Contiguity in Episodic Memory

M Karl Healey and Michael J Kahana
What is Temporal Contiguity?
What is Temporal Contiguity?

- Recalling one event, \( i \), tends to trigger recall of another event that occurred near in time to \( i \)
Temporal Contiguity

Kahana (1996)
Healey & Kahana (submitted)
Temporal Contiguity

Kahana (1996)
Healey & Kahana (submitted)
Why does temporal contiguity influence memory search?
Why does temporal contiguity influence memory search?

- Memory system encodes information about temporal distance (TCM, SIMPLE)
Why does temporal contiguity influence memory search?

- Memory system encodes information about temporal distance (TCM, SIMPLE)
- It is a trick of the short time scale of free recall (STM buffer)
Why does temporal contiguity influence memory search?

- Memory system encodes information about temporal distance (TCM, SIMPLE)

- It is a trick of the short time scale of free recall (STM buffer)

- It is a trick of the peculiarities of free recall (task-specific strategies)
Two Questions
Two Questions

1. Is the effect easy to break?
Two Questions

1. Is the effect easy to break?

2. Does the effect depend on timescale?
Two Questions

1. Is the effect easy to break?

2. Does the effect depend on timescale?
1. Is the effect easy to break?
Table C1

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PEERS — From Neurophysiology of Encoding and Retrieval Study (Bulman, Costaferri, & Kukla, 2011; Bulman & Kukla, 2011; Hoekx & Kukla, 2011; Kukla et al., 2011; NEESE et al., 2011).
Does it depend on ability?
Does it depend on ability?
Does it depend on ability?

Extremes of the Contiguity Distribution
- Top Half of Participants
- Bottom 5 Participants

Age
- Younger Adults
- Older Adults

Intellectual Ability
- Top Quartile IQ
- Bottom Quartile IQ

Learning the Task
- 12th List
- 1st List

Gaining Expertise
- 23rd Session
- 1st Session

Output Position
- 1-6
- 11-15

Serial Position
- 1-8
- 9-16
- 17-24

List Length
- 20
- 40

Presentation Modality
- Auditory
- Visual

Recall Modality
- Written
- Spoken

Encoding Task
- No Task
- Task

Inter-Item & Final Delay
- IFR
- DFR
- CDFR

Presentation Rate
- 0.5 sec
- 1 sec

Category Structure of List
- Uncategorized Lists
- Lists Drawn from Single Category

Lag to Available
- Strong Semantic Associate
- Available at Near Lag
- No Available Associate
- Available at Remote Lag

0 0.3 0.6

Lag
-5 -1 1 5

Healey & Kahana (submitted)
Does it depend on ability?

Extremes of the Contiguity Distribution

Top Half of Participants
Bottom 5 Participants

Age
Younger Adults
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Intellectual Ability
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Learning the Task
12th List
1st List

Gaining Expertise
23rd Session
1st Session

Output Position
1-6-10
11-15

Serial Position
1-8
9-16
17-24

List Length
20
40

Presentation Modality
Auditory
Visual

Recall Modality
Written
Spoken

Encoding Task
No Task
Task

Inter-Item & Final Delay
IFR
DFR
CDFR

Presentation Rate
0.5 sec
1 sec

Category Structure of List
Uncategorized Lists
Lists Drawn from Single Category

Lag to Available
Strong Semantic Associate
Available at Near Lag
No Available Associate
Available at Remote Lag

0
0.3
0.6

Lag
-5
-1
1
5

Healey & Kahana (submitted)
Does it require experience?
Does it require experience?

Learning the Task


Lag

12th List

1st List

Available at Remote Lag

Available at Near Lag

Spoken

Written

Strong Semantic Associate

Available at Remote Lag

Available at Near Lag

Spoken

Written

Gaining Expertise

Recall Modality

Presentation Modality

Category Structure of List

Presentation Rate

Intellectual Ability

Serial Position

Age

List Length


0.3

0.6

-5 -1 1 5

Healey & Kahana (submitted)
Does it require experience?

**Learning the Task**

- 12th List (black)
- 1st List (gray)

**Gaining Expertise**

- 23rd Session (black)
- 1st Session (gray)


Lag

Healey & Kahana (submitted)
Is it influenced by list length?
Is it influenced by list length?

Healey & Kahana (submitted)
Modality?
Modality?

Healey & Kahana (submitted)
Modality?

Presentation Modality

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Recall Modality

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Healey & Kahana (submitted)
Presentation rate?
Presentation rate?

![Graph showing presentation rate against lag for 0.5 sec and 1 sec presentation rates.](image)


Lag

0.6

0.3

0.2

0.1

0

-5 -1 1 5

Presentation Rate

0.5 sec

1 sec

Healey & Kahana (submitted)
Presentation rate?

• Robust to very fast presentation rates (Howard, 2016)

• Robust to very slow presentation rates (Nguyen & McDaniel, 2015)
By type of processing?
By type of processing?

Healey & Kahana (submitted)
By non-temporal associations?
By non-temporal associations?

Healey & Kahana (submitted)
By non-temporal associations?

McCluey, Burke, & Polyn (submitted)

Healey & Kahana (submitted)
By task demands?

Figure 3. Effects of across-pair contiguity on paired-associate recall. The probability of an intrusion from pair $i + |\text{lag}|$ when the correct response is from pair $i$ decreases monotonically with absolute lag.

By task demands?

![Figure 3. Effects of across-pair contiguity on paired-associate recall. The probability of an intrusion from pair $i + |\text{lag}|$ when the correct response is from pair $i$ decreases monotonically with absolute lag.](image)

Nature of stimuli?
Nature of stimuli?

• Reduced, but present when list includes emotional items (Siddiqui & Unsworth, 2011)
Nature of stimuli?

- Reduced, but present when list includes emotional items (Siddiqui & Unsworth, 2011)

- Present when items vary in assigned value (Stefanidi & Brewer, 2016)
Nature of stimuli?

• Reduced, but present when list includes emotional items (Siddiqui & Unsworth, 2011)

• Present when items vary in assigned value (Stefanidi & Brewer, 2016)

• Robust to variation in stimuli complexity (Nguyen & McDaniel, 2015)
Does anything eliminate the effect?
Does anything eliminate the effect?

• Perhaps:
Does anything eliminate the effect?

• Perhaps:
  
  • Absent in orthographically distinct lists (McDaniel et al., 2011)
Does anything eliminate the effect?

• Perhaps:
  
  • Absent in orthographically distinct lists (McDaniel et al., 2011)
  
  • Absent when subjects do not intend to encode (Nairne et al., 2016)
Two Questions

1. Is the effect easy to break?
Two Questions

1. Is the effect easy to break?

2. Does the effect depend on timescale?
Long-Range Contiguity


Inter-Item & Final Delay

Lag

0

Uncategorized Lists

Lists Drawn from Single Category
Long-Range Contiguity

Howard et al., 2008; Unsworth, 2008
Long-Range Contiguity

Howard et al., 2008; Unsworth, 2008
Long-Range Contiguity

Reproduced from:
Figure 3. The lag conditionalized response probability (CRP) functions of recalled autobiographical events. Lag refers to the difference in relative retention intervals of successive responses, and the CRPs are calculated by dividing, for each participant, the different responses made at each lag by the number of opportunities that there were to make the different transitions. Error bars represent ±1 standard error.
Two Questions

1. Is the effect easy to break?

2. Does the effect depend on timescale?
But Why?

• Memory system encodes information about temporal distance (TCM, SIMPLE)

• It is a trick of the short time scale of free recall (STM buffer)

• It is a trick of the peculiarities of free recall (task-specific strategies)
Open questions

• Does temporal contiguity require intent to learn?

• In temporal contiguity important when material is richly semantically related?

• Does temporal contiguity really emerge over long time scales?
Thanks!