Reflections On Context And Episodic Memory

Gordon Bower
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Gordon Bower; CEM Conference; Philadelphia, 5/8/2014

1. Aspects of context people can remember

2. Context learning as paired associates of items to contexts
   (correspondence to neuroscience approach)

3. Implications of the paired-associate view:
   A) Inter-list confusions; source misidentifications,
   B) Interference among multiple context associations,
   C) Context changes may underlay item recency judgments
   D) Context changes may support item-frequency judgments

4. Context associations support explicit but not implicit memory.
   Independent strengthening of associations; MTL injuries

5. Increasing emphasis on internal vs external sources of context;
   Mental sets – drugs, moods, feeling states
Memory Records Of Word
(adapted from Anderson & Bower 1972)

Word A in List 1
Word B in Lists 1 & 2
Word C twice in List 3
The Prefrontal Cortex As The Seat Of Temporal Context
(Polyn & Kahana 2007)
Memory Records Of Word
(adapted from Anderson & Bower 1972)

Word A in List 1
Word B in Lists 1 & 2
Word C twice in List 3
Illustration of two overlapping sets of context stimulus elements (e.g., List 1 & List 2). Solid dots represent elements associated to a particular memory. The index of stimulus generalization is provided by the proportion of elements that a given set shares with another, e.g., 6 out of 16 here.
Overlap of Context Elements In Three Successive Lists Of Items, Each Context Sharing \( \% \omega \) Elements With Its Neighbor
Inter-List Confusions Among Three Successive Lists: Middle List Has Most Confusion Errors
Patterns of Appearances (+) And Non-Appearances (-) of Items Across 3 Lists

<table>
<thead>
<tr>
<th></th>
<th>List 1</th>
<th>List 2</th>
<th>List 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>n items</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>n items</td>
<td>+</td>
<td>+</td>
<td>_</td>
</tr>
<tr>
<td>n items</td>
<td>+</td>
<td>_</td>
<td>+</td>
</tr>
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<td>_</td>
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</tr>
<tr>
<td>n items</td>
<td>_</td>
<td>_</td>
<td>+</td>
</tr>
<tr>
<td>n items</td>
<td>_</td>
<td>_</td>
<td>_</td>
</tr>
</tbody>
</table>
Inter-List Generalization In a 4-List and a 5-List Experiment
List Discrimination Worsens The More Lists In Which An Item Appears (A&B 1974)
Fluctuating Availability of Contextual Elements Over Time

$t = 0$

$t = 1$

$t = x$

Diffusion Exchanges

Temporarily Unavailable Context Elements
Overlapping sets of context stimulus elements for NOW versus those retrieved by the test item (S1) presented earlier. Solid dots represent elements associated to a particular memory. The index of stimulus generalization is provided by the proportion of elements that a given set shares with another set. e.g. 6 out of 16 here.
Direct Recency Judgments Within A Continuous Stream Of Unrelated Items

- Recency judgments ("How far back in series"?)
  
  ...x p t z b [recency of p?] m j [recency of m?]..
  
  "p is 4 back" "m is 2 back"

Judgments can be expressed in "LAG", or number of intervening items since earlier presentation of the target item being judged.
Overlapping sets of context stimulus elements for NOW versus those retrieved by the test item (S1) presented earlier. Solid dots represent elements associated to a particular memory. The index of stimulus generalization is provided by the proportion of elements that a given set shares with another set. e.g. 6 out of 16 here.
Recency ("Lag") Judgments When Actual Lags were 1 to 9, But Different Subjects Were Misinformed That Lag-Maxs Would Be 6, 9, or 12. (Hinrichs, ’70)

Mean judgment of recency for three groups told that the maximum lag was 6, 9, or 12. The actual lags were 1 to 9 for all subjects.
Comparative Recency Judgments (Yntema & Trask, 1963)

- Which item occurred more recently?

k n p s b x m t j k  [Is B or N More Recent?] fywc..
Percent Choice That an Item At Lag (n) Is Judged More Recent Than An Item At Lag (n + k)
Memory Records Of Word

Word A in List 1
Word B in Lists 1 & 2
Word C twice in List 3
Judged Frequency Is Log \((F + .7)\)
For \(F = 0, 1, 2, 4, 6, 10\) (Hintzman, 1969)

Median frequency judgments from memory (black dots, right vertical) plotted against log of presented item-frequencies of 0, 1, 2, 4, 6, and 10 in a long list.
How Repeating An Item (“A” here) Can Make It Appear a bit More Recent Than It Should

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>..B...</th>
<th>Obs’d</th>
<th>Predict</th>
</tr>
</thead>
<tbody>
<tr>
<td>...</td>
<td>A</td>
<td>..B...</td>
<td>.61</td>
<td>.61</td>
</tr>
<tr>
<td>A</td>
<td>...</td>
<td>..B...</td>
<td>.64</td>
<td>.65</td>
</tr>
<tr>
<td>A</td>
<td>B</td>
<td>...B...</td>
<td>.77</td>
<td>.77</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>..B...</td>
<td>.69</td>
<td>.71</td>
</tr>
<tr>
<td>A</td>
<td>A</td>
<td>..B...</td>
<td>.54</td>
<td>.48</td>
</tr>
</tbody>
</table>
Associative Connections From Visual Features To Letters To Words
Phonemic Priming & Disambiguation Of Homonyms (Hare vs. Hair)
“Hare” Associated To Its Context Of Presentation (In Study List)
Evolving Ideas About Context

• Changing emphasis moving from External stimuli (e.g., lab rooms) to Internal stimuli -- mental sets, moods, feelings
### 20 Pegwords Used By Bower & Reitman (1971)

<table>
<thead>
<tr>
<th>Mnemonic Number</th>
<th>Rhymes</th>
</tr>
</thead>
<tbody>
<tr>
<td>One is a gun</td>
<td>Eleven is “penny-one,” hotdog bun</td>
</tr>
<tr>
<td>Two is a shoe</td>
<td>Twelve is “penny-two,” airplane glue</td>
</tr>
<tr>
<td>Three is a tree</td>
<td>Thirteen is “penny-three,” bumble bee</td>
</tr>
<tr>
<td>Four is a door</td>
<td>Fourteen is “penny-four,” grocery store</td>
</tr>
<tr>
<td>Five is knives</td>
<td>Fifteen is “penny-five,” big bee hive</td>
</tr>
<tr>
<td>Six is sticks</td>
<td>Sixteen is “penny-six,” magic tricks</td>
</tr>
<tr>
<td>Seven is oven</td>
<td>Seventeen is “penny-seven,” go to heaven</td>
</tr>
<tr>
<td>Eight is plate</td>
<td>Eighteen is “penny-eight,” golden gate</td>
</tr>
<tr>
<td>Nine is wine</td>
<td>Nineteen is “penny-nine,” ball of twine</td>
</tr>
<tr>
<td>Ten is hen</td>
<td>Twenty is “penny-ten,” ball point pen</td>
</tr>
</tbody>
</table>
Physiological States as Contexts (State-dependent Memory)

- Psychoactive Drug States — alcohol, marijuana, heroin, meth, sedatives, etc.
- Dissociative States — multiple personality, fugue states, deep hypnotic amnesia, etc.
- State-dependency revealed in free recall memory but not in implicit memory.
Individual-participant relation between event recall and ratings of subjective similarity:

Experiments 1, 2, and 3 (upper, center, and lower panels, respectively). I = inside; O = outside. + = positive mood induction; − = negative mood induction.

Similarity Of Subjective Feelings Mediates Transfer Between Contexts (Eich 1995)
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Thank You For Your Attention!

For details of Bower’s papers, go to

www.Stanford.edu/~gbower

or through the departmental website

https://Psychology.Stanford.edu/gbower