

# Models of Seeing with Visualizations

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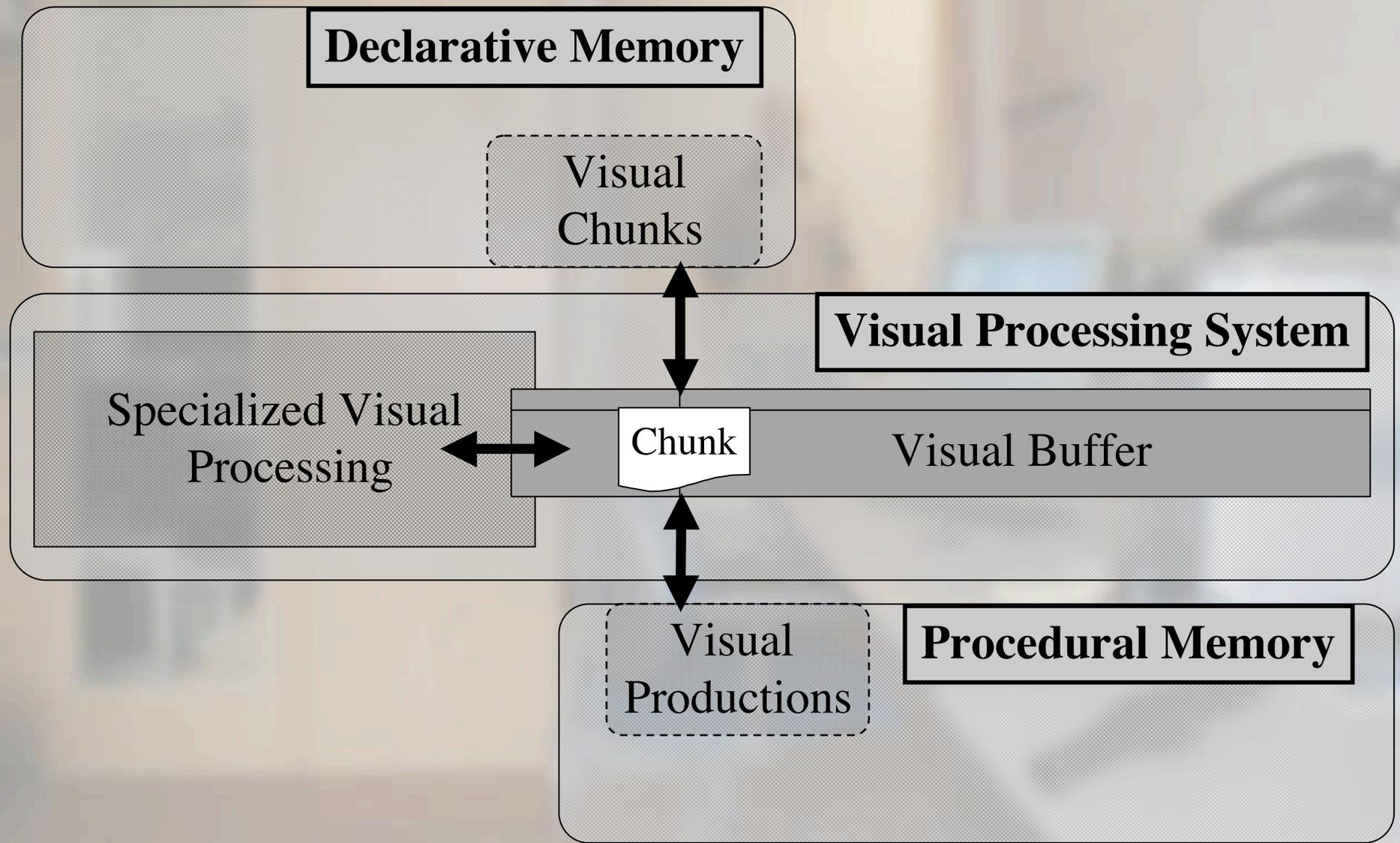
# A Problem of Some Depth

- Most visualizations are 2D
- The world is usually 3D
  - Weather at different heights
  - Enemy subs at different depths
- People can think of the world in 2D or 3D
- How can we predict/understand what people see?

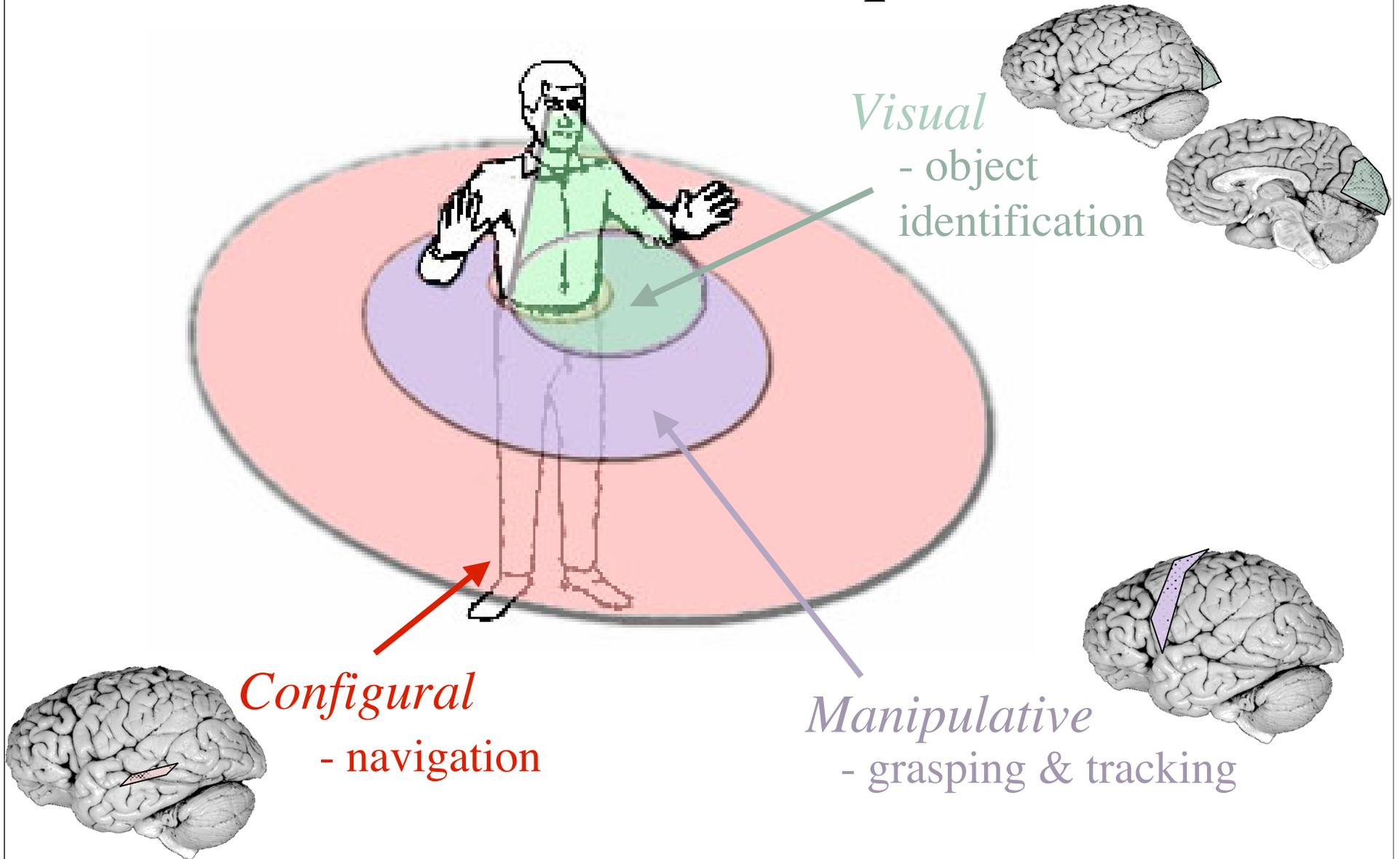
# ACT-R/S - A modeling framework of 3D perception

- Add a neurocomputational theory of 3D perception to a model of complex problem solving
- Predict representation use based on computational affordances
  - Predict that people use what is easiest and most accurate

# ACT-R 5.0 (Anderson & Lebiere, 1998)



# ACT-R/S: Three Visiospatial Buffers



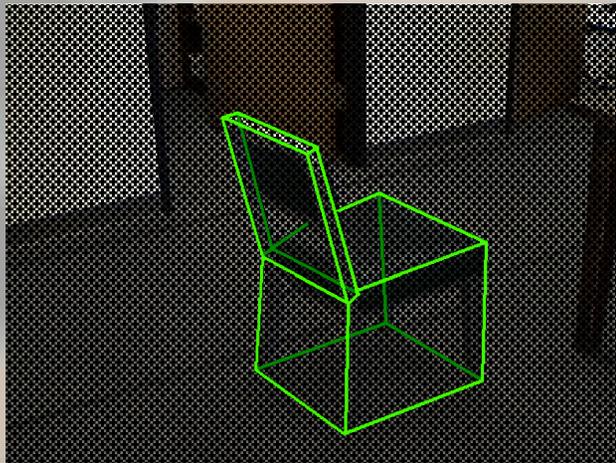
Visual input of nearby chair



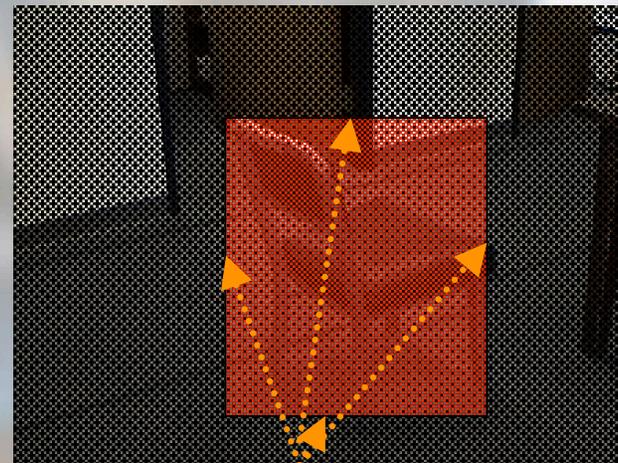
Visual Representation



Manipulative Representation



Configural Representation

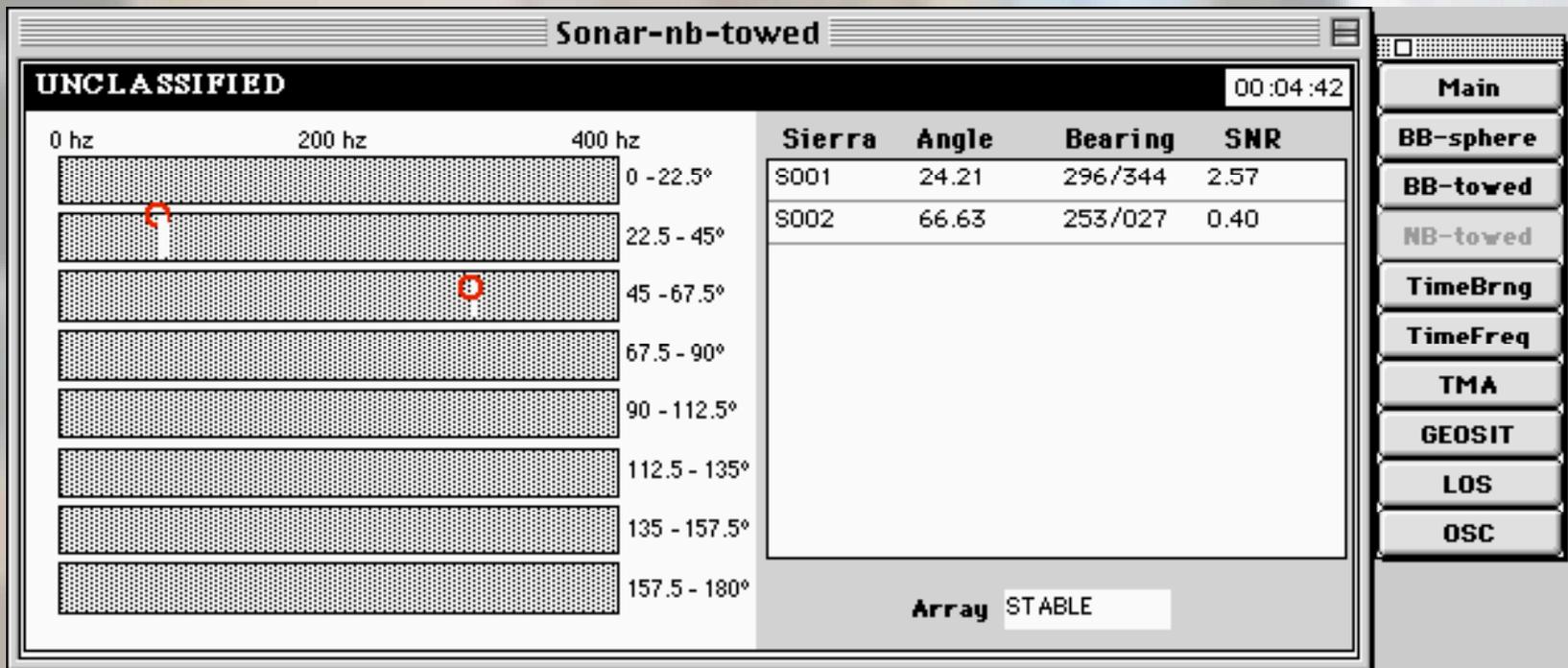
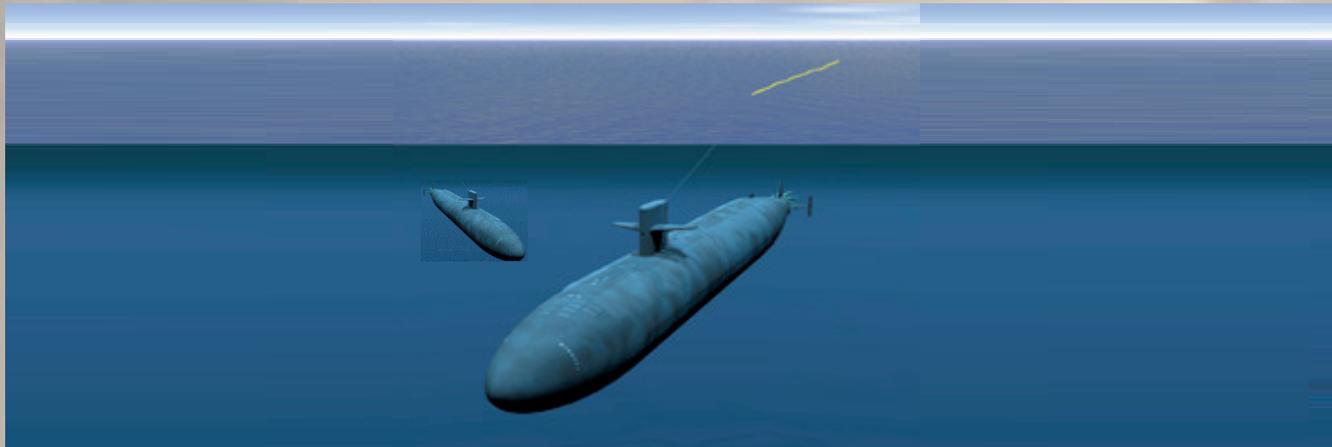


# Core Theoretical Assumption

- All visual/spatial problem solving must be done with one of these representations
  - Experts cannot invent a new representational system

=> Research question then becomes how does one know which representational system will be used?

# An Example from Submarine Sonar



# Questions:

- How will people represent this task?
- Vary by expertise?
  - Experts say they don't think in 3D
  - But task is very 3D
- Driven by input?
  - Very 2D
  - Far from real world situation
- Change over time?

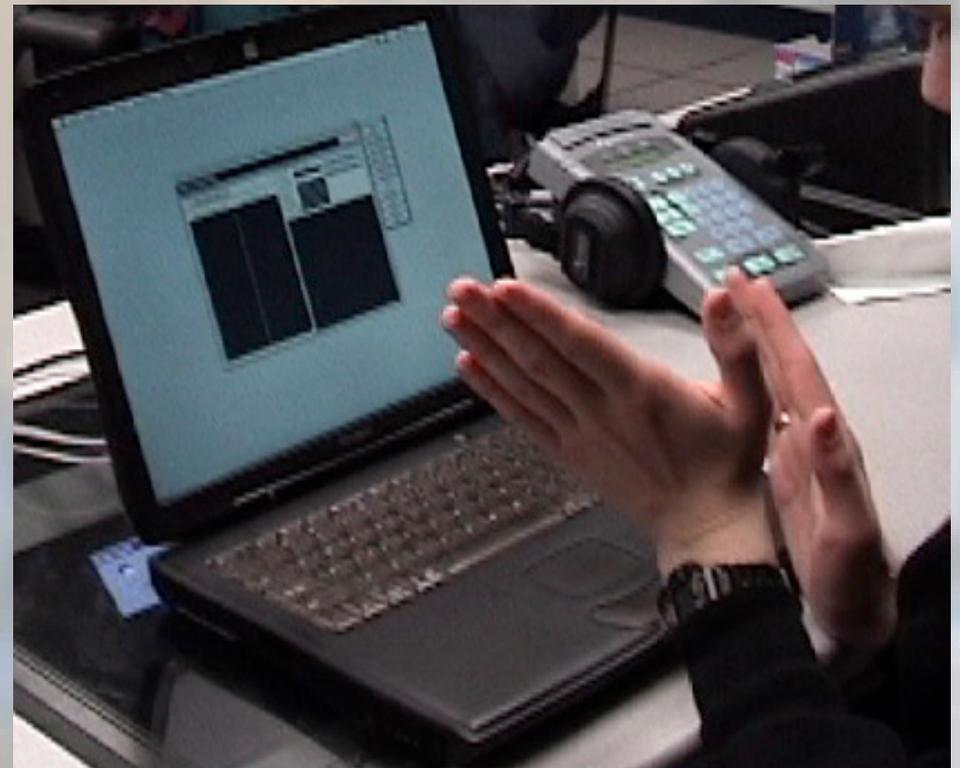
# Prediction

- Move from configural to manipulative
  - Configural representation more appropriate for weak initial knowledge of location and distance
  - Manipulative representation more appropriate when location and distance knowledge more accurately known (and relative motion is a factor)

# Coding Representations

- Gesture coding
  - Configural gestures

“...bearing around course oh three five, our own-ship course is about three five seven, we’ll be about...here”



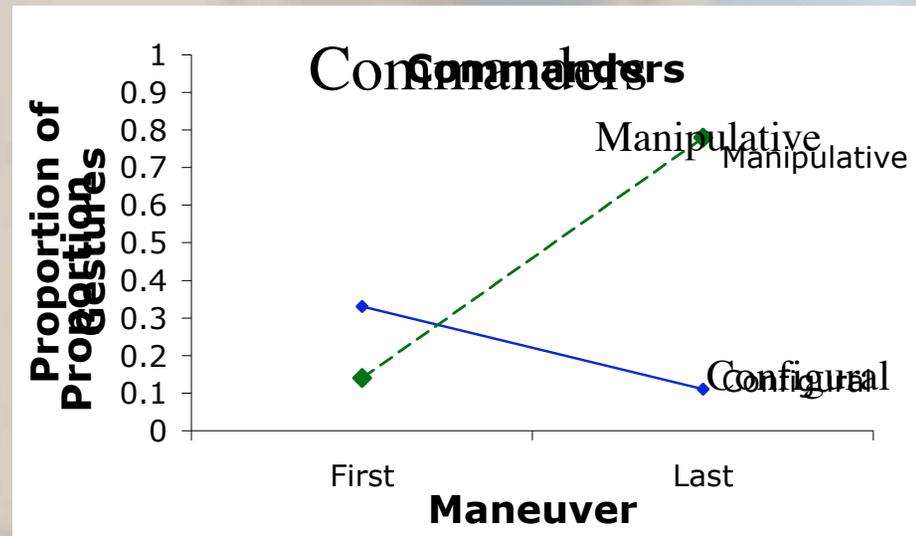
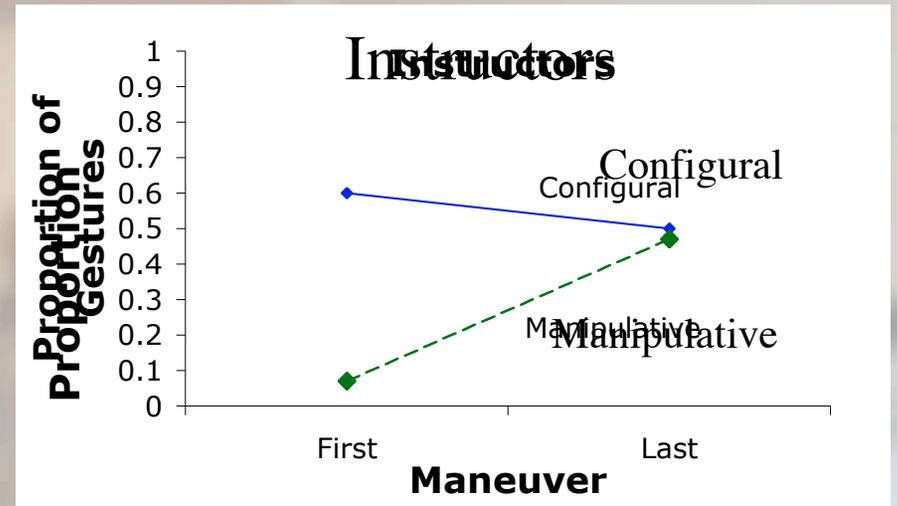
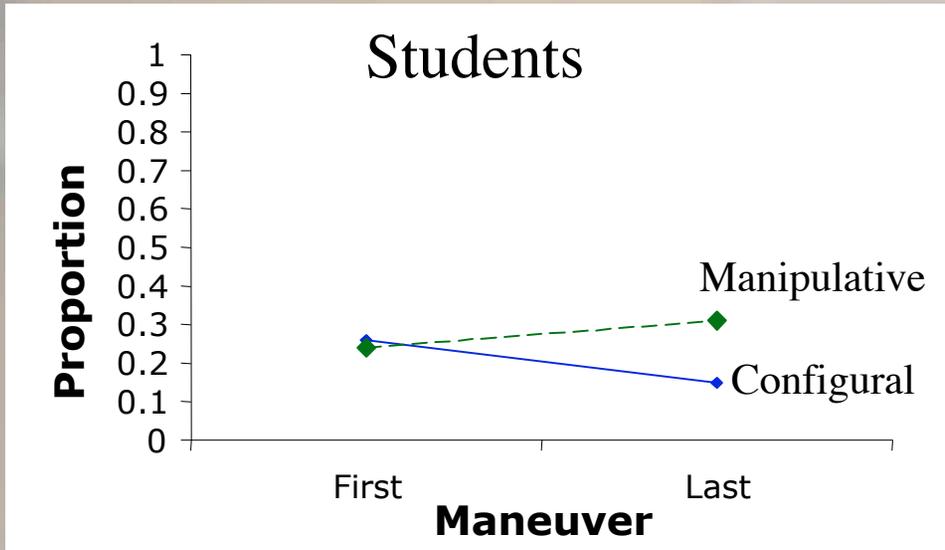
# Coding Representations

- Gesture coding
  - Configural gestures
  - Manipulative gestures

*“I should’ve gone left...come left and gone behind him...”*



# Move from configural to manipulative



# The Value of Modeling

- Unpacks the cognition where our subjective experience fails us
  - We don't notice our separate representations
- Provides methods for prediction
  - With some learning and performance assumptions