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.*
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– 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
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- 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)
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• 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
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- 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!”
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• 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.
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• 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?
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• 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**
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• 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
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• 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
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• 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)
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• 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
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• 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
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• 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)
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• 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*
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• 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
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• 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
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• 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
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• 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
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• 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
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• 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
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• Another result?
  – Congruency effect: longest decision time when speed of motion conflicted with terrain type, shortest when speed of motion congruent with terrain type

<table>
<thead>
<tr>
<th>Manner</th>
<th>Difference in decision time for difficult vs. easy terrain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>337 ms</td>
</tr>
<tr>
<td>Fast</td>
<td>934 ms</td>
</tr>
<tr>
<td>Slow</td>
<td>211 ms</td>
</tr>
</tbody>
</table>
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• 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.*
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• 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
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- 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
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• Ex. 6 results
  – Decision times 213 msec longer in difficult terrain condition than in easy terrain condition
  – Consistent with hypothesis that simulation is involved in processing type 2 fictive motion.
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• 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
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• 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
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• 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.