

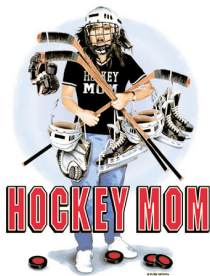
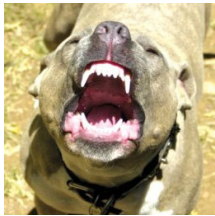
Conceptual Integration in Multi-modal
Discourse Comprehension:
*ERP Studies of Iconic Co-speech
Gestures*

Seana Coulson
Cognitive Science, UCSD

*Agile Mind Symposium
Brussels
September 12, 2008*



What's the difference between a pit
bull and a hockey mom?



...lipstick

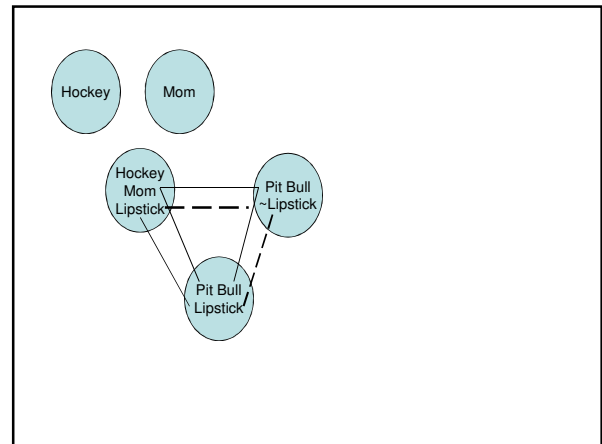
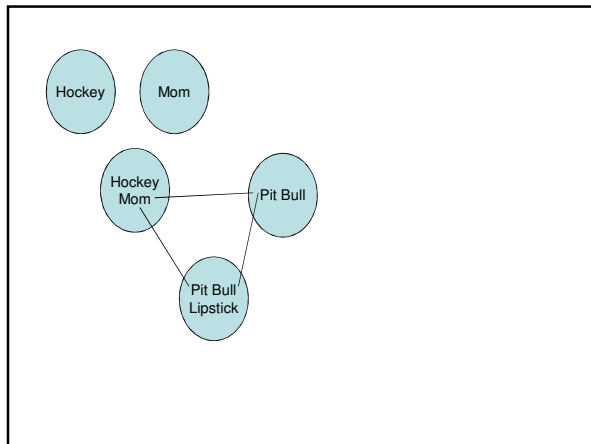


Palin's Joke

- Evokes image of a pit bull wearing lipstick
- Draws on stereotype of pit bulls as ferocious dogs
- Draws on stereotype of hockey as a violent game
- Conveys her ferocity as a political candidate while simultaneously highlighting her conformity to stereotype of traditional American female
 - Role as Mother
 - Nurturing caretaker
 - Stern disciplinarian
 - Vicious in defense of her children
 - Sexually Attractive

Conceptual Blending

- Non-compositional processes for information integration
- Combine partial structure from 2 or more mental spaces in a *blended* mental space
- Involves:
 - Establishment and/or exploitation of mappings
 - Activation of background knowledge
 - Mental imagery, mental simulation
- Occasionally bizarre, but many examples where blends support reasoning with real-world consequences



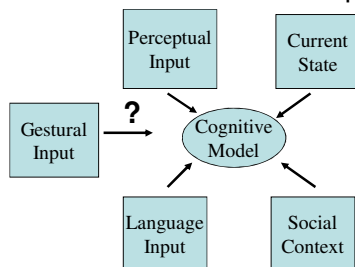
Creative Language Use

- Palin's joke does not rely on particularly innovative language use, e.g. metaphor, but *does* cue a novel construal of her political identity
- Exploits
 - selective recruitment of conceptual structure
 - integration of concepts from different domains
- This in turn can prompt
 - further recruitment of conceptual structure from active domains for integration with extant structure
 - activation of novel construals

Semantic Indeterminacy

- Meaning in natural language is underspecified – even in very straightforward communicative contexts
- Speakers exploit a variety of resources to help evoke construals with the necessary degree of specificity
- Gestures

Multi-Modal Discourse Comprehension



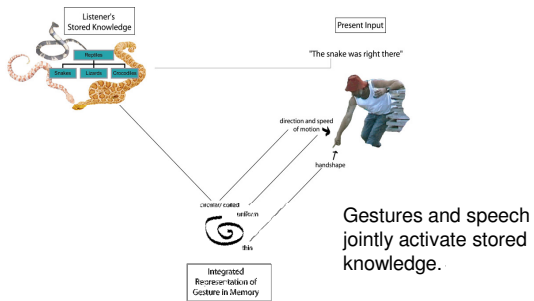
- Language prompts the construction of cognitive models in working memory

Language in Oregon



...the snake was right here.

Blending & Multi-Modal Discourse Comprehension



"The snake was right there"



Particular Issues

- Real-time processing of iconic gestures
 - are gestures processed semantically?
 - are gestures integrated with preceding nonlinguistic context?
- Do speakers integrate gestural information with linguistic information in the accompanying speech?
 - does speech-gesture congruity affect visual processing of the discourse referent
 - does gestural information lead to more visually specific expectations about discourse referents?
- Does the presence or absence of gestural information affect the real-time processing of speech?



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Beats



Emblems



Iconic Gestures



Indeterminate semantic status

Action



Iconic Gesture

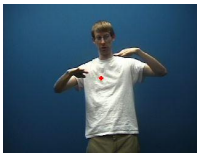


Sign Language

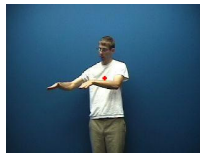


?

Similar forms map to different meanings



the gum that's coming out is set very very perfect



here's where you put your feet



Same meaning can map to different forms



it has three stripes



white with a few yellow stripes

Gestures are not informative

"... it may be that much of the gesture's meaning is illusory. In the absence of speech, the very same gesture's meaning can be quite opaque, communicating little, if anything."

Krauss, Morell-Samuels, & Colasante, 1991

Gestures are communicative resources

"...descriptive gestures, rather like drawings or pictures, can achieve adequate descriptions with much greater economy of effort and much more rapidly than words alone can manage."

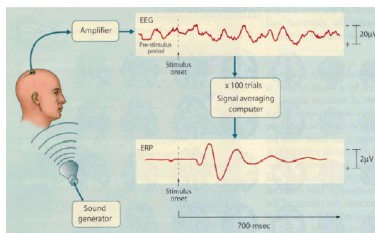
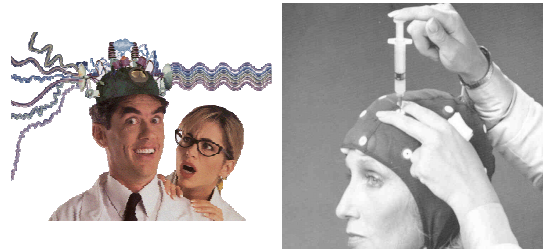
Kendon, 2004

Previous Studies

- Behavioral studies support both views
 - Gestures for the speaker's benefit ONLY
 - Gestures used by speakers and hearers



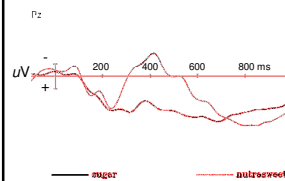
ERPs



Language ERP Effects



"I take my coffee with cream and"



- N400
 - Negative-going wave
 - 200-700 ms post-word
 - Peak approx. 400 ms
- Modulated by
 - Word Class
 - Kutas & Van Petten, 1990
 - Contextual Congruity
 - Kutas & Hillyard, 1980
 - Cloze Probability
 - Kutas & Hillyard, 1983
- Index of difficulty of lexical integration
- Index of processing the meaning of an event

Words and Pictures elicit N400

The old man lay on the grass and lit his



pipe

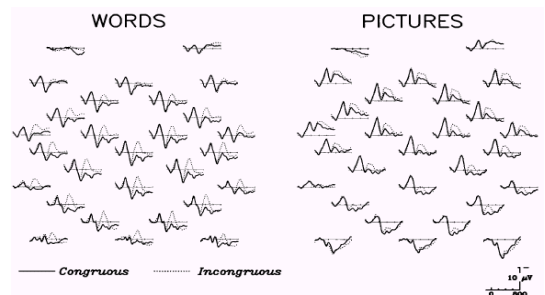
The old man lay on the grass and lit his



carrot

Ganis, Kutas, and Sereno (1996)

Results



Real-time Processing of Gestures



- Does the real-time processing of iconic gestures invoke brain processes associated with the comprehension of meaningful visual stimuli?
- Do contextually incongruous gestures elicit an N400-like ERP component?

Wu & Coulson (2005)

Needed

- 100-200 iconic gestures
 - spontaneously produced
 - half contextually congruous
 - half contextually incongruous
- Go to CogSci Happy Hour
- Ask people to describe cartoons
- Show cartoon clip followed by appropriate or inappropriate video of description



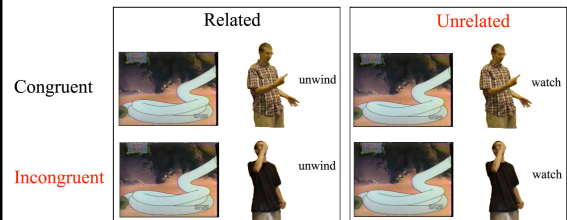
Real-time Processing of Iconic Gestures



- Task: Indicate via button press whether silent video “goes with” the preceding cartoon

Wu & Coulson, 2005

Experiment 2



Task: Relatedness Decision to Probe Word

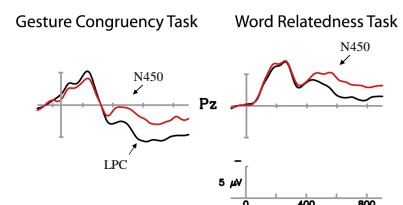
Wu & Coulson, 2005

Predictions

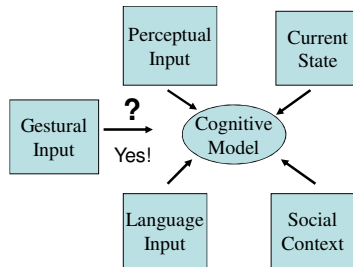


If comprehending gestures recruits processes similar to those activated by meaningful images, contextually incongruent gestures should elicit enhanced N400 relative to congruent ones.

Gesture N450



Multimodal Discourse Comprehension



- Gestures engage semantic integration processes
 - Speakers exploit gestural input in their construction of meaning

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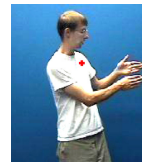


Language underspecifies meaning

“It’s actually a double door.”



Speakers use iconic gestures to enhance their cognitive models



“It’s actually a double door.”

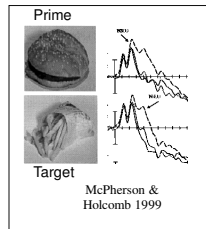
Speech-Gesture Integration

- Using conceptual blending processes, listeners integrate
 - propositional information in speech with
 - analogue information in iconic gestures
 - to form more specific expectations about discourse referents

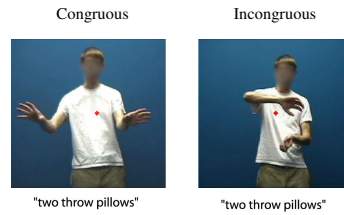
Empirical Assessment

- Vary Speech-Gesture Congruity
 - Test impact on ERPs to picture probes
- Vary Picture Probe Congruity with prior discourse
 - Test impact on ERPs to picture probes

ERPs elicited by photographs



Vary Speech-Gesture Congruity

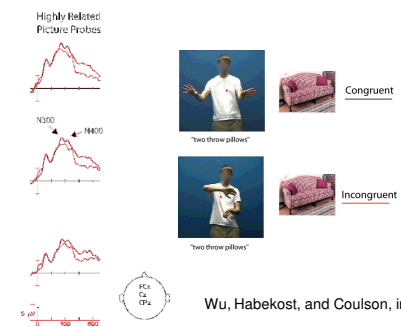


Wu, Habekost, and Coulson, in prep

Design

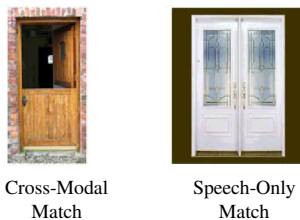


ERPs elicited by highly related picture probes

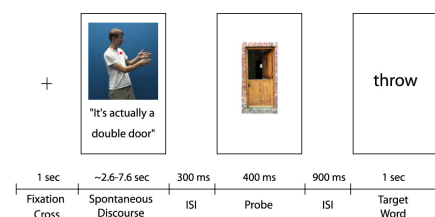


Slightly more natural paradigm

- All speech-gesture pairings congruous
- Vary how well picture probe matches prime

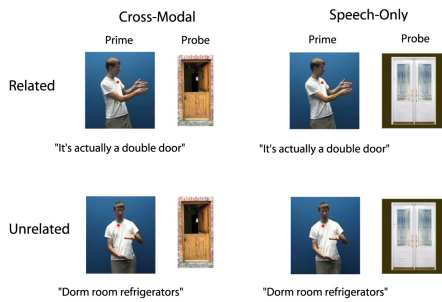


Procedure

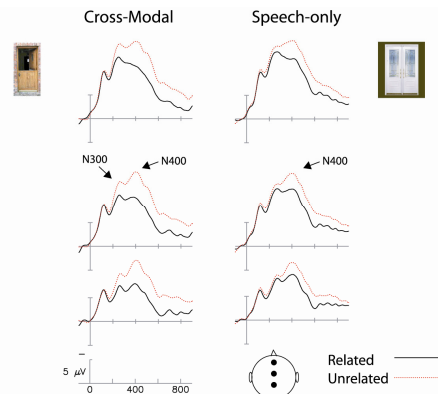


Wu & Coulson, 2007b

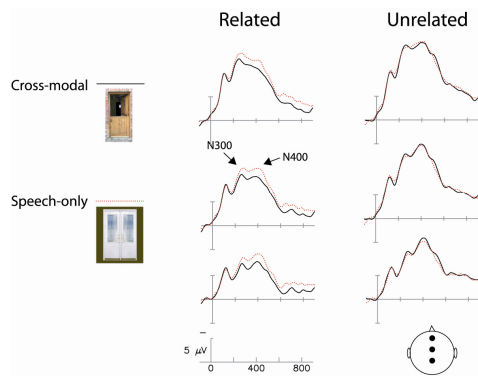
Design



Wu & Coulson, 2007b



Wu & Coulson, 2007b



Wu & Coulson, 2007b

Conclusions

- Cross-modal pictures are easier to identify than speech only ones
 - as indexed by less negative N300
- Cross-modal pictures are easier to integrate with discourse primes
 - as indexed by less negative N400
- Analogue information in gestures is integrated with propositional information in speech to form more perceptually specific representations

Particular Issues

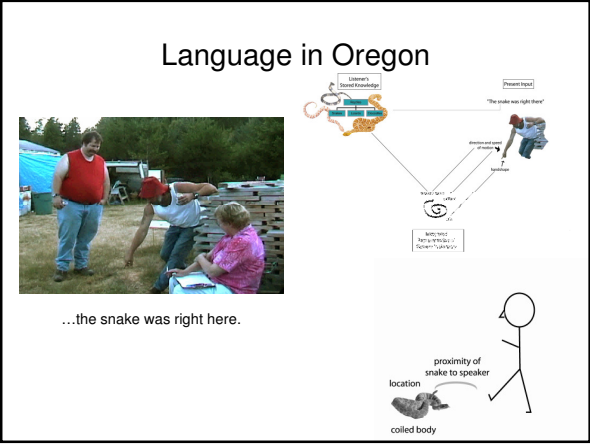
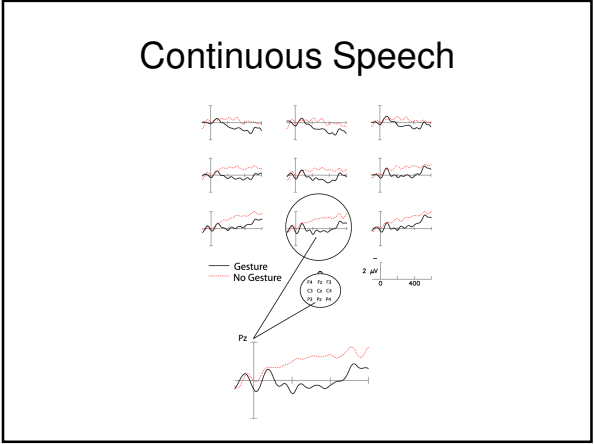
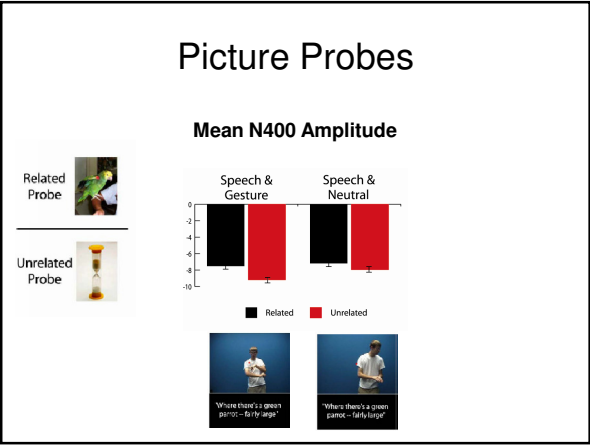
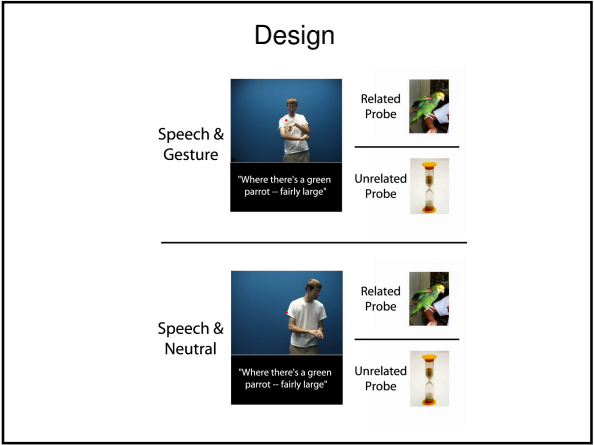
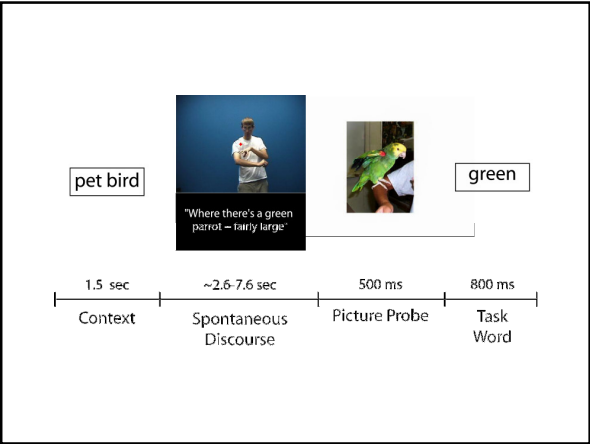
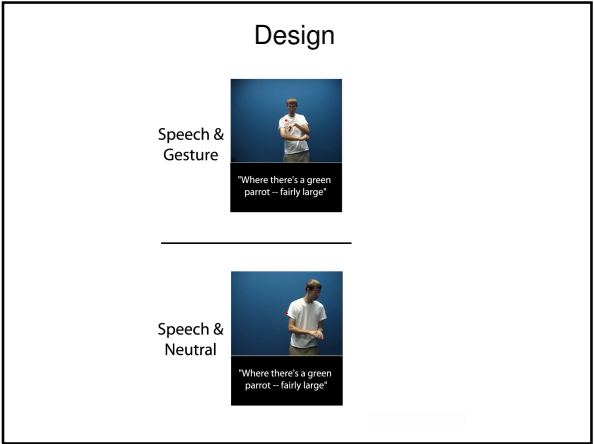
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"Where there's a green parrot – fairly large"



Wu & Coulson, ongoing...



Creative Language Use

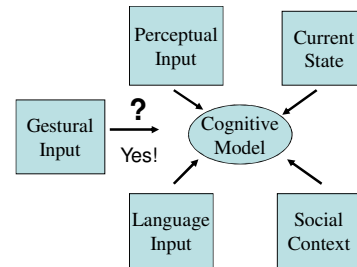
Creative Language Use

- Exploits
 - selective recruitment of conceptual structure
 - integration of structure from *different domains*
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Multimodal Discourse

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Thanks

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What's the difference between
 Sarah Palin and George Bush?

lipstick...

Language in the Wild

