Imagery

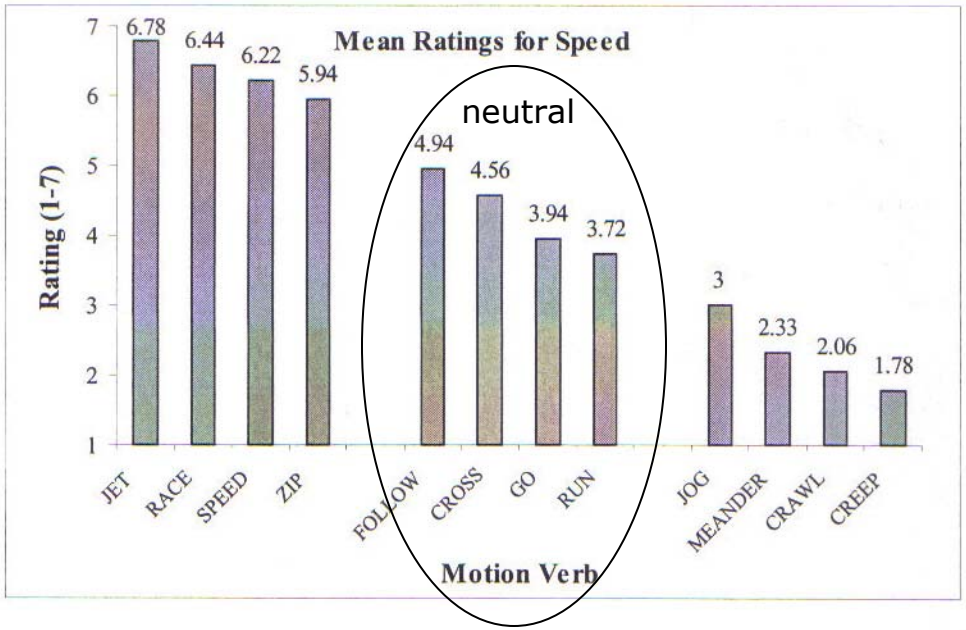
- Fictive motion as cognitive stimulation
- Teenie Matlock Experiments:
  - Hypothesis: Fictive motion (FM) sentences involve mental simulation and thus processing time should be manipulable by varying a subject's conception (mental model) of environment
  - Ex. *The road runs from the mountain to the lake.*

Imagery

- Basic design of 6 experiments:
  - Subjects read a story that encourages them to construct a particular spatial model of an environment.
  - Subject then reads a statement with or w/o FM and decides whether true or not
  - Decision times measured

Imagery

- Subjects rated how quickly they imagined themselves doing the action referred to by different verbs (and, in another norming study, how long to do the action)



Imagery

- Experiment 1: Short distance vs. long distance
  - If people simulate motion while comprehending FM sentences, those sentences should be processed quicker after reading about travel over a long distance than over a short distance
  - Set up
    - Subject reads story (either long/short or filler)
    - Subject presented with a statement containing FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Long/short distance story sample

  Imagine a desert
  The desert is *small/large*
  It is *only 30/400* miles in diameter
  There is a road in the desert
  It is called Road 49
  It starts at the north end of the desert
  It ends at the south end of the desert
  Maria lives in a town on the north end of the desert
  Her aunt lives in a town on the south end
  Road 49 connects the two towns
  Today Maria is driving to her aunt's house
  She is driving on Road 49
  It takes her *only 20 minutes/over 7 hours* to get to her aunt's house
  After she arrives, Maria says, "What a *quick/long* drive!"

Imagery

- Critical sentence: involves fictive motion (FM)

  Road 49 crosses the desert

- Result:

  – Decision time 409 msec longer for long distance than short distance condition

  – Consistent with hypothesis that reader would build spatial model on comprehending story and simulate movement within that model on comprehending FM sentence.

Imagery

- Did priming influence result?
  - Long distance sentences contained phrases such as
    - *over 7 hours*
  - Short distance sentences contained phrases such as
    - *only 20 minutes*
  - Could this language have caused the effect independent of mental simulation associated with FM sentence?

Imagery

- Priming Control Study
  - Similar stories
  - Critical sentence did not contain FM
    - *Road 49 is in the desert*
  - Norming study ensured similarity of meaning between FM and non-FM sentences
  - Decision times for long distance condition slightly longer (28msec), not statistically significant
  - **Priming effect not supported**

Imagery

- Experiment 2: Travel rate
  - If people simulate motion while comprehending FM sentences, those sentences should be processed quicker after reading about fast travel than slow travel
  - Set up
    - Subject reads story (either slow/fast or filler)
    - Subject presented with a statement containing FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Ex. 2 Story sample slow/fast condition

  Imagine a forest

  There is a huge meadow in the forest…

  A footpath goes from the picnic table to the cabin

  An *elderly man/young boy* is on the footpath…

  He is *slowly walking/quickly running* down the path

  He *goes/sprints* from the picnic table to the cabin

- Critical sentence:
  - *A footpath crosses a large meadow*

Imagery

- Exp 2 results
  - Decision time 391msec longer in slow travel condition than in fast travel condition
  - Consistent with hypothesis
  - Priming effect ruled out (65msec determined non-sig)

Imagery

- Experiment 3: Terrain
  - If people simulate motion while comprehending FM sentences, those sentences should be processed quicker after reading about travel over easy terrain than over difficult terrain
  - Set up
    - Subject reads story (either difficult/easy or filler)
    - Subject presented with a statement containing FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Ex. 3 Story sample difficult/easy terrain

  Imagine a peninsula…

  The shoreline of the peninsula is *very rugged/smooth and flat*.

  There is a scenic road along the shore

  Bob is driving the entire length of the peninsula

  There are many hairpin turns/the road is straight and leveli

  Bob drives past many *jagged cliffs/white sandy beaches*

- Critical sentence:
  - *A road runs along the peninsula*

Imagery

- Ex. 3 results
  - Decision time 337 msec longer in difficult terrain condition than in easy terrain condition
  - Consistent with hypothesis
  - Priming ruled out (78 msec, determined non-sig)

Imagery

- Manner of motion verbs in FM
  - Verbs may express various aspects of motion including rate of speed
  - Manner-neutral verbs tested – don't express particular level of speed *go, cross, follow, run*
  - Fast verbs: express high rate of speed
    jet, race, speed, zip
  - Slow verbs: express low rate of speed
    jog, meander, crawl, creep

Imagery

- Manner verbs in FM sentences less common & have metaphorical flavor

1) ***The road meandered*** *voluptuously over lake-side undulations, providing gorgeous sweeping views across serene beaches…*

2) *We marveled as the mountains loomed above us with snow on their peaks, then as* ***the road meandered*** *up to 10,000 feet*

3) *The open terrain changed to light forest cover as* ***the road crept*** *up the east slope of Craig's Mountain…*

4) *The highway road up and down the swells of the land curving to find its path through the waves of land until the land flattened and* ***the road sped*** *east before us* ***...***

5) ***The road sped*** *down into a beautiful valley*

Imagery

- Experiment 4: Fast verbs
  - Will effect measured for Fm with manner-neutral verbs (*go, follow, etc.)* in terrain-contrast stories be found if FM verb expresses high speed
    - Ex. *The road zips across the desert*
  - Set up
    - Subject reads story (either difficult/easy or filler)
    - Subject presented with a statement containing FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Ex. 4 Story sample difficult/easy

  Imagine a large field
  The field *is riddled with gopher holes and gullies/has been leveled recently*
  The ground is *uneven and bumpy/flat and smooth*
  Armando is walking across the field

- Critical sentence:
  - *The trail zips across the field*

Imagery

- Ex. 4 Results
  - Decision times 934 msec longer in difficult terrain condition than in easy terrain condition
  - Consistent with expectation that FM containing manner verbs will behave like manner-neutral FM with respect to simulation time effect

Imagery

- Experiment 5: Slow verbs
  - Will effect measured for FM with manner-neutral verbs (*go, follow, etc.)* in terrain-contrast stories be found if FM verb expresses slow speed
    - Ex. *The road creeps across the desert*
  - Set up
    - Subject reads story (either difficult/easy or filler)
    - Subject presented with a statement containing FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Difficult/easy terrain stories presented (similar to experiments 3 & 4)
- Critical sentence:
  - *A trail creeps through the jungle*

- Ex. 5 results
  - Decision times 211 msec longer in difficult terrain condition than in easy terrain condition
  - Consistent with expectation that Fm with manner verbs will behave like manner-neutral FM with respect to simulation time effect

Imagery

- Another result?
  - Congruency effect: longest decision time when speed of motion conflicted with terrain type, shortest when speed of motion congruent with terrain type

Manner	Difference in decision time for difficult vs. easy terrain
Neutral	337 ms
Fast	934 ms
Slow	211 ms

Imagery

- Type 1 vs. Type 2 FM
  - Type 1 – actual (factive) motion involved
    - Metonymic relationship between subject and motion
    - Ex. *The trail runs through the wood*
    - *Trail* associated with walking or hiking
  - Type 2 – no motion involved
    - Subject presents path that can be mentally scanned
    - Ex. *A fence goes over the hill.*

Imagery

- Experiment 6:
  - Will effect discovered for type 1 FM occur for type 2 FM as well?
  - Tested for terrain contrast stories (in which terrain might be seen to impede scanning, although no actual motion)
  - Set up
    - Subject reads story (either difficult/easy or filler)
    - Subject presented with a statement containing type 2 FM, pushes button to answer ‘yes’ if true
    - Decision time measured

Imagery

- Ex. 6 story sample difficult/easy terrain

  Imagine a mountain range
  The mountains are *tall and rocky/low and rounded*
  The highest peak is *over 10,000 feet/only 1000 feet*
  The slope is very *steep/gentle*
  A fence goes over the mountain range
  The fence forms a *jagged/straight* line

- Critical sentence:
  - *A fence goes over the mountain range*

Imagery

- Ex. 6 results
  - Decision times 213msec longer in difficult terrain condition than in easy terrain condition
  - Consistent with hypothesis that simulation is involved in processing type 2 fictive motion.

Imagery

- Overall results from Matlock experiments 1-3:

- Control model of environment by varying distance, speed and terrain conditions
- FM sentences expected to produce mental simulation that is influenced by conditions in mental model of environment
- Non-FM sentences should not produce mental simulation and so not be influenced by conditions in mental model.
- Results: FM sentences took longer to process when spatial model presented long distance, slow travel and difficult terrain conditions

Imagery

- Overall results from Matlock experiments 4& 5:

- FM sentences containing manner verbs might be expected to display similar effect despite the fact that they are less used in FM sentences and have a metaphorical flavor
- Results: FM sentences containing both ‘fast’ and ‘slow’ verbs took longer to process in difficult terrain condition
- Congruency effect seems likely
  - Largest processing difference for difficult > easy terrain when FM contained fast verb
    - Moving quickly through difficult terrain incongruent
  - Smallest processing difference when FM contained slow verb

Imagery

- Overall results from Matlock experiments 6:

- Type 2 FM sentences , which involve no actual motion, only possible mental scanning might be expected to display similar effect if mental simulation involved

- Results: Type 2 FM sentences took longer to process when story involved difficult terrain and path of scanning could be seen as being impeded by the terrain.