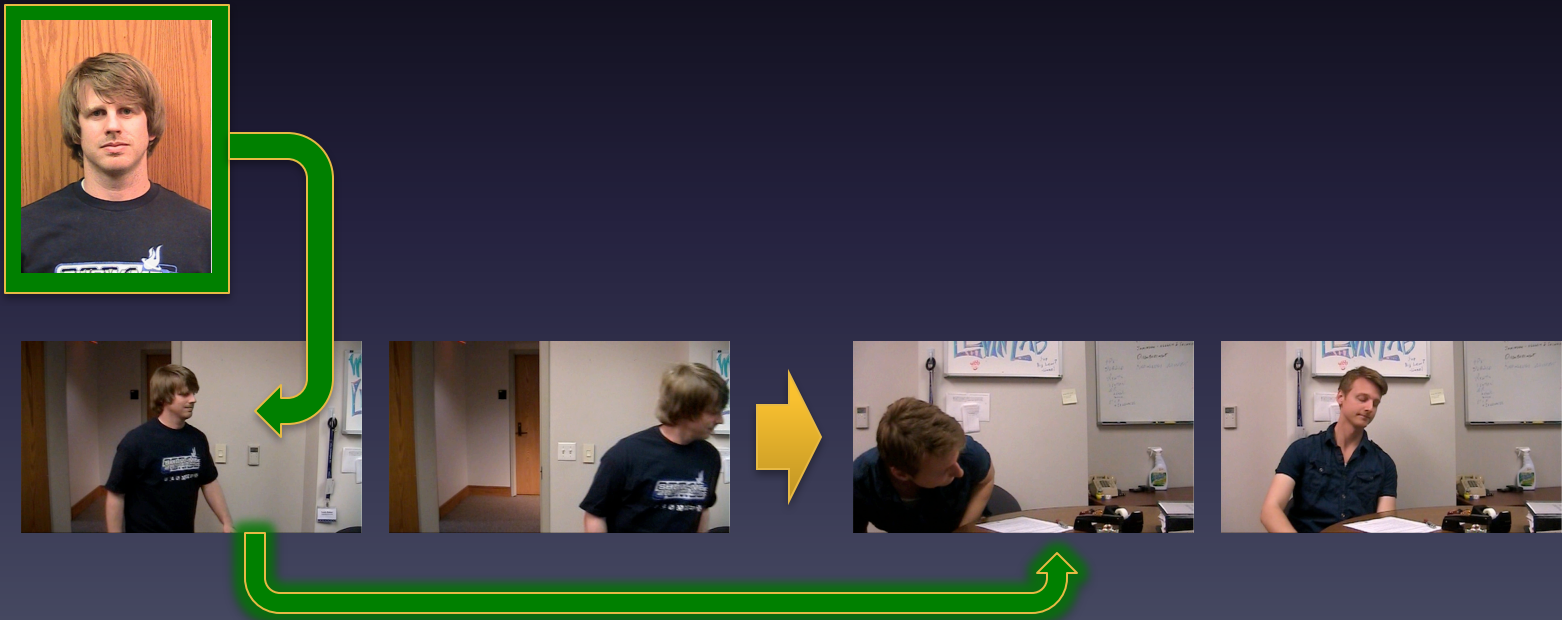
BUT

Pre-event creation of a target-template of prechange actor increases change detection



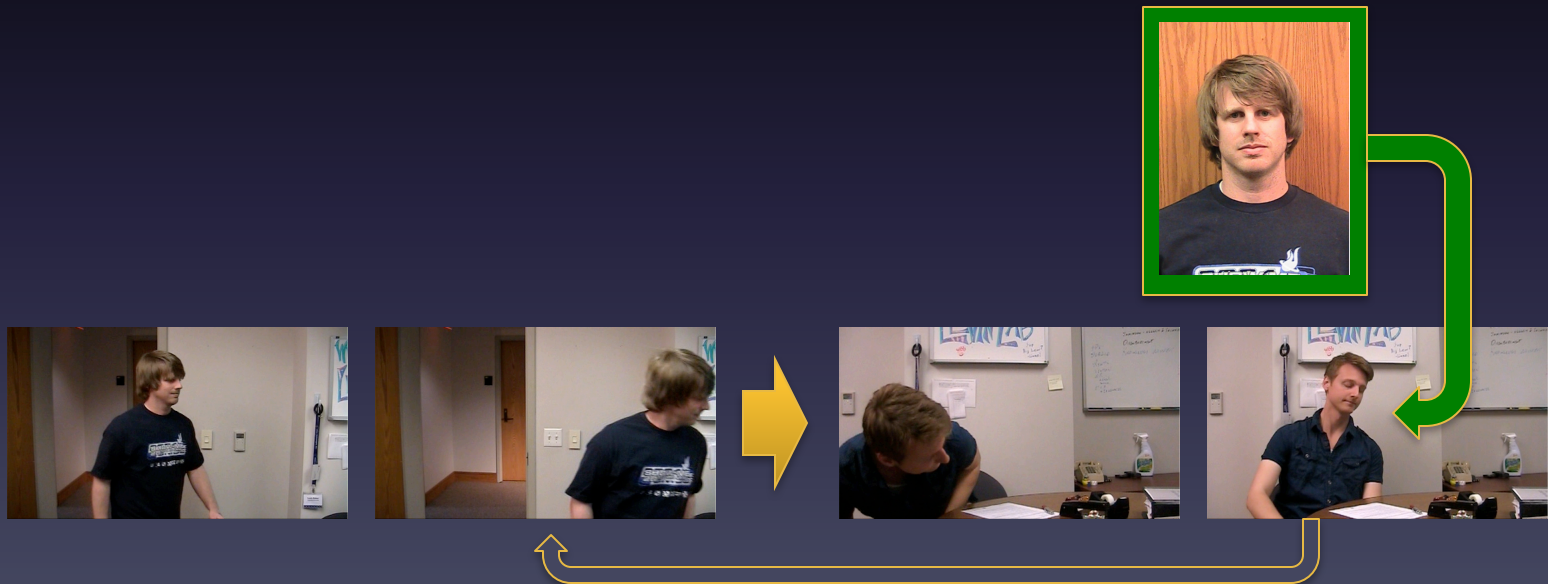
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- BUT
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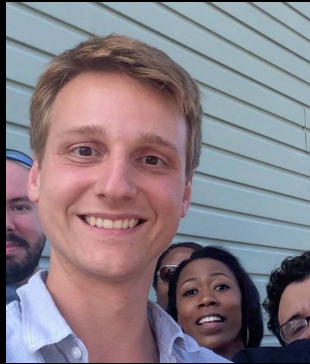
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The Role of Temporal Matching in Perceptual Continuity

Lewis Baker



Chris Jaeger



Josh Little



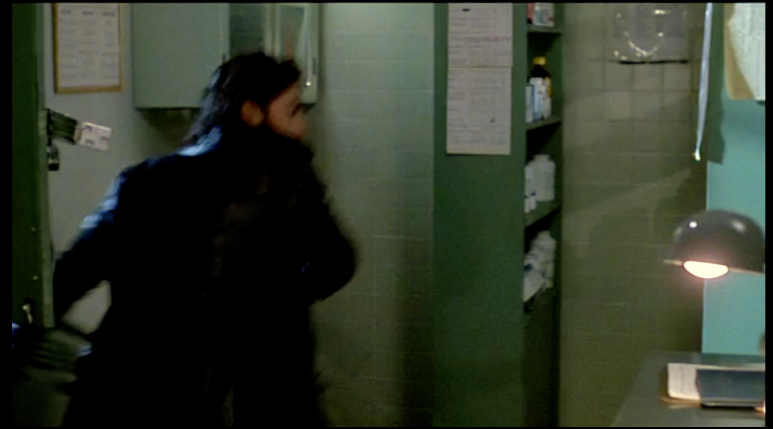
Match-action editing

Match-action editing

Last frame of outgoing shot



First frame of incoming shot



Match-action editing

Last frame of outgoing shot



First frame of incoming shot



Match-action editing

Last frame of outgoing shot



First frame of incoming shot



Match-action editing

Last frame of outgoing shot



First frame of incoming shot



What temporal match is best?

Exact Match? (precisely match object location and configuration)

Most editing practice

Ellipsis? (skip forward a few frames)

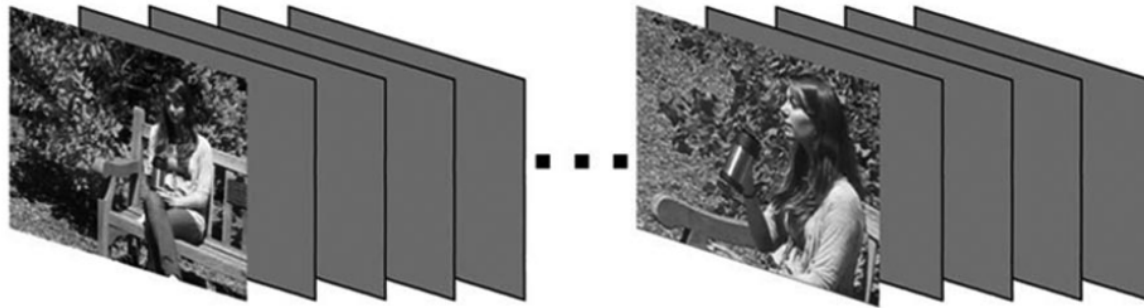
Empirical Research: Hecht & Kalkofen (2009)

Overlap? (repeat a few frames)

Film Editors: Anderson (1998); Dmytryk (1984); Roberts & Sharples (1971)

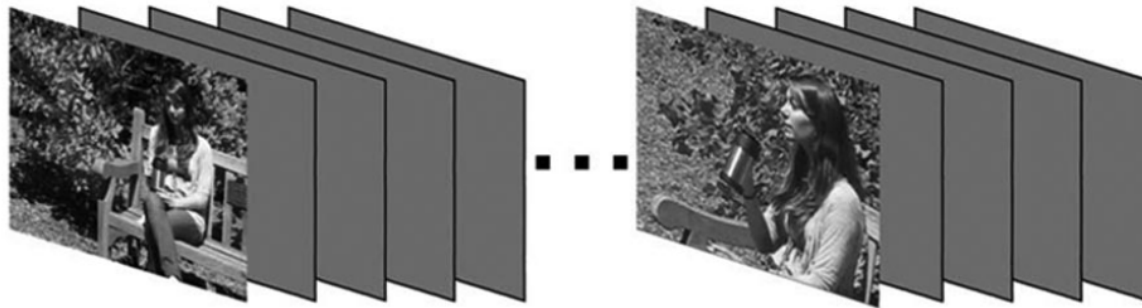
Empirical Research: Shimamura, Cohn-Cheehy, & Shimamura (2014)

Edit Overlap Bias



Shimamura, A.P., Cohn-Sheehy, B.I. & Shimamura, T.A. (2014). Perceiving movement across film edits: A psychocinematic account. *Psychology of Aesthetics, Creativity and the Arts*, 8(1), 77-80.

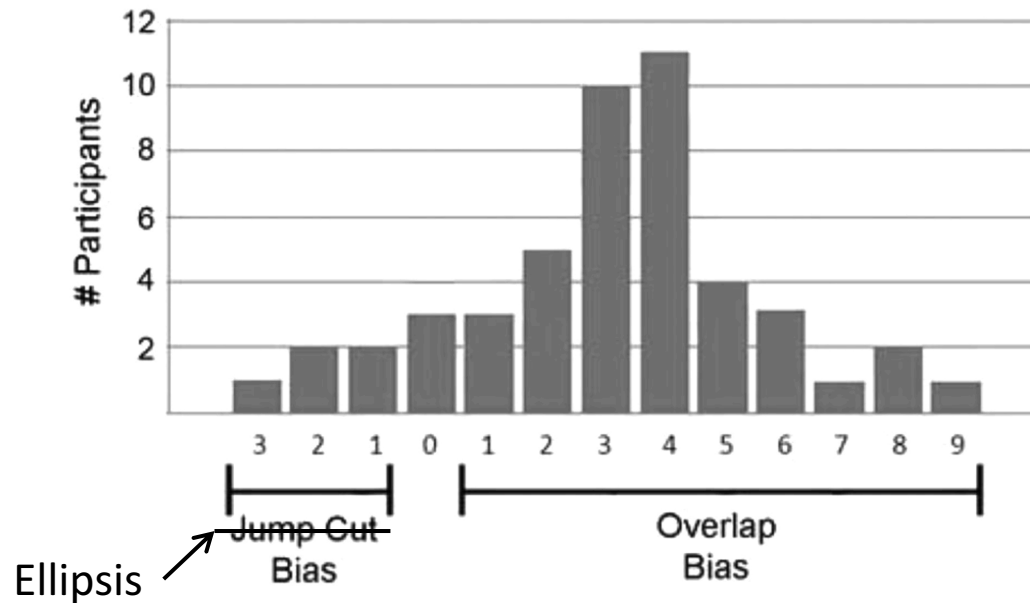
Edit Overlap Bias



*Participants as editors: choose best match by repeated comparison

Shimamura, A.P., Cohn-Sheehy, B.I. & Shimamura, T.A. (2014). Perceiving movement across film edits: A psychocinematic account. *Psychology of Aesthetics, Creativity and the Arts*, 8(1), 77-80.

Edit Overlap Bias



Shimamura, et al. Fig 2

Match-action editing



Last Frame of Outgoing
Shot

|
CUT
/

First Frame of Incoming
Shot

MATCH



OVERLAP
(-12 Frames)



ELLIPSIS
(+12 Frames)



Match-action editing



Experiment 1

“Please rate the smoothness of the film's editing on a scale of 0 to 10, with 0 being a very rough edit and 10 being a very smooth edit.”

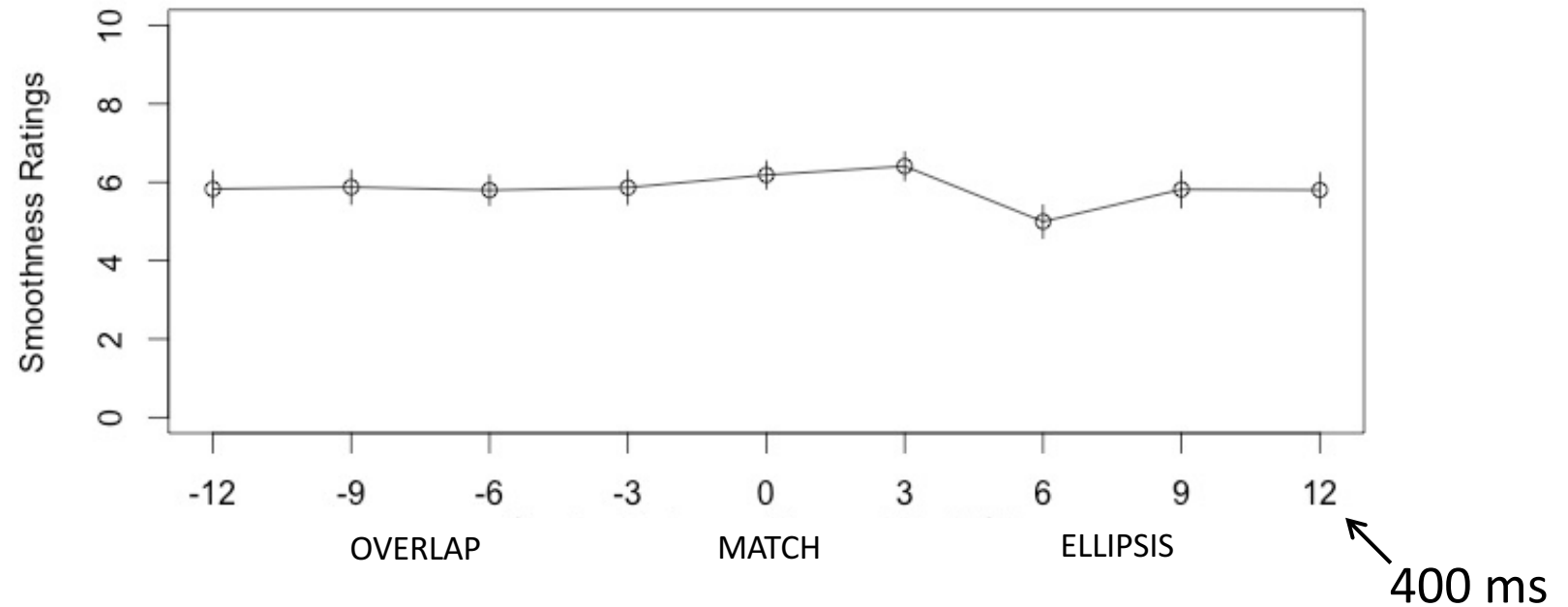
Two Films: Drinking and picking up a quarter

Nine levels of match: -12, -9, -6, -3 frame overlap, 0 frame match, and, +3, +6, +9, +12 frames ellipsis

Each of 378 mechanical turk participants viewed and rated one film

Experiment 1

Continuity Ratings by Overlap Condition



Experiment 2

Will a more sensitive measure of perceptual continuity reveal differences in audience experience?

"How fast was the overall pacing of this film?"

Fast

6

1

Slow

-12

-9

-6

-3

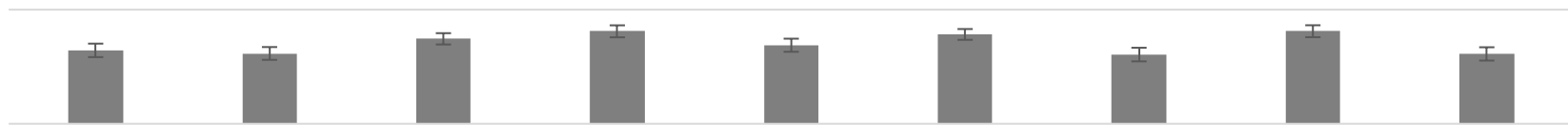
0

3

6

9

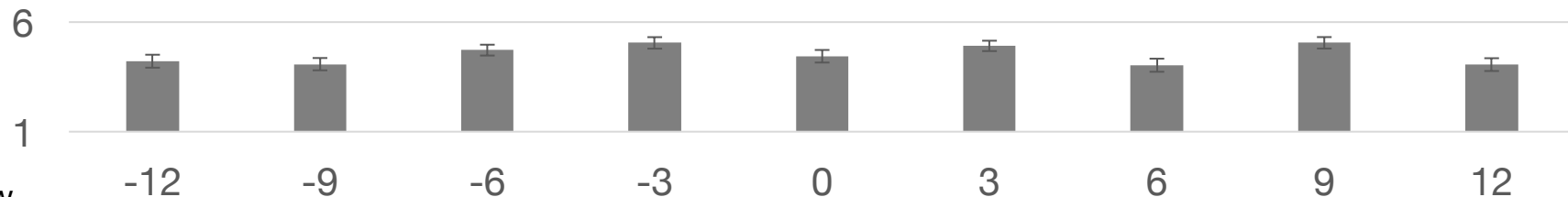
12



"How fast was the overall pacing of this film?"

Fast

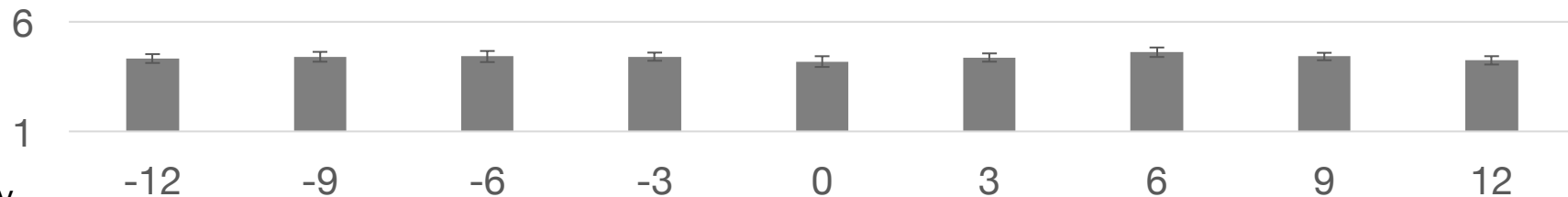
Slow



"Do you feel like the first shot cut out too early or too late?"

Late

Early

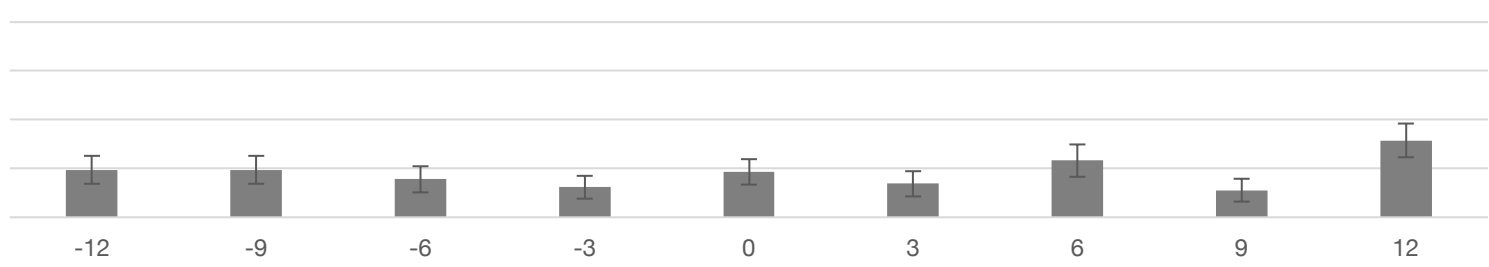


Missing

"Do you feel any parts of the action were missing
between edits?"

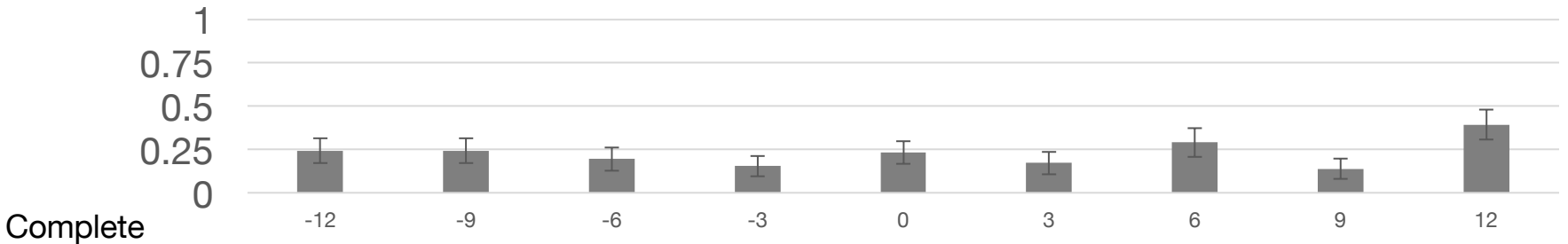
Complete

1
0.75
0.5
0.25
0



Missing

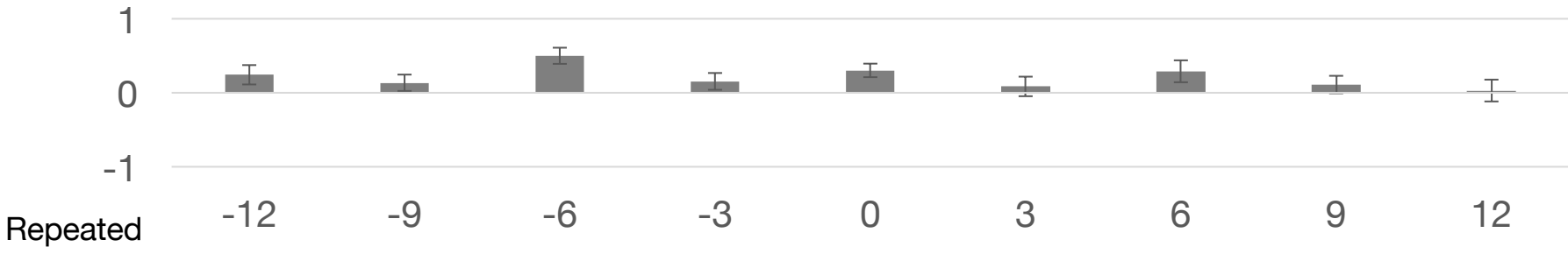
"Do you feel any parts of the action were missing between edits?"



Complete

Skipped

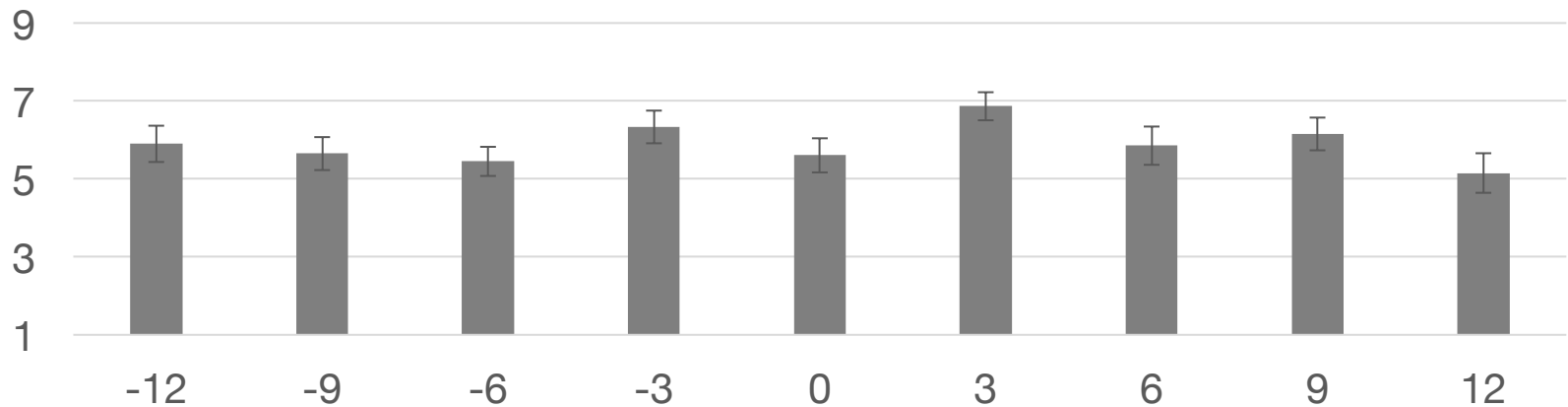
"Do you think the second shot repeated or skipped information?"



Repeated

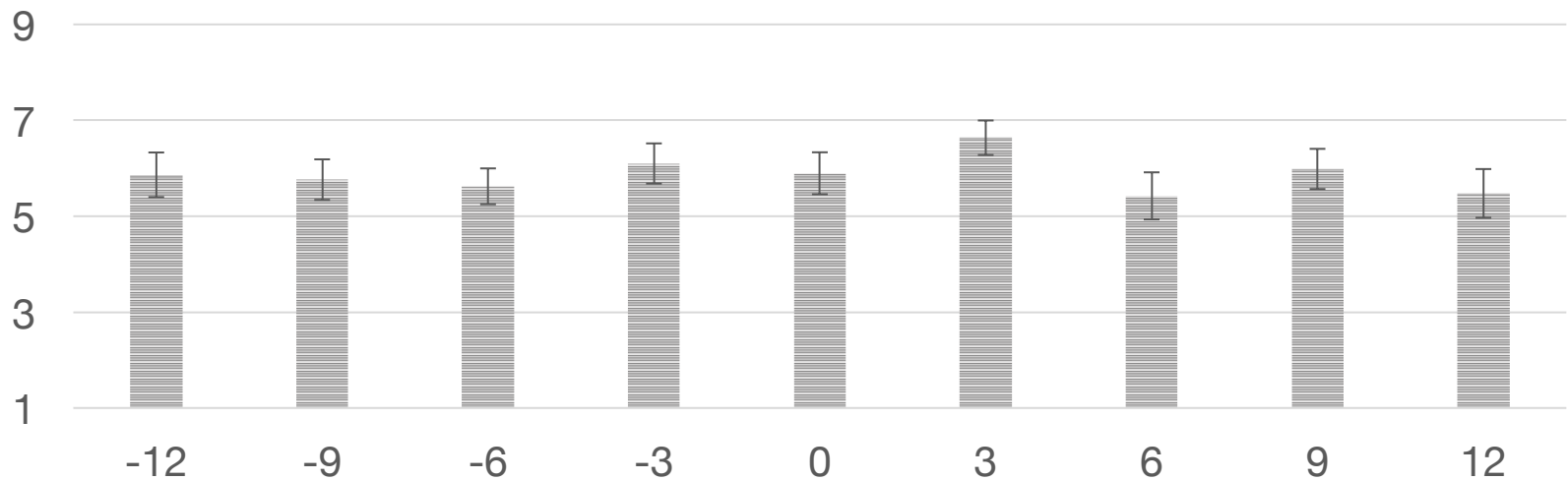
Experiment 2

“Rate the smoothness of the edit from 0-10”



Experiment 2

Experiments 1 & 2: Percieved Continuity



Experiment 3

Can viewers **discriminate** between varying overlap?

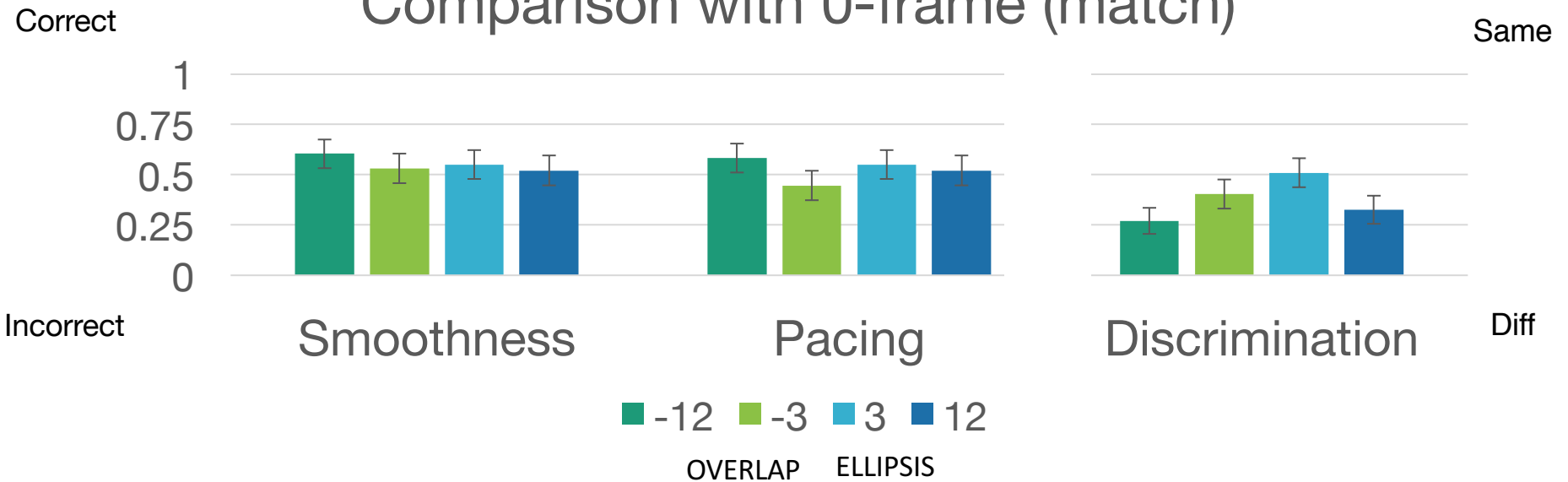
Experiment 3



“Are these exactly the same or are they different?”
Compare 0 with 3; 0 with -3; 0 with 12; 0 with -12

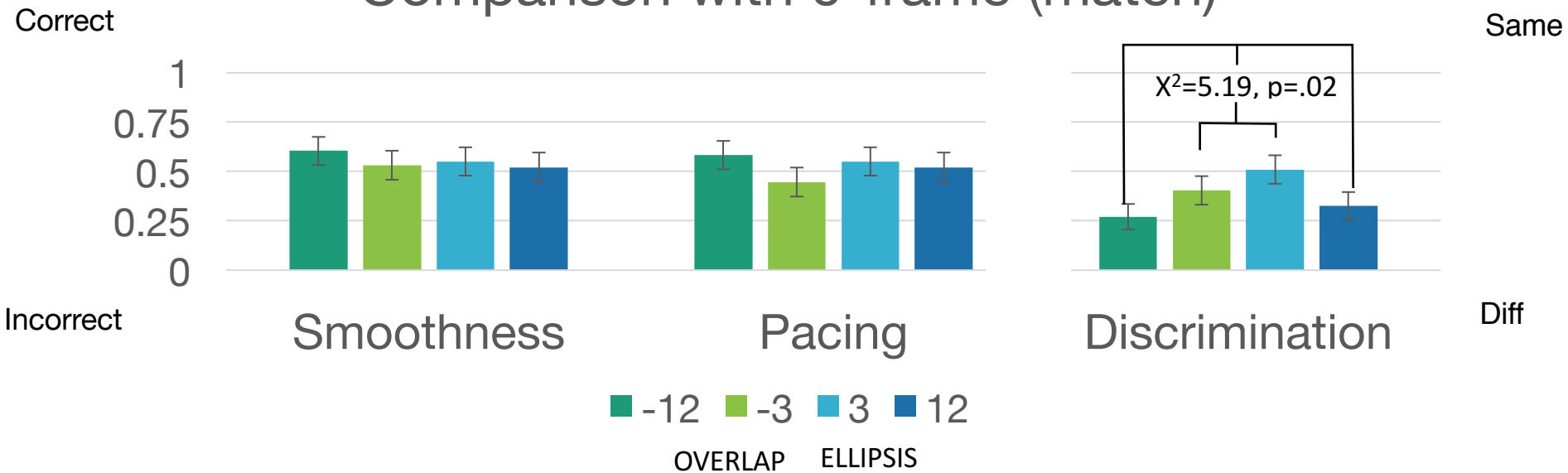
Experiment 3

Forced-Choice Continuity Ratings: Comparison with 0-frame (match)



Experiment 3

Forced-Choice Continuity Ratings: Comparison with 0-frame (match)



Conclusions

Precise temporal matching is not a default constituent of perceptual continuity

Viewers *can* discriminate between large differences in overlap but only when prompted to scrutinize and compare

Perceptual Continuity II: Does continuity depend on the sequence of events?

“Mental representation of the time course of a dynamic situation is a prerequisite for understanding”

Claus & Keltner (2006)

It is “crucial that violations of the temporal order [of event sequences] are detected in order to adjust behavior or re-analyze the situation”

Raisig, Welke, Hagendorf & van der Meer (2010)

Hymel, A., Levin, D.T., & Baker, L.J. (2016). Default processing of event sequences. *Journal of Experimental Psychology: Human Perception and Performance*, 42, 235-246.

Evidence for encoding and comparison of events in sequence

On-line action prediction and forward extrapolation (e.g. Freyd, 1987)

Statistical learning of event sequences (e.g. Baldwin, Andersson, Saffran, & Meyer, 2008)

Role of prediction and comparison in event perception models (e.g. Zacks, Speer, Swallow, Braver, & Reynolds, 2007)

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...BUT

Attentional blink, repetition blindness

Failures to detect disruptions (Levin & Varakin, 2004)

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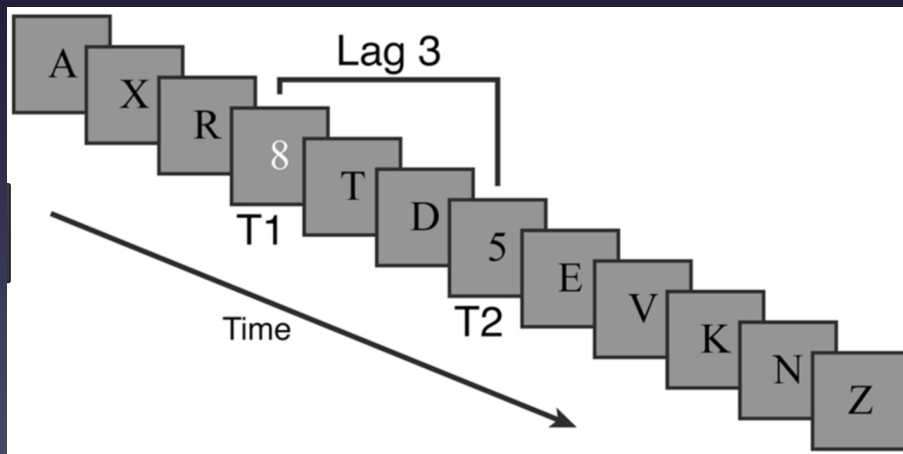
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Cain, Prinzmetal, Shimamura, & Landau (2014)

Evidence for encoding and comparison of events in sequence

On-line action prediction and forward extrapolation (e.g. Freyd, 1987)

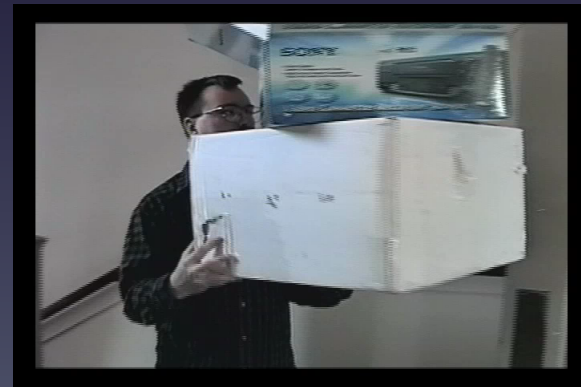
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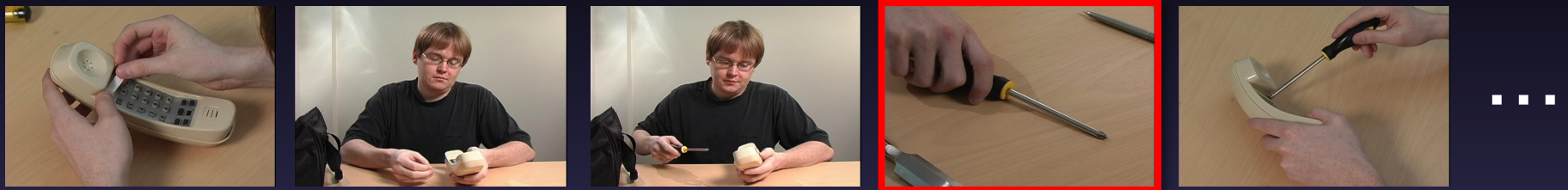


Normal and Reversed Sequences

Normal



Reversed



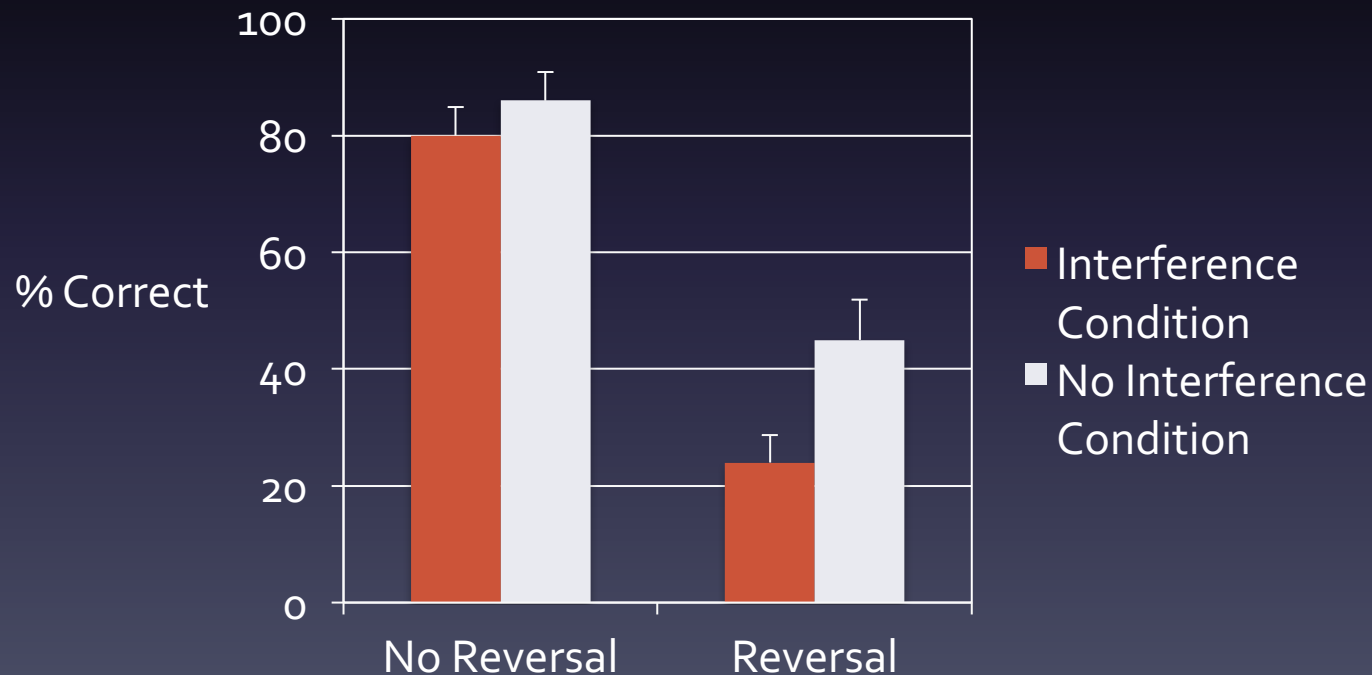
- 2 black frames between shots (67 ms)
- Reversed shot mean duration = 536 ms (range: 300-1066 ms)
- 12 different videos, 6 with reversals

Basic Results

- Detection 31-62%; 5-13% FAs

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- Verbal interference -> chance performance



Basic Results

- Detection 31-62%; 5-13% FAs
- Verbal interference -> chance performance
- Incidental detection ~0%

What does this all mean?

Rich Representation Models:



Sparse Representation Models:





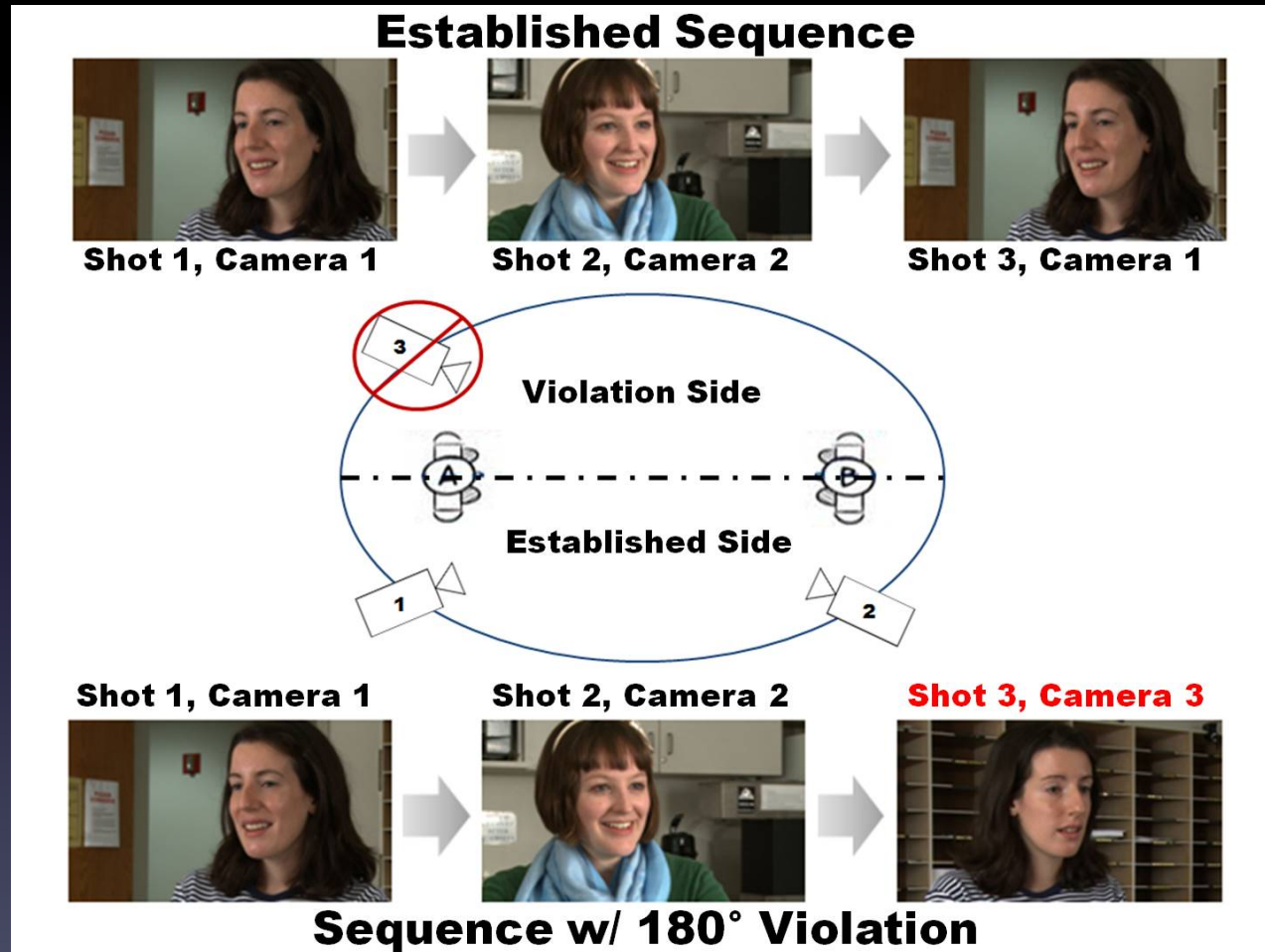
Attention, Comparison, and Cinematic Space

Lewis Baker

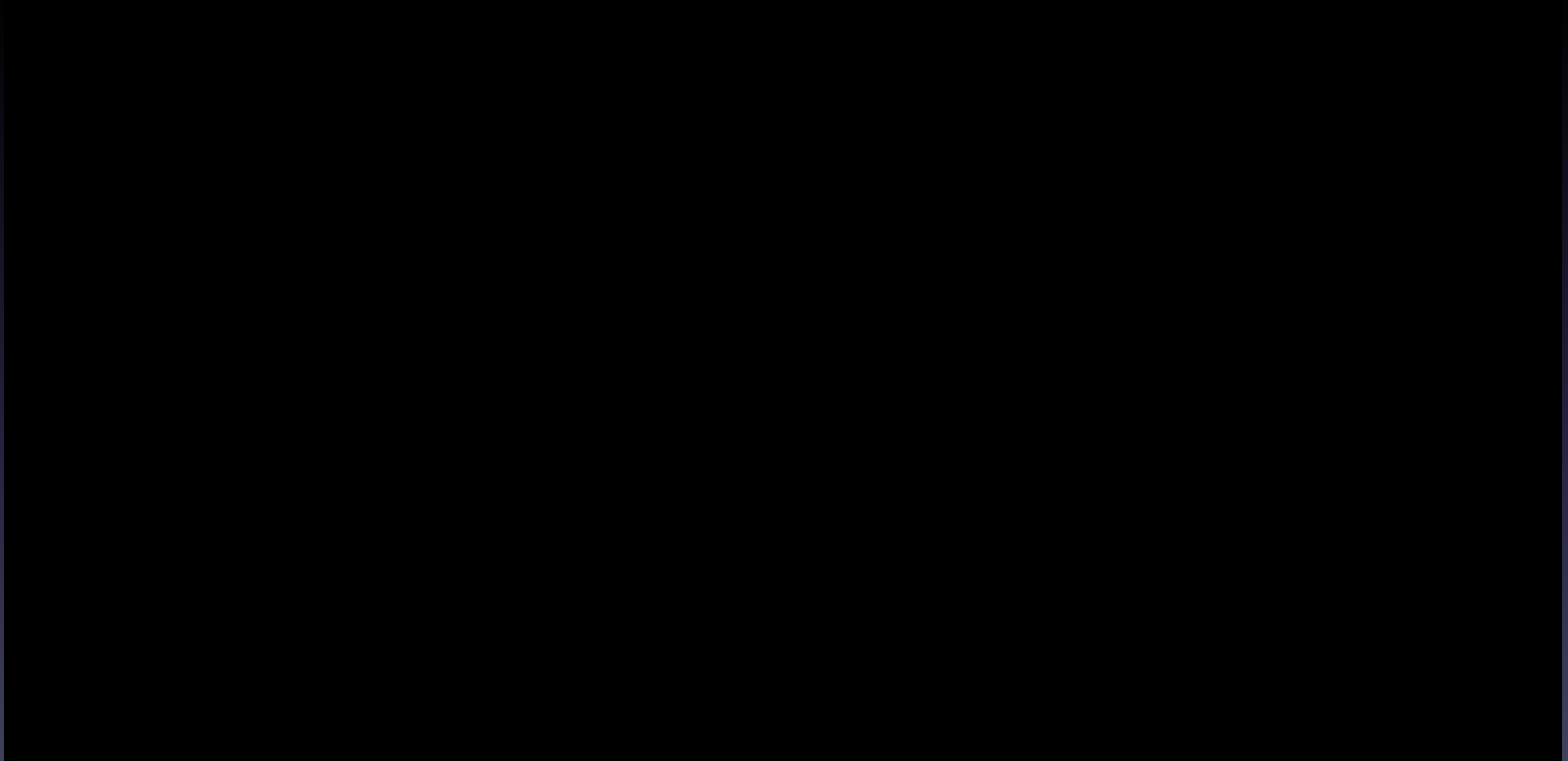
	Shot 6	Shot 7	Shot 8	Shot 9	Shot 10a	Shot 10b
Event Boundary Condition						
Ongoing Event Condition						
Violation Condition						

Baker, L.J., & Levin, D.T. (2015). The role of relational triggers in event updating. *Cognition*, 136, 14-29.

Maintaining spatial coherence between views: The 180 rule



Change Detection: Experiment 1



Change Detection: Experiment 1

Conditions: Experiment 1



**Condition 1:
Violation Only**



**Condition 2:
Change Only**



**Condition 3:
Change + Violation**

Change Detection: Experiment 1

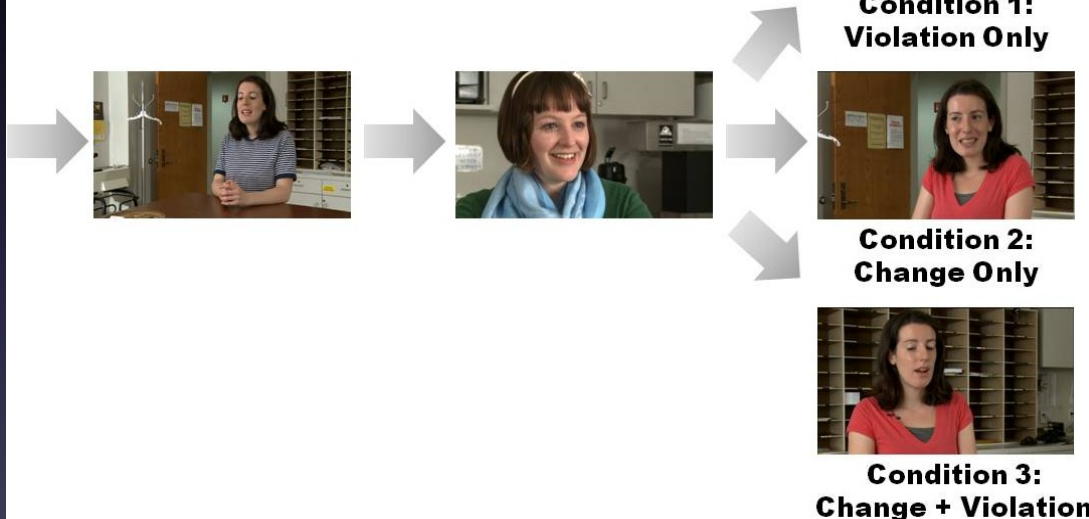
0% Control Cond. FAs
(0/11 participants)

0% FAs
(0/50 participants)

48% Change detection
(24/50 participants)

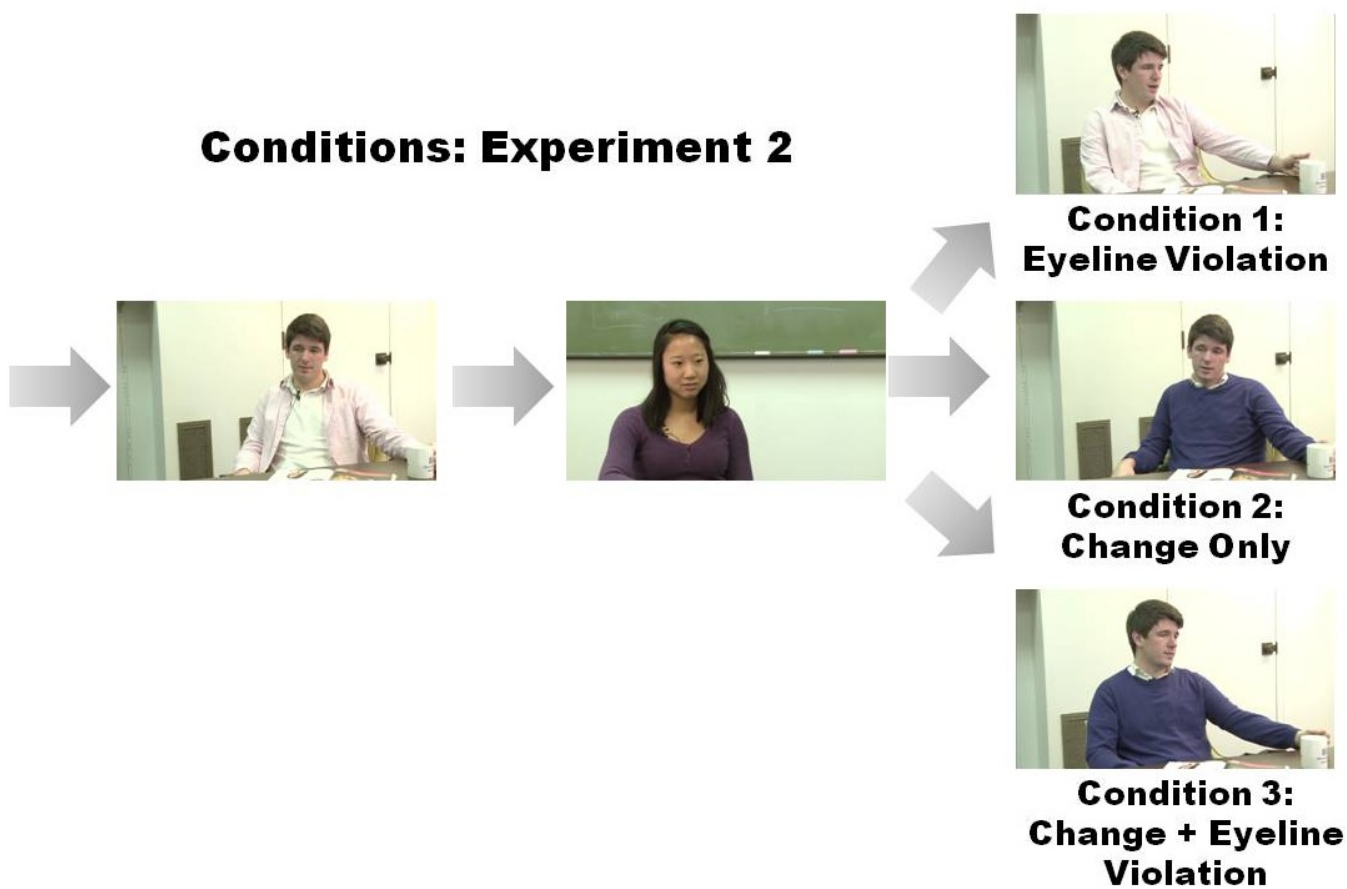
68% Change detection
(34/50 participants)

Conditions: Experiment 1



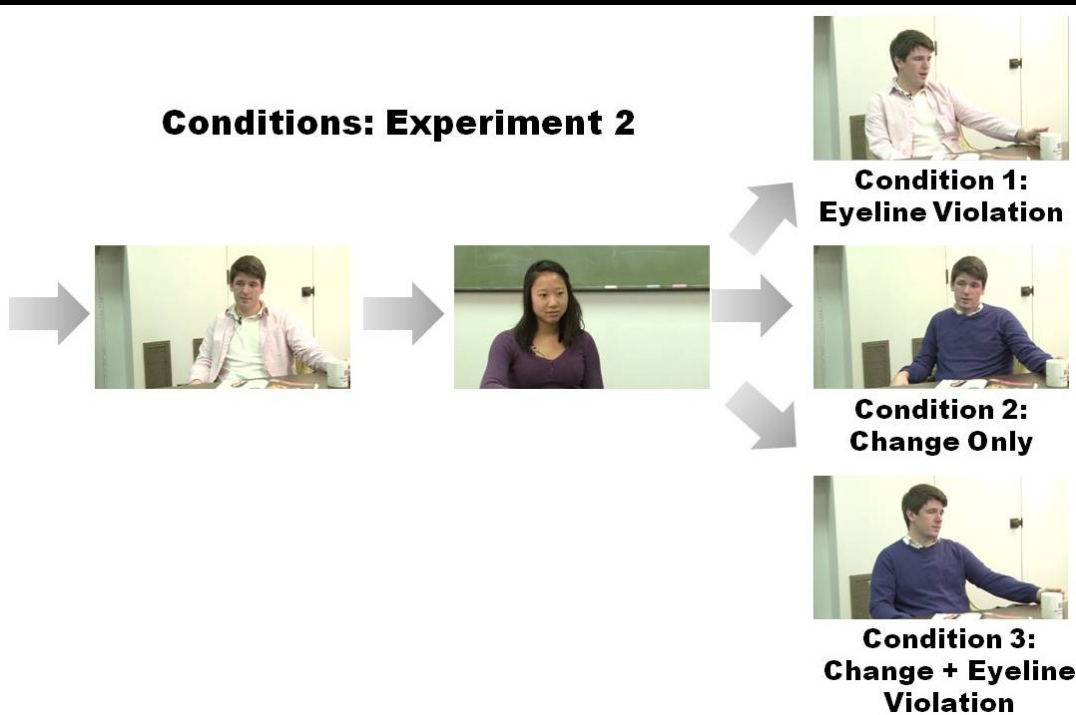
Experiment 2

Conditions: Experiment 2



Results Experiment 2

Conditions: Experiment 2



8% change detection FAs
(2/27 participants)*

43% Change detection
(12/28 participants)

83% Change detection
(20/24 participants)

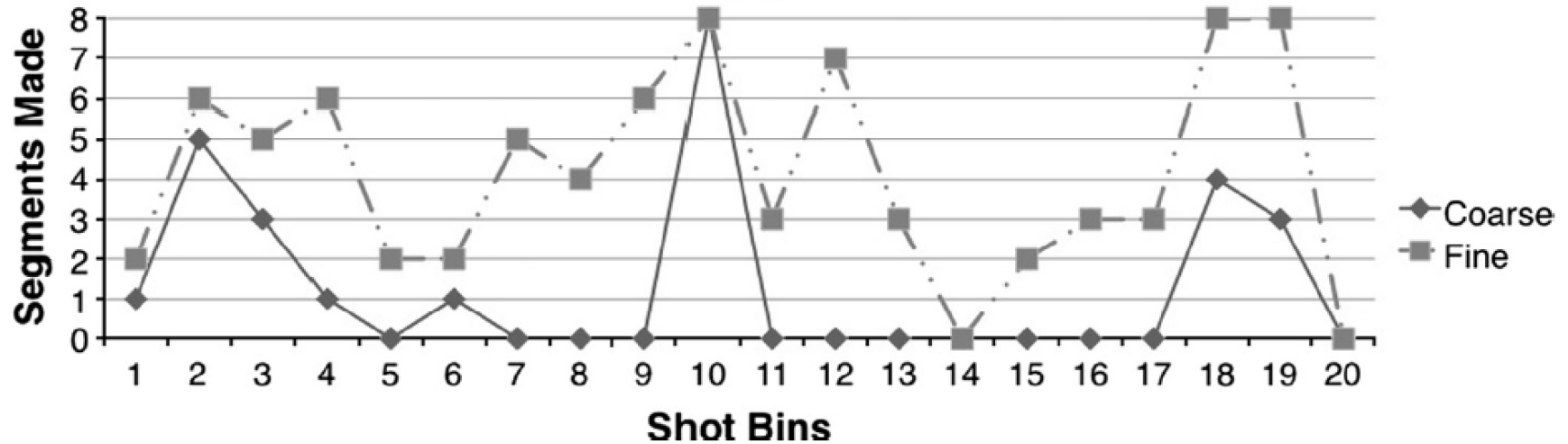
** ... but not really – FAs were for a different shot.*

Experiment 3: Change detection and goal-organized events

	Shot 6	Shot 7	Shot 8	Shot 9	Shot 10a	Shot 10b
Event Boundary Condition						
Ongoing Event Condition						
Violation Condition						

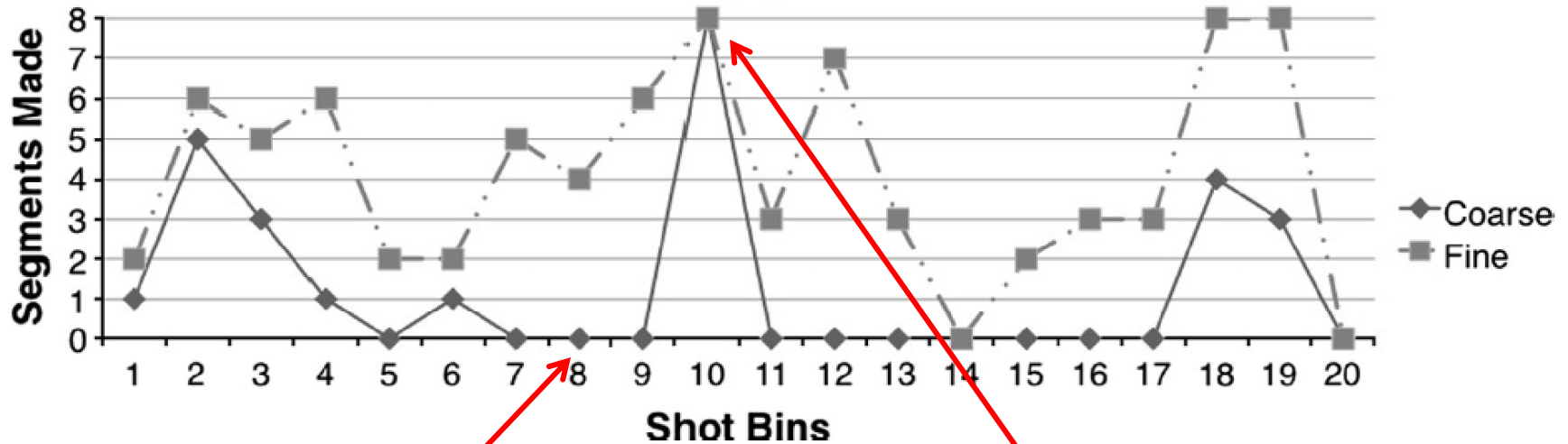
Experiment 3: Change detection and goal-organized events

Film 2 Segmentation



Experiment 3: Change detection and goal-organized events

Film 2 Segmentation

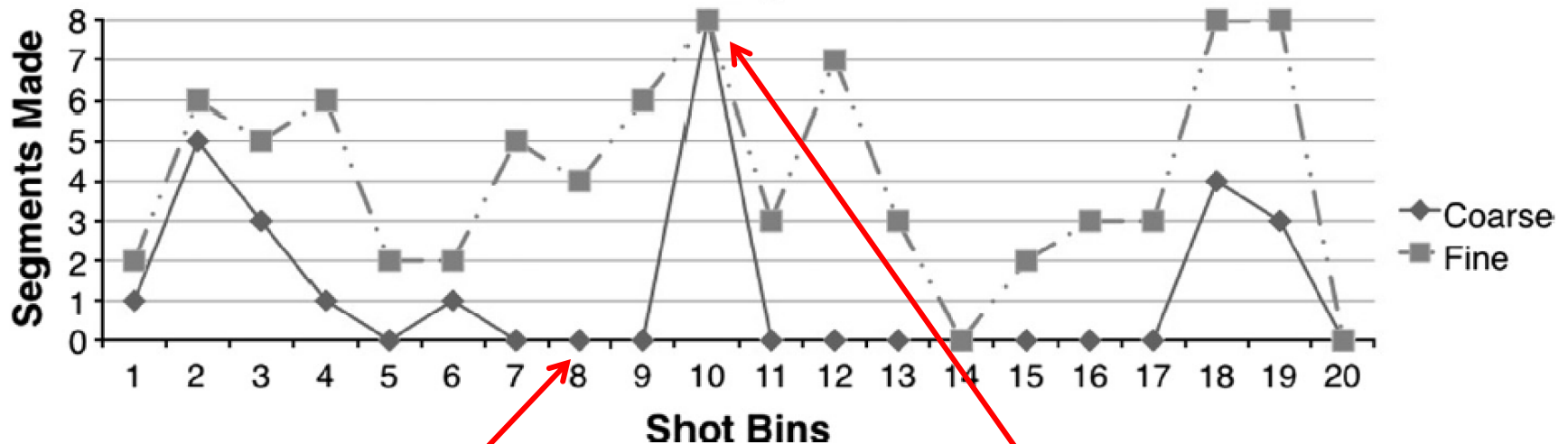


16% within-event change detection

45% between-event change detection

Experiment 3: Change detection and goal-organized events

Film 2 Segmentation



16% within-event change
detection

43% within-event +
violation change detection

45% between-event
change detection



The order of pictures on the screen is no longer the order of events in nature but rather that of our own mental play. Here lies the reason why this new art has such peculiar interest for the psychologist. It is the only visual art in which the whole richness of our inner life, our perceptions, our memory, and our imagination, and our attention can be made living in the outer impressions of themselves.

Munsterberg, 1920



What can we learn from a cinematic fail...

Medium-specific skills/knowledge

Gricean Maxim of Quantity

Too much information



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Default event coding

Events have only one beginning



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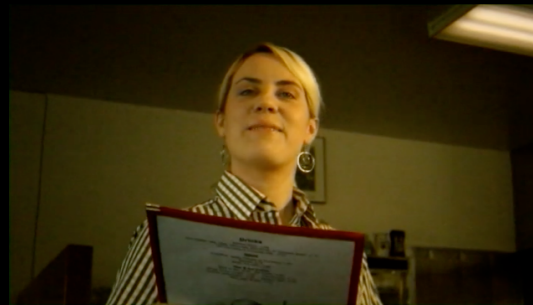
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Subjectivity tagging



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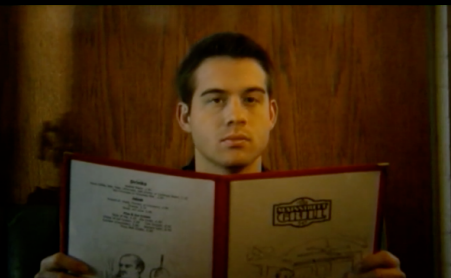
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What can we learn from a cinematic fail...

Medium-specific skills/knowledge

- Gricean Maxim of Quantity

 - Too much information

 - Too little information

Default event coding

- Events have only one beginning

- Subjectivity tagging

- Identify ALL agents in the scene: the camera





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Hugo Munsterberg, 1920



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Adriane Seiffert

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