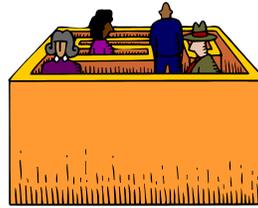


## 3-3-navigation

## Human Navigation



- Sources of Spatial Knowledge
- Internal Representation of Spatial Knowledge
- Individual Differences in Navigational Ability

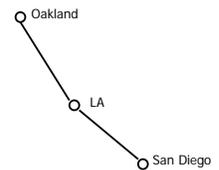
## Sources of Spatial Knowledge



- Direct Experience
- Indirect Experience
- Ability to integrate direct and indirect spatial knowledge

## Internal Representation of Spatial Knowledge

- Network
- Node=Place
- Link=Relationships
  - Distance
  - Adjacency
  - Direction
- Route=pathway thru nodes



## Route Representations

- Production Rules
- Unordered Productions
- Ordered Productions

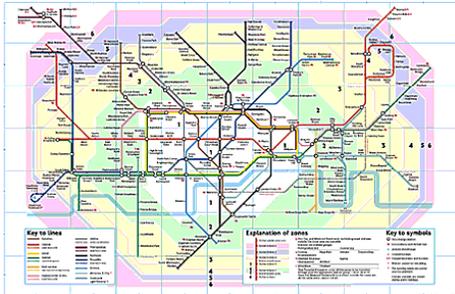
IF *the goal* is to go to TJ  
and you are on Nobel  
and you see the 5 entrance  
THEN get on 5 South

## Spatial Configuration

- Cognitive Maps contain distortions
  - Distance
  - Direction
- Egocentric Reps
- Topological Reps



## Topological Representation



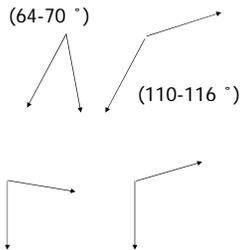
## Distance Estimation

### Byrne

- Estimate distance of 12 well-known routes
  - 3 straight
  - 3 w/2-4 curves
- 6 in Town Center
  - 300, 540, 700 meters
- Short routes Overestimated
- Long routes Underestimated
- Short routes w/curves overestimated more than short straight routes
- Effects more pronounced for routes in *town center* than *outskirts*

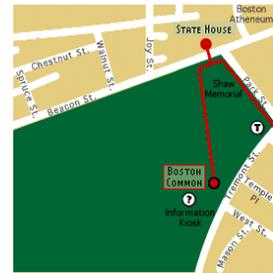
## Direction Estimation

- Byrne (1979)
- Draw 10 Road Junctions
  - 5 Acute
  - 5 Obtuse
- Means: 83.5° - 103.7°
  - 89.7°
  - 94.5°



## Direction Estimation

- Chase & Chi (1981)
  - Maps of CMU
  - Two Streets really 45°, Drawn 90°
- Lynch (1960)
  - People draw Boston Common w/4 sides
- Smith (1978)
  - Blind subjects directions off by a constant factor (= degrees the campus deviated from a true rectangle)



## Direction Estimation

- Which is farther east, San Diego or Reno?
- Which is farther north, Seattle or Montreal?
- Which is farther west, the Atlantic or the Pacific entrance to the Panama Canal?

## Distortions





## Individual Differences

- Sense of Direction and Pointing Accuracy
  - Questionnaire
  - Pointing Task
- Sense of Direction and Maze Learning
  - 2 groups pre-selected for sense of direction
  - No difference on 1<sup>st</sup> trial
  - Subsequent trials:
    - Good Sense of Direction Folks Improve
    - Bad s.o.d. folks Flounder

## Good

- Better at giving and following directions
- Better at remembering routes travelled as a passenger
- Like reading maps
- Enjoy giving directions
- Liked exploring new places

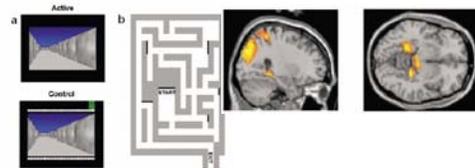
## Poor

- Poorer at giving and following directions
- Poorer at remembering routes travelled as a passenger
- Prone to anxiety when lost

## Sex Differences in Strategies

- "Go down Elm Street till you see the McDonald's. Then make a left, go past the hardware store and the Exxon station, then you'll see the elementary school. Make a right just past the elementary school and go about another block till you see a split level house painted lime green, with these unbelievable fuchsia shutters and trim, can you believe it? It looks like a gingerbread house after the mold has gotten to it. That's their house."
- "Go south on Elm Street about two miles, then turn left so you're heading east on Duke Street. After one mile on Duke Street, turn south again onto Scottsdale Boulevard. Their house is the fourth from the intersection, on the left."

## Gron & colleagues (2000)



Navigation activated a network of brain areas in all participants: medial occipital gyri, lateral and medial parietal regions, posterior cingulate, parahippocampal gyri, and right hippocampus

## Women navigating



- Right middle frontal gyrus
- Right parietal lobe
- WM & ego-centric representation involved in landmark strategy?

## Men navigating



- Left Hippocampus
- Mental map that allows men to process multiple geometric cues?
- Episodic memory information in navigation?