

Virtual MathPsych/ICCM 2025
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Summarization reflects characteristics of memory recall

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Collaborators



Dr. Qiong Zhang



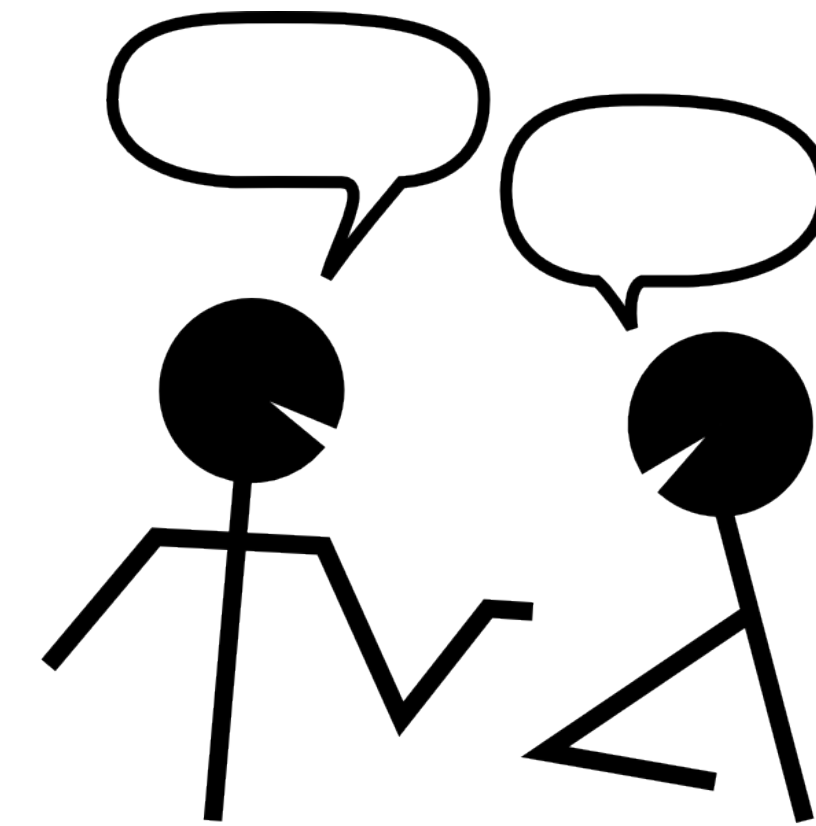
Sam Lin



Snigdha Sushil Mishra

Real-world Summarization task

- **Summarization is ubiquitous in daily life**, from briefing friends on the latest news to condensing seminar talks for colleagues

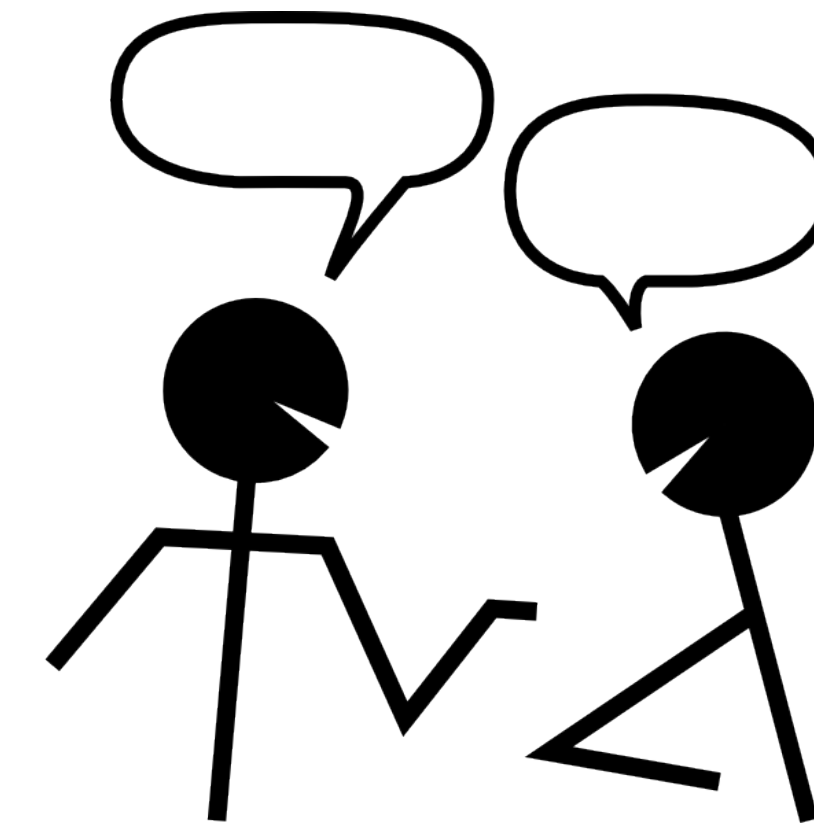


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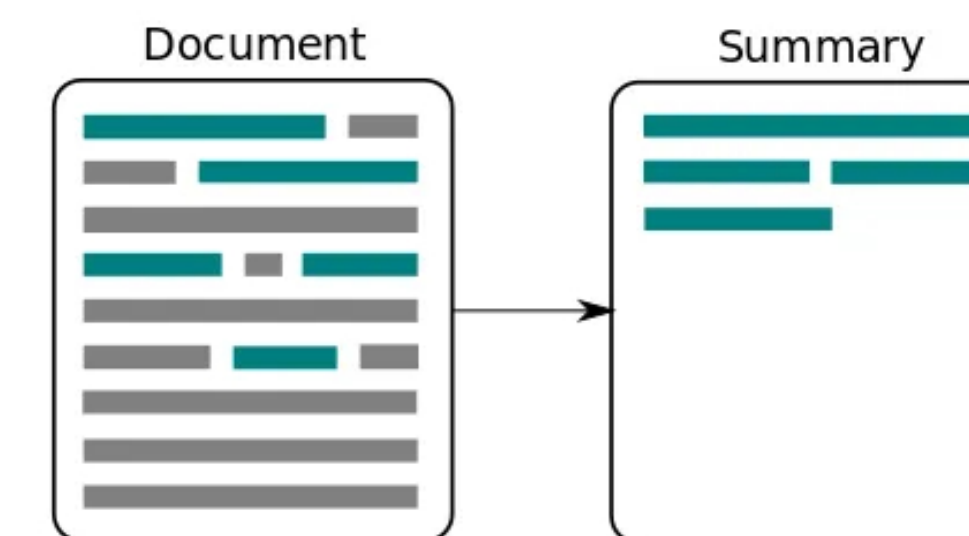
Real-world Summarization task

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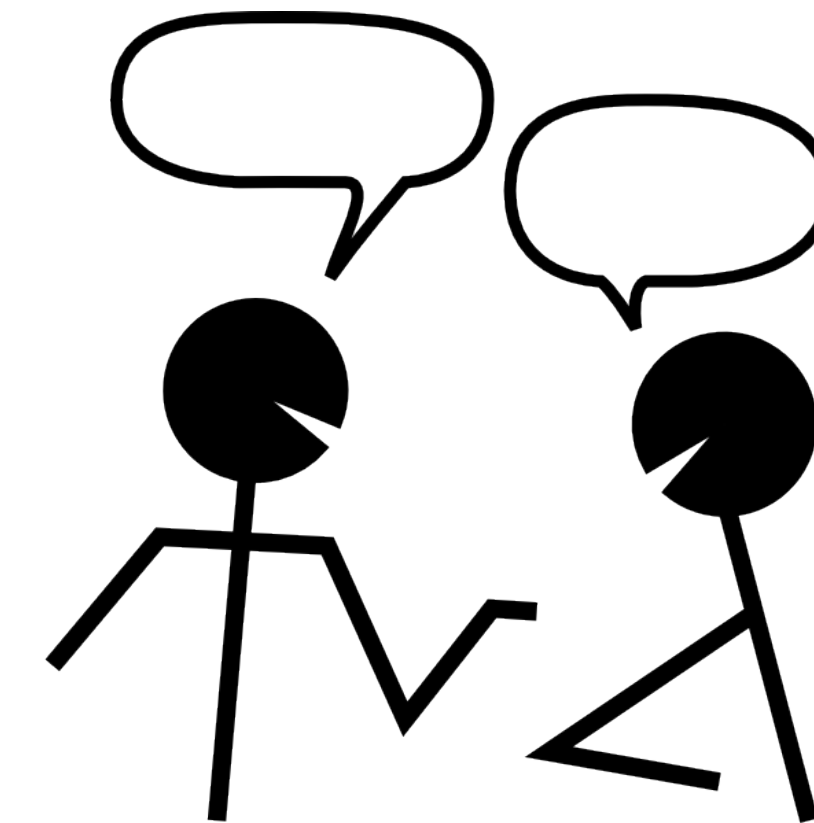
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Poses challenges of natural language understanding & generation

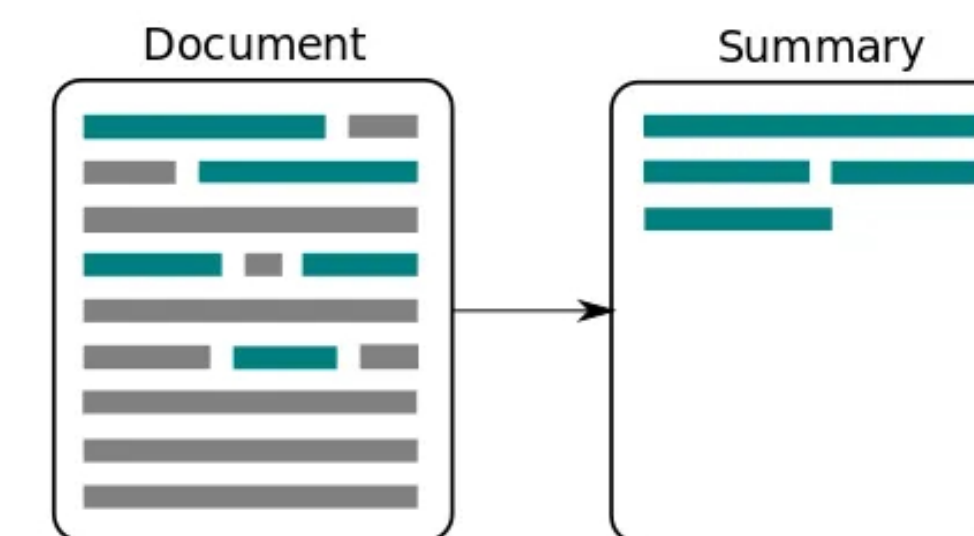
Real-world Summarization task

- **Summarization is ubiquitous in daily life**, from briefing friends on the latest news to condensing seminar talks for colleagues
- **Automated summarization** is a central problem in natural language processing
- What do we know about summarization in psychology?



A: Could you recap that seminar talk for me?

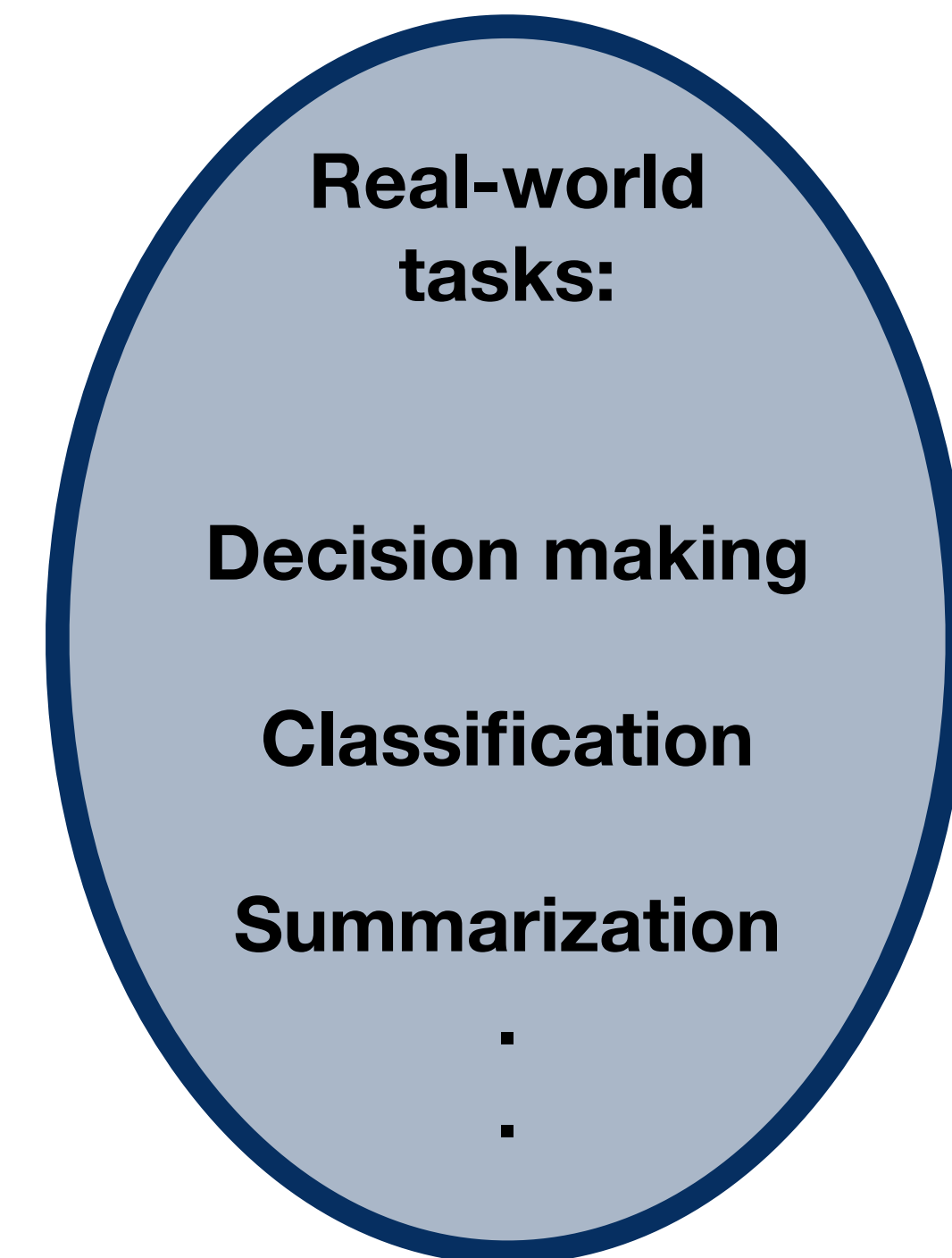
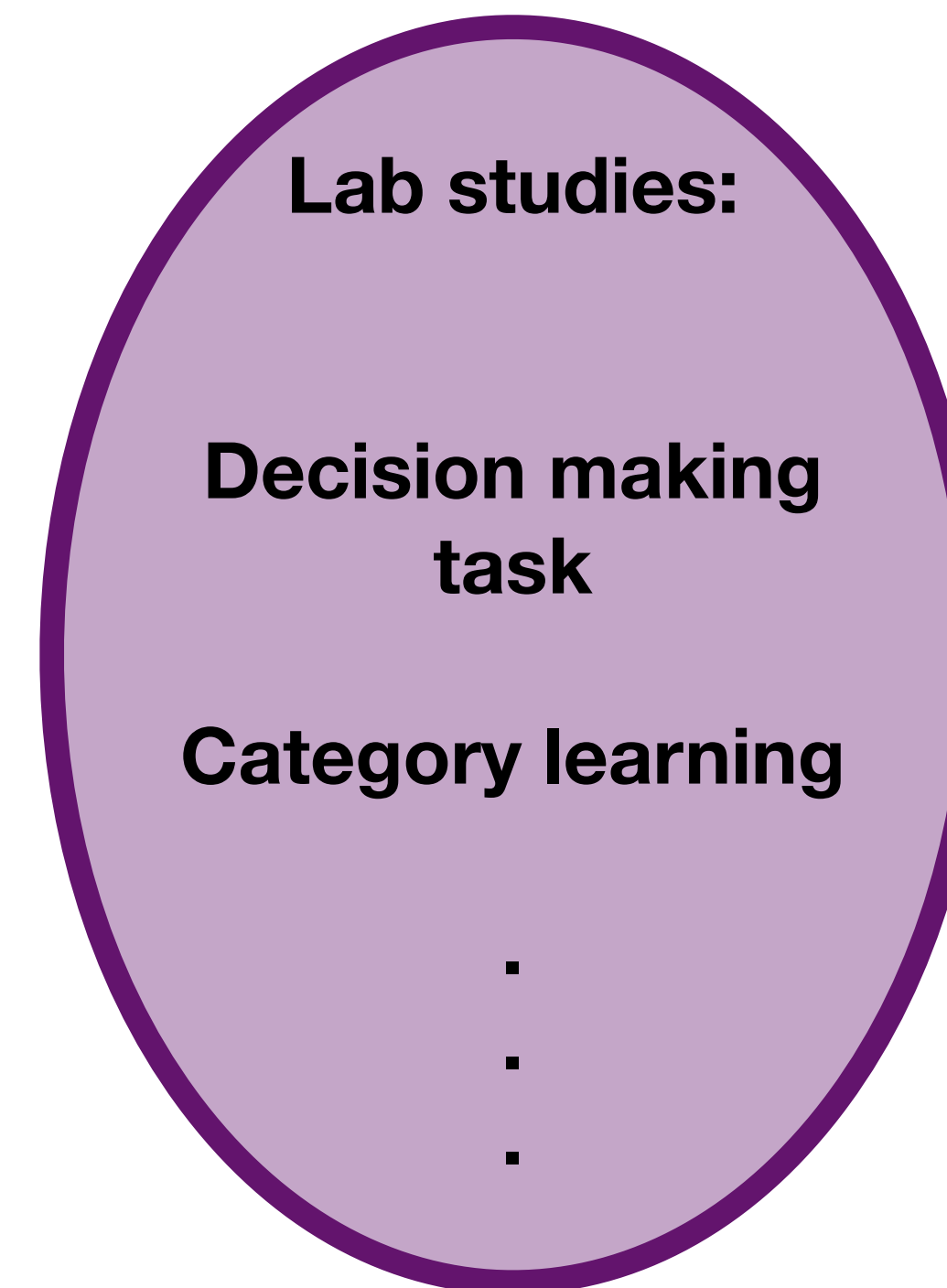
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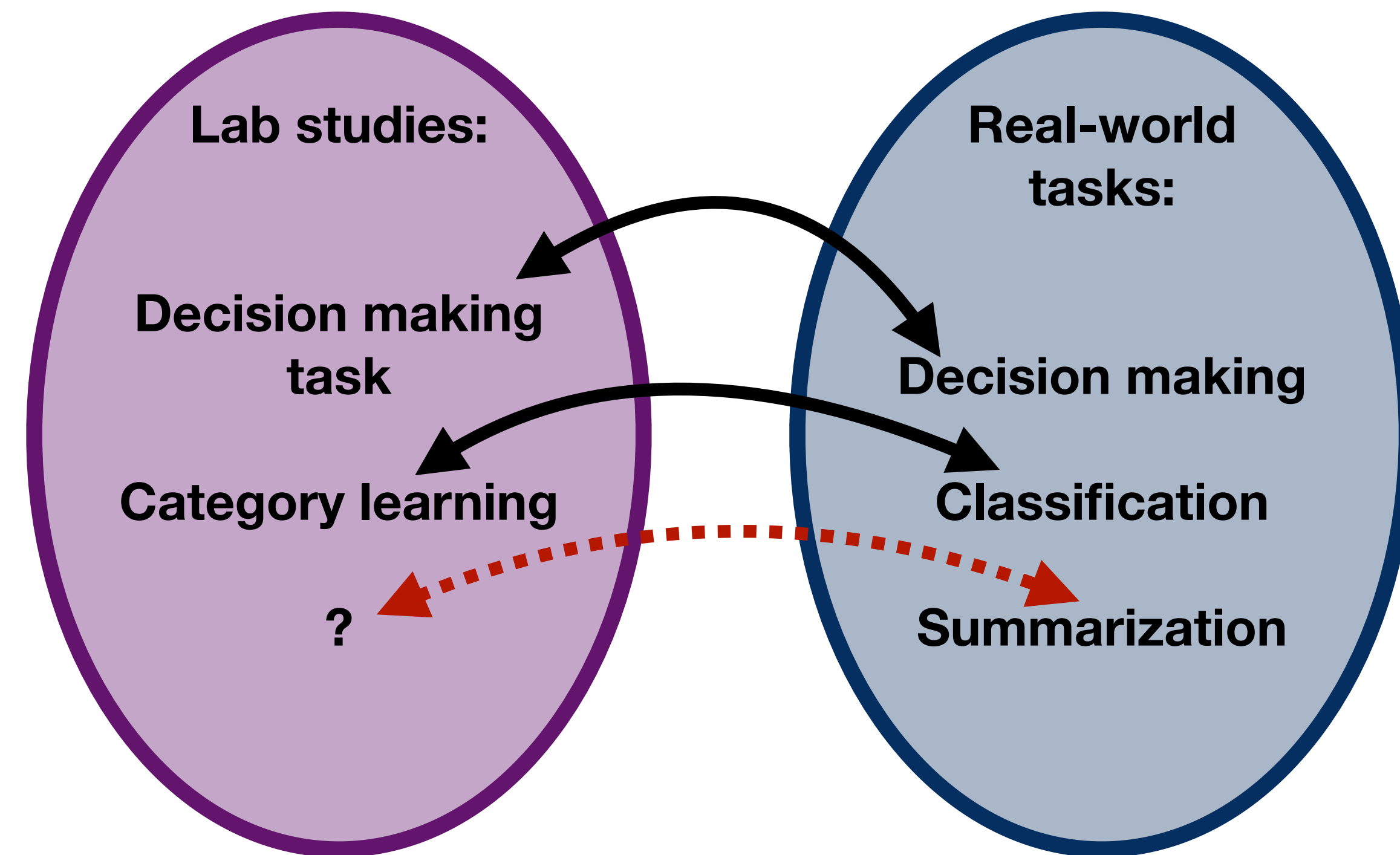
Laboratory paradigms and real-world tasks

- In psychology, **well-controlled, isolated tasks** are used to study specific cognitive functions, with the goal of advancing our understanding of **real-world behaviors**

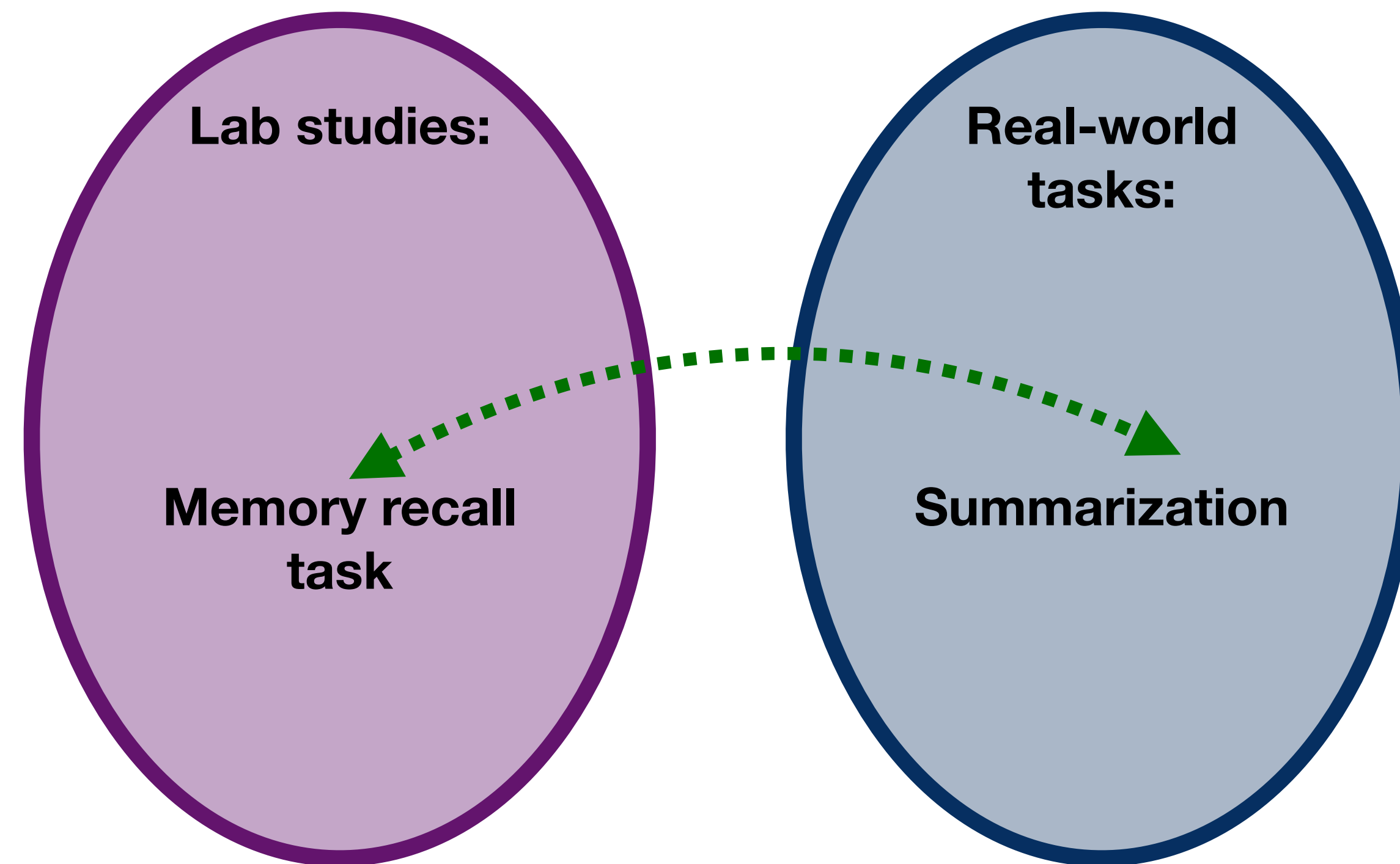


Laboratory paradigms and real-world tasks

- Some real-world tasks have a clear correspondence to simplified lab tasks
- However, **summarization lacks a laboratory counterpart**

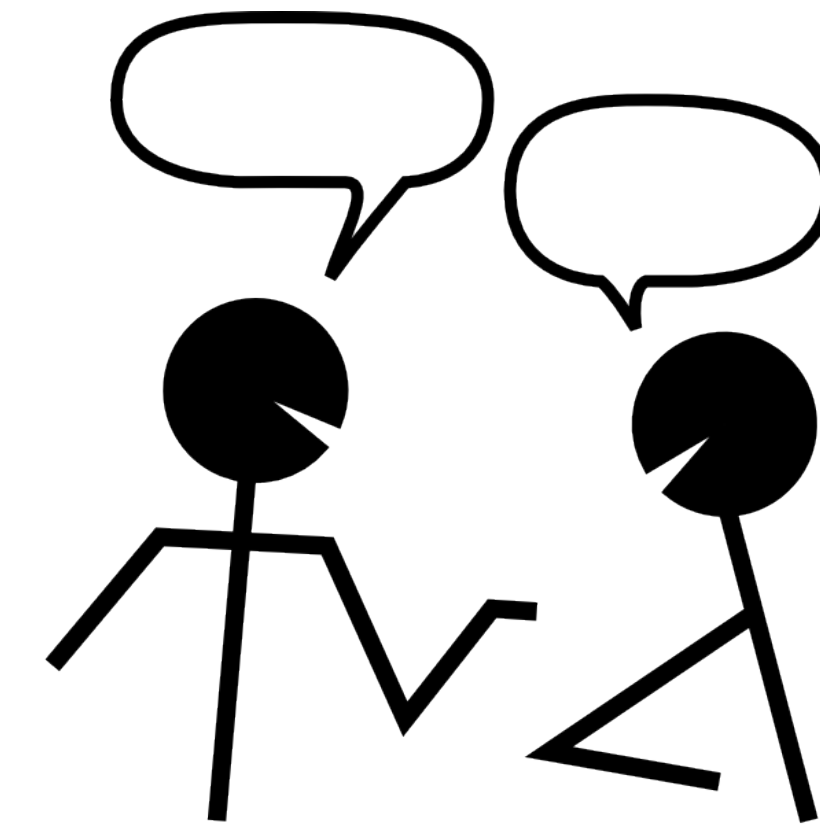


Proposing a relationship between summarization and memory recall



Proposing a relationship between summarization and memory recall

- One's **ability to provide good summaries is constrained by their ability to recall** information from the original source.



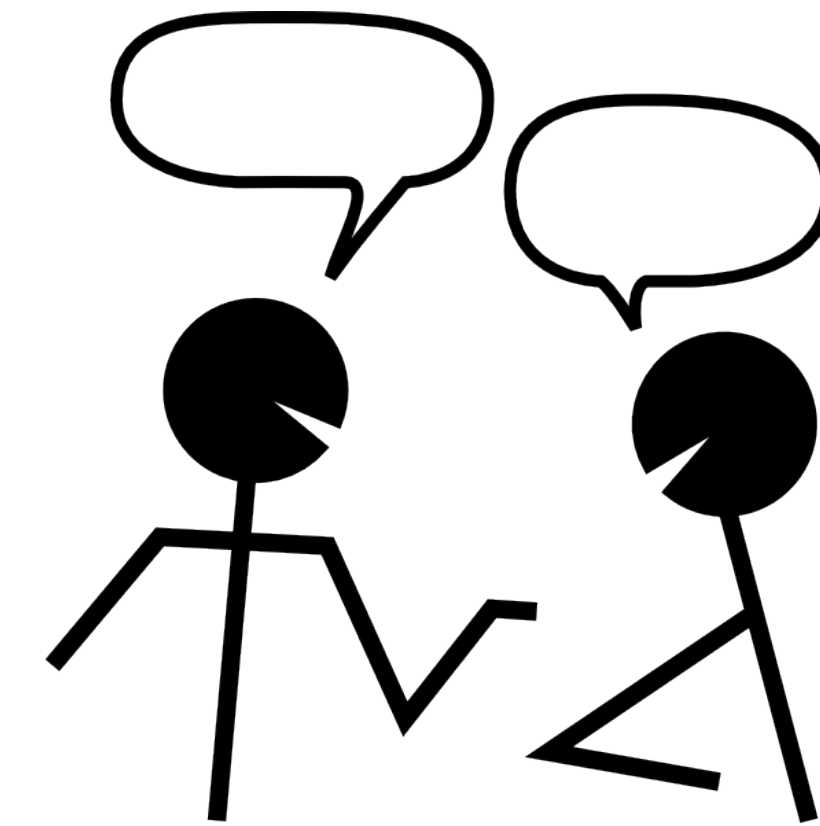
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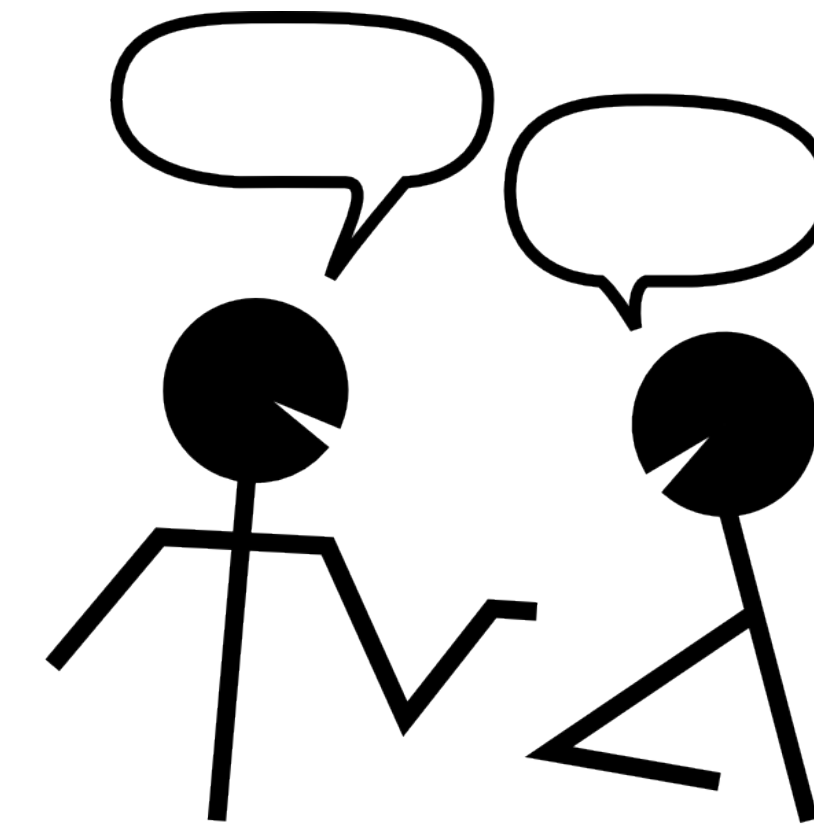
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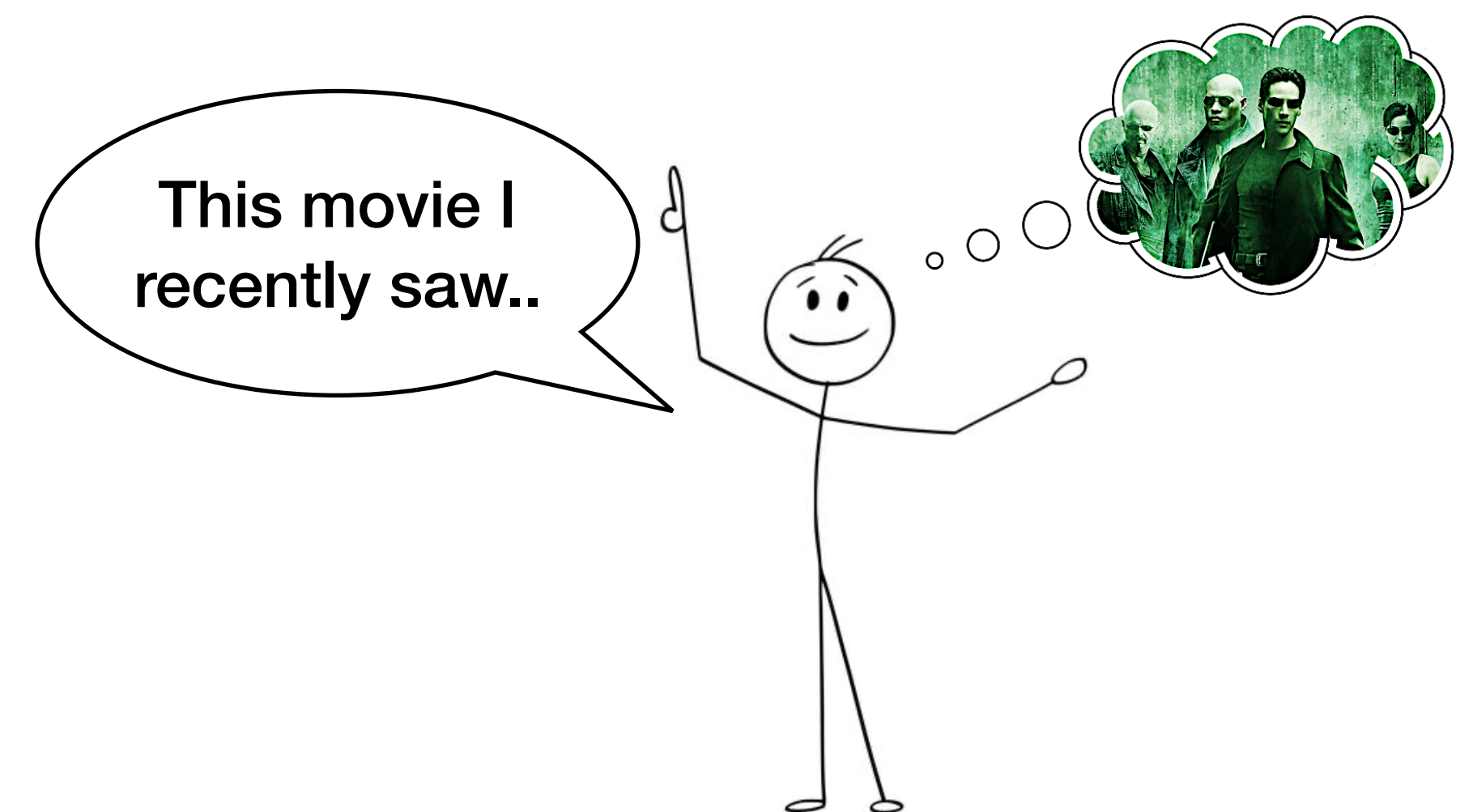
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- One's **ability to provide good summaries is constrained by their ability to recall** information from the original source.
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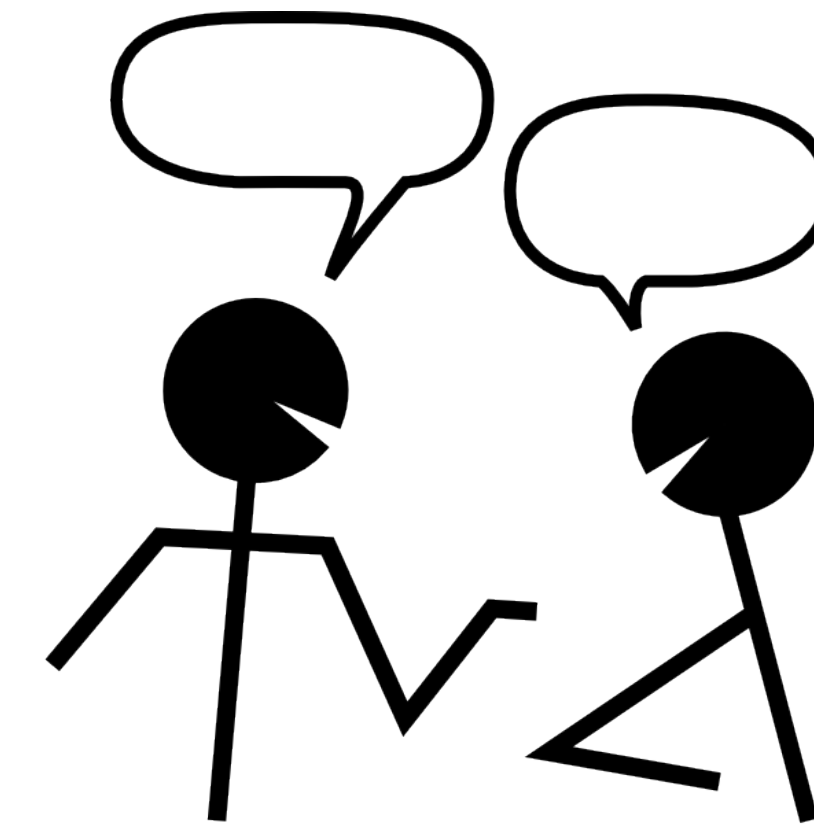


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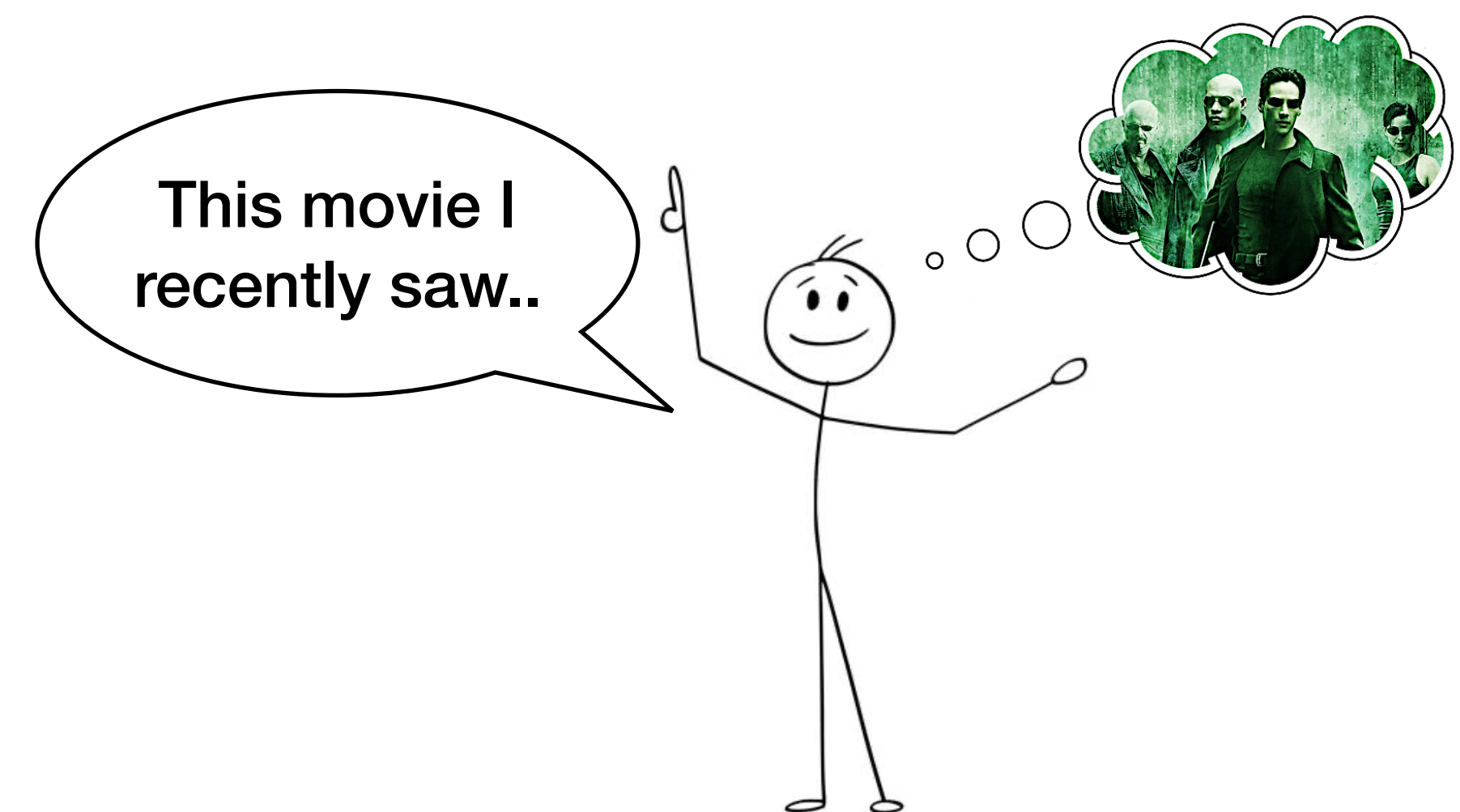
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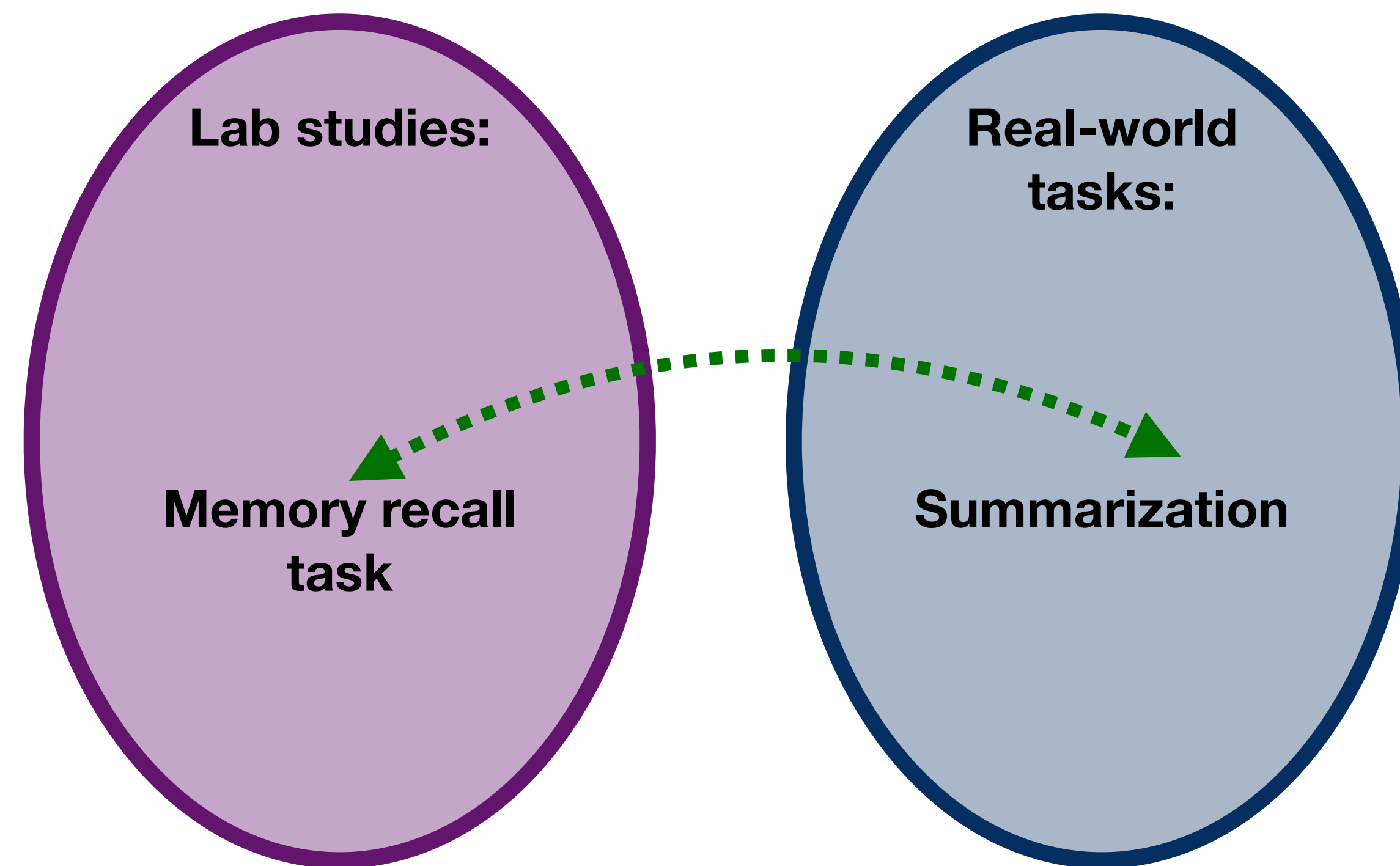


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Proposing a relationship between summarization and memory recall



- We will formally analyze the relationship between summarization and recall, examining the **similarities** and **differences** between them

Overview

1. Motivation
- 2. Datasets**
- 3. Summarization reflects recall characteristics**
- 4. Recall reflects summarization characteristics**
- 5. Differences between recall and summarization**

Overview

1. Motivation

2. Datasets

3. Summary == Recall

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5. Differences

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Datasets

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**Narrative
free recall
dataset**

843 stories (8-70 sentences) & **recalls** (1-55 sentences),
(Naturalistic version of standard free recall task) Georgiou, A. et al. (2023)

**News
articles
dataset**

302 news articles (6-110 sentences) & summaries (1-4 sentences)

Zhang, T. et al. (2024)

**HIPPOCORPUS
dataset**

2279 autobiographical stories (13-34 sentences) &
summaries (1-7 sentences)

Sap, M. et al. (2022)

**Reddit TIFU
dataset**

42,139 autobiographical stories (1-453 sentences) &
summaries (1-23 sentences)

Kim, B. et al. (2019)

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Standard free recall task

Presentation list:

Cat
Sky
Sigil
...

Recall list:

Sky
Sigil
...

Narrative free recall task

Source:

In the neighborhood I grew up in, Mrs. Baker was the resident cat lady. She had adopted at least ...

Recall:

There was a girl who lived next door to A woman who had 20 cats (or so) plus her son. Her son ...

Datasets

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Temporal analysis of standard free recall and summarization

1. Motivation

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To test whether summarization involves processes of memory recall,
we **borrow methods from memory literature** to carry out temporal analysis on
summarization data

Temporal analysis of standard free recall

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2. Datasets

3. Summary == Recall

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Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON,
PAPAYA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

Recall list: PAPAYA, PENTACLE, COUCH, STAKE

- In standard free recall, mapping is straightforward; a recalled item is mapped to an item on the presentation list

Temporal analysis of standard free recall

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Standard free recall task

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- In standard free recall, mapping is straightforward; a recalled item is mapped to an item on the presentation list
- The **serial positions** of the presentation list items are used to analyze temporal dynamics in recall

Temporal analysis of summarization

1. Motivation

2. Datasets

3. Summary == Recall

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5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPAYA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

Recall list: PAPAYA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

Summary: What happened is that I was on a trip with my friends going to Acadia National Park. During the car ride there, we got a little out of hand and the driver started to swerve, and we got pulled over by a cop and everything was fine. Just the moment itself was extremely scary.

- With summaries, every summary sentence is mapped to one source sentence using METEOR score

Banerjee, S. et al. (2005)

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- Instead of serial position, **normalized sentence positions** are used to analyze temporal dynamics of different source lengths together

Temporal analysis: Probability of recall

Standard free recall task

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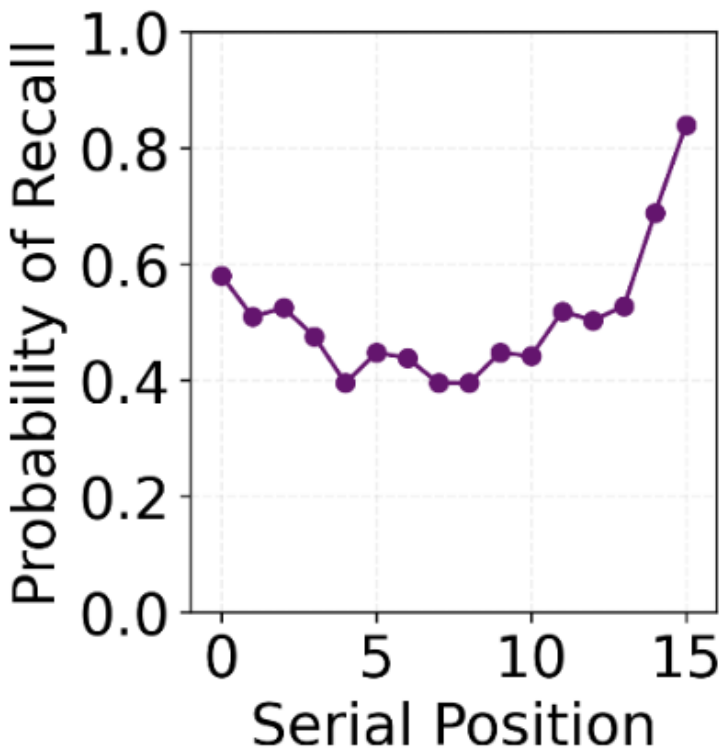
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Standard free recall task



Cornell, C.A. et al. (2024)

Temporal analysis: Probability of recall

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5. Differences

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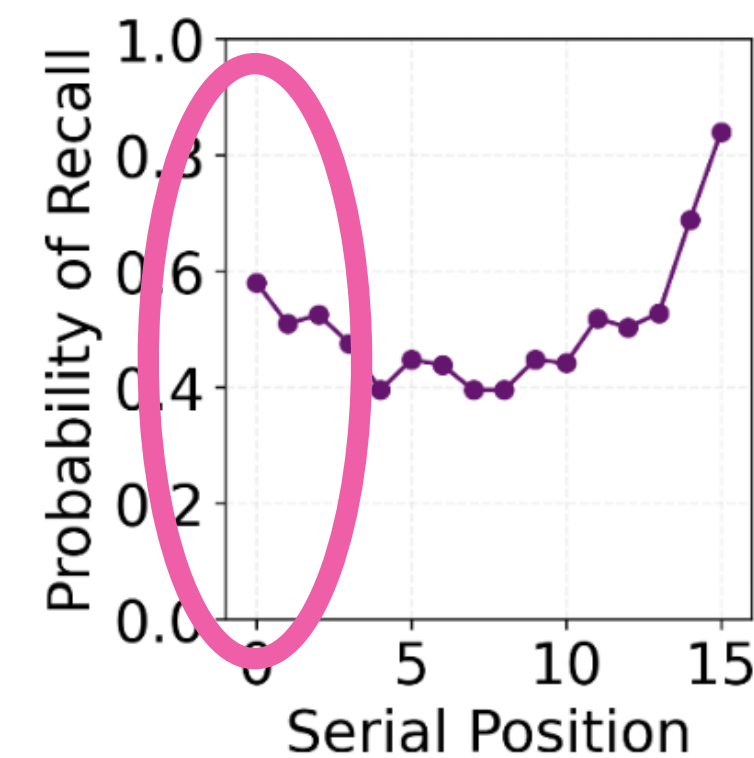
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Standard free recall task



Primacy
effect

Temporal analysis: Probability of recall

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Standard free recall task

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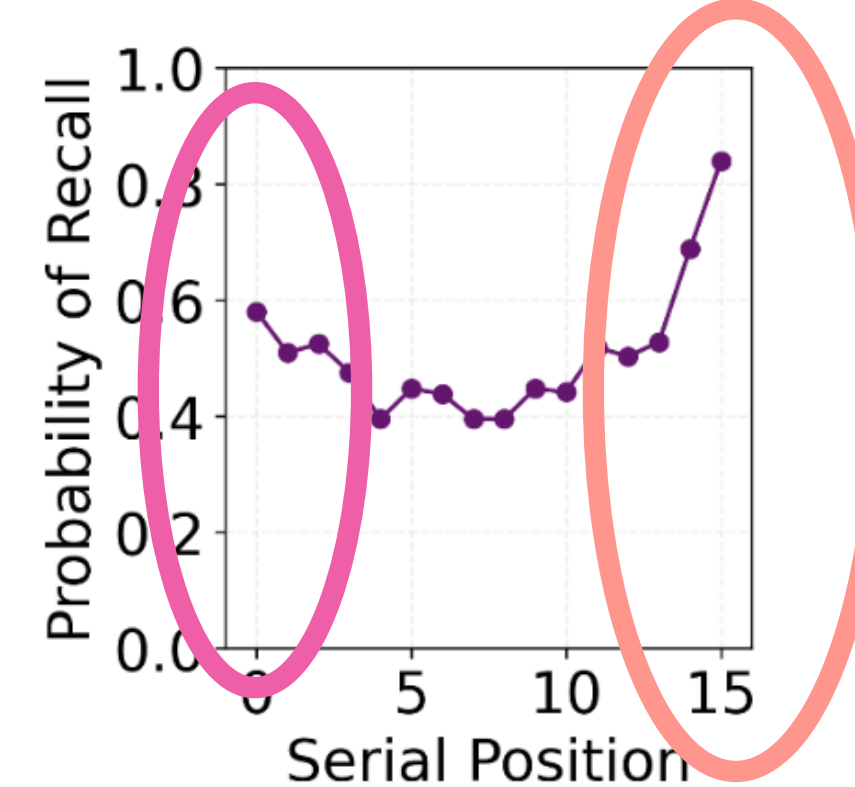
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Standard free recall task



Primacy
effect

Recency
effect

Temporal analysis: Probability of recall

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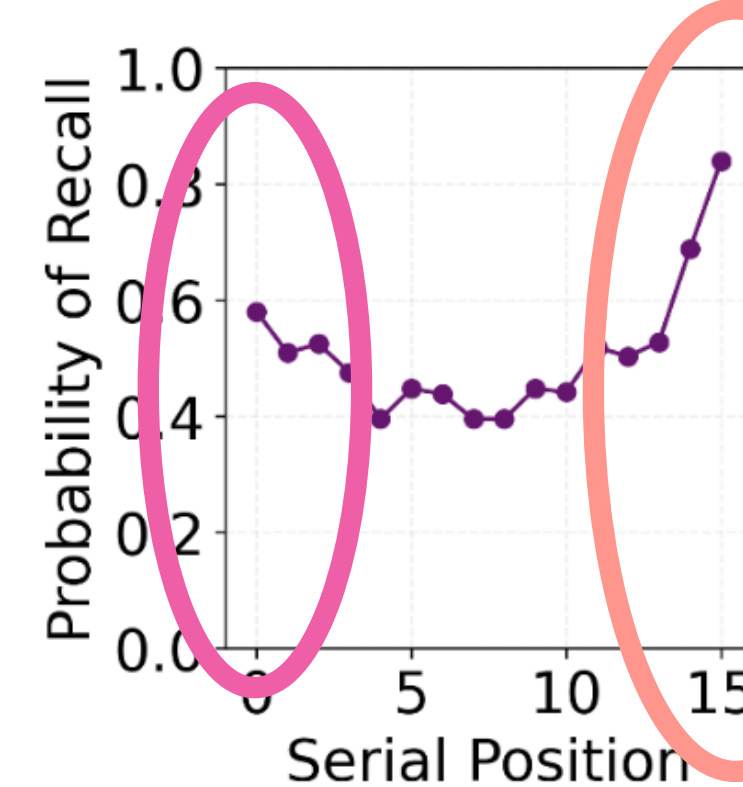
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Standard free recall task



Narrative free recall dataset

News articles dataset

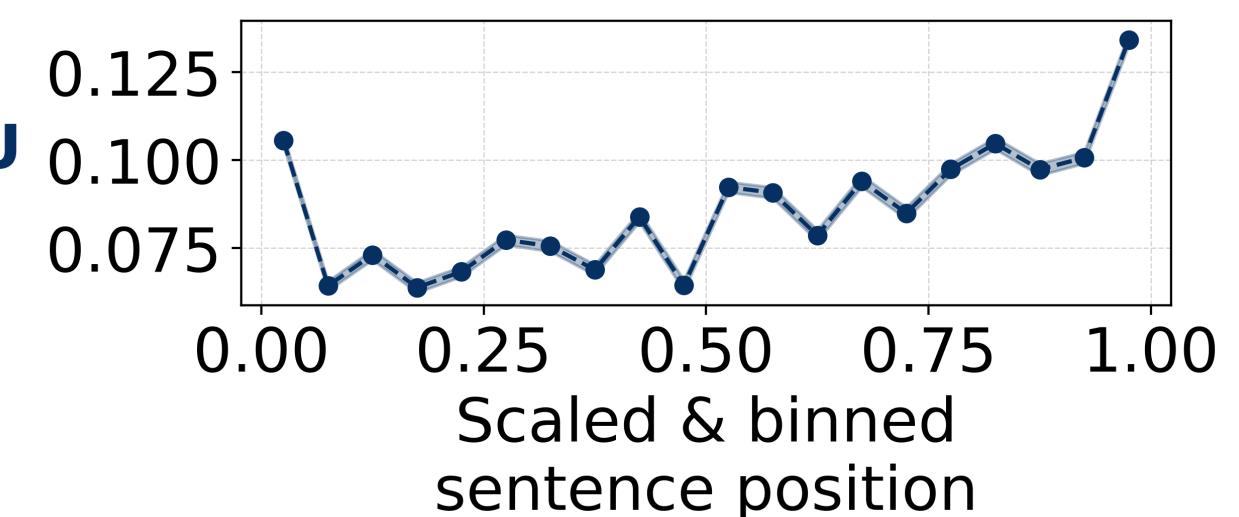
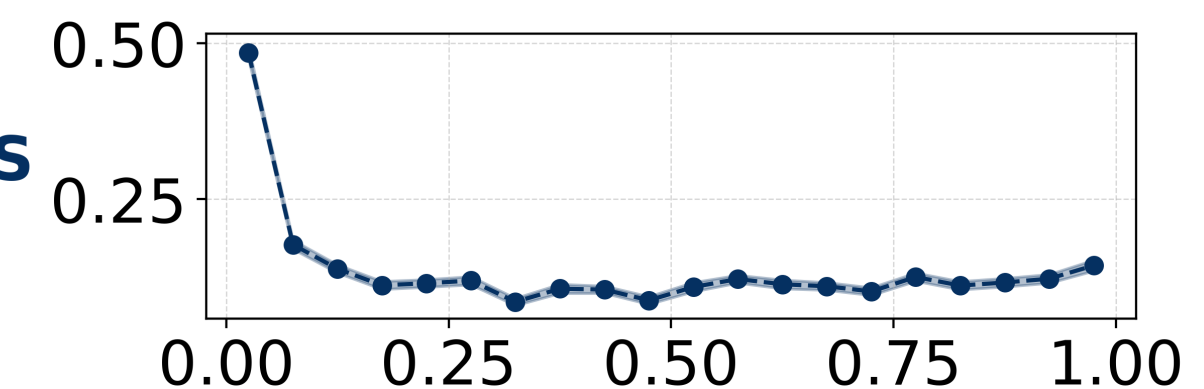
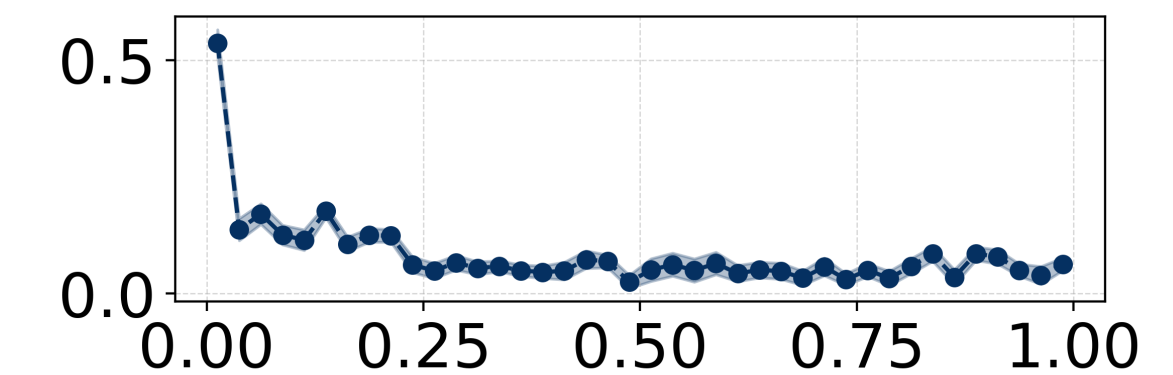
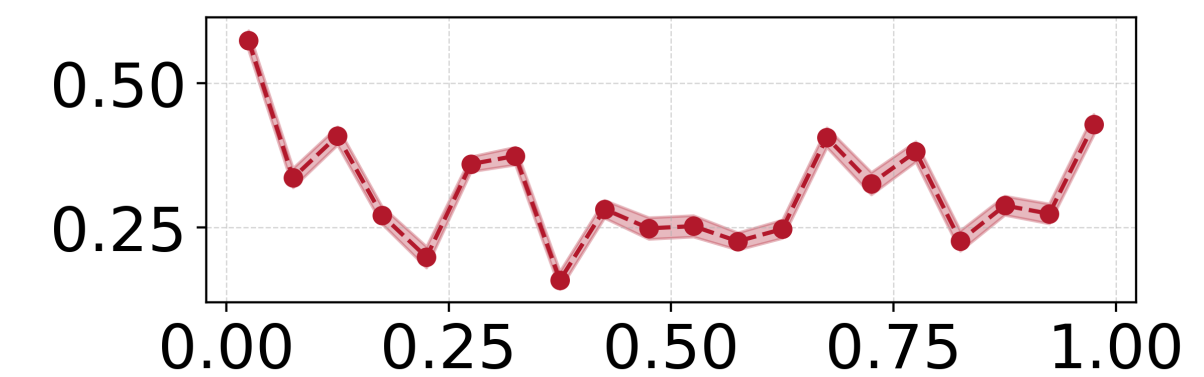
HIPPOCORPUS dataset

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Probability of recall



Temporal analysis: Probability of recall

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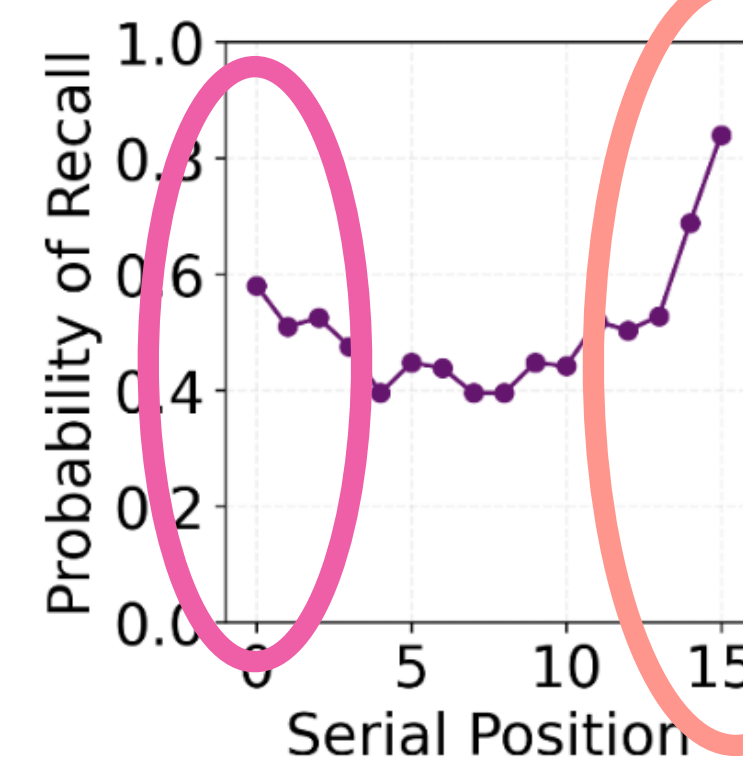
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Narrative free recall dataset

News articles dataset

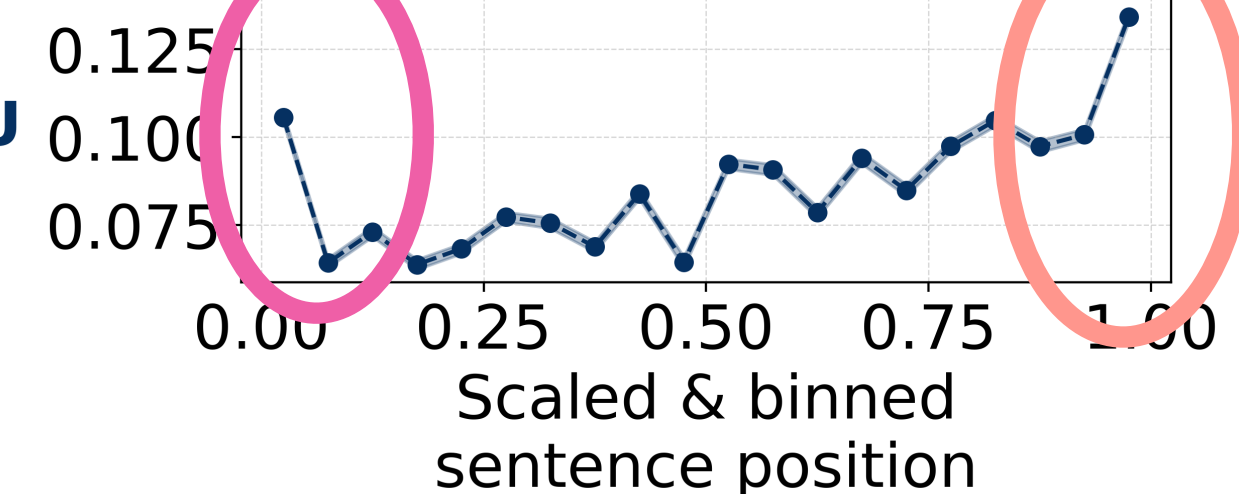
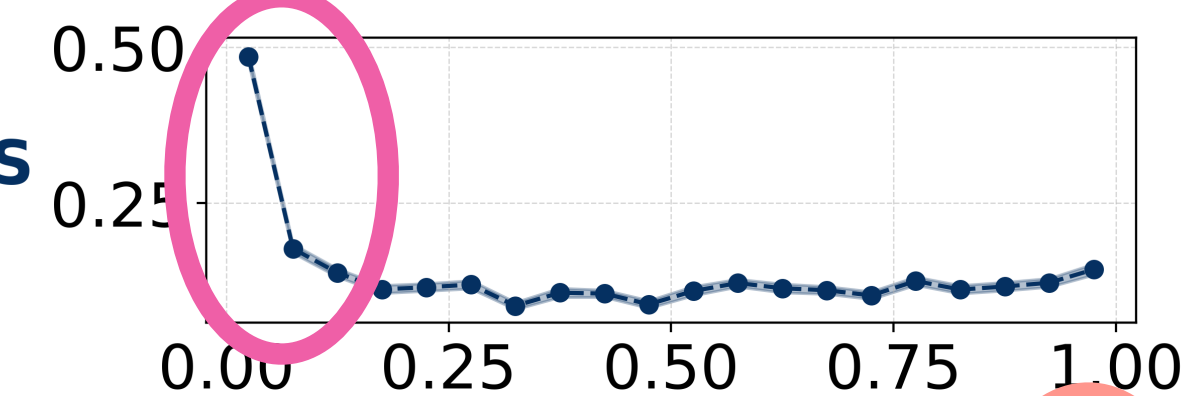
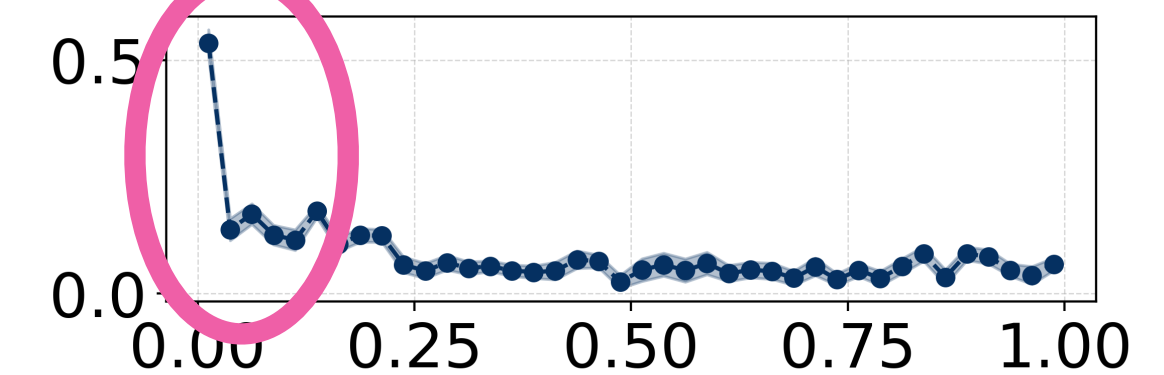
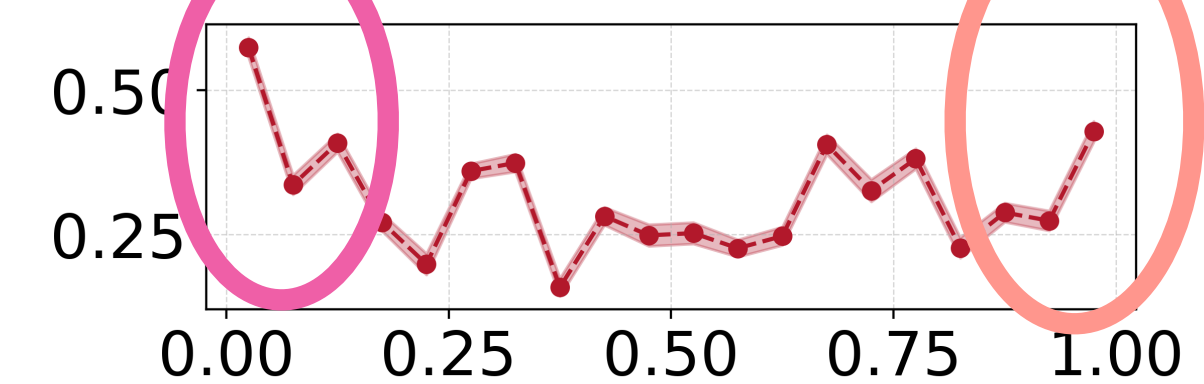
HIPPOCORPUS dataset

Reddit TIFU dataset

Primacy effect

Recency effect

Probability of recall



Temporal analysis: Probability of first recall

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPAYA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

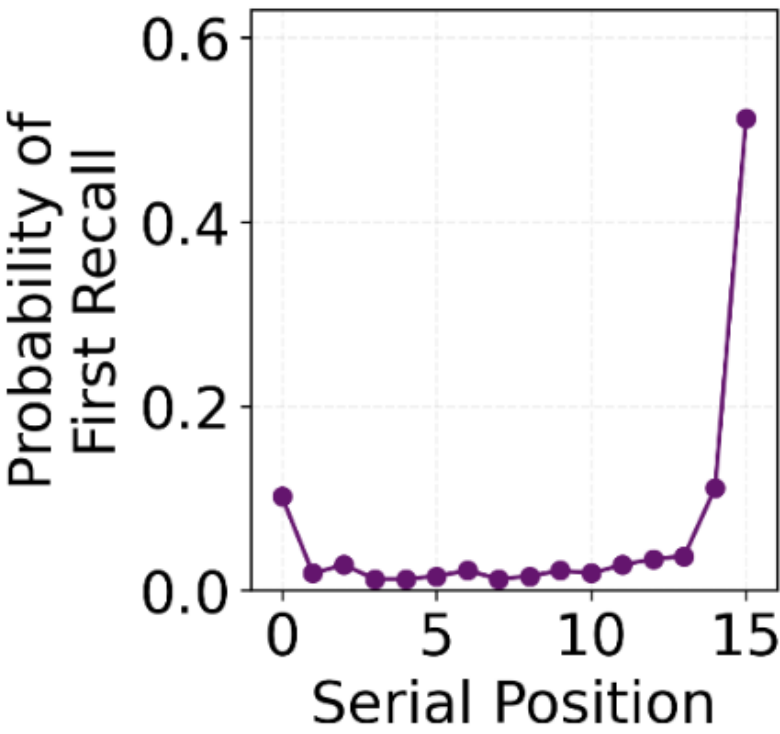
Recall list: PAPAYA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



Cornell, C.A. et al. (2024)

Temporal analysis: Probability of first recall

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Standard free recall task

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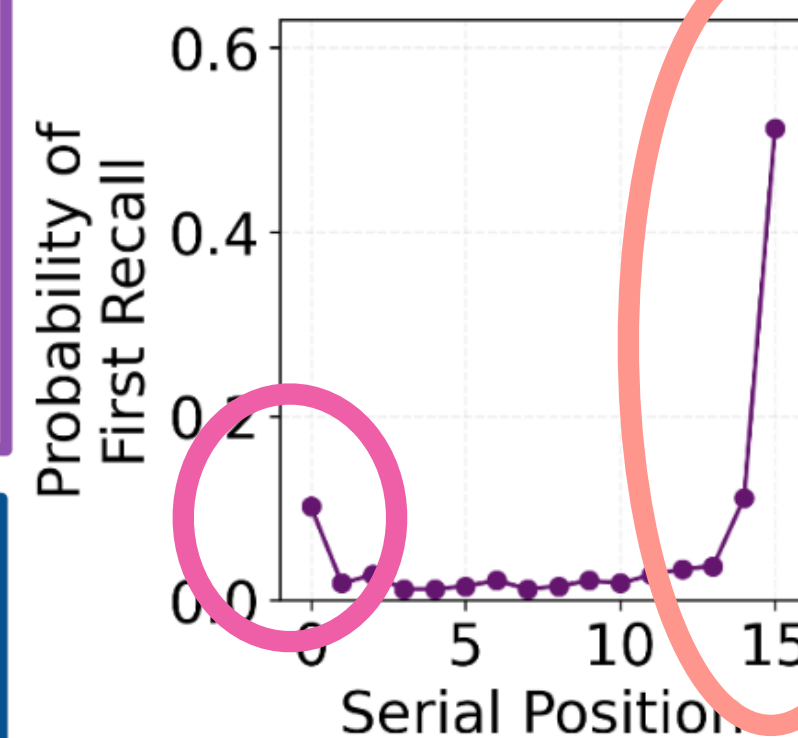
Recall list: PAPAYA, PENTACLE, COUCH, STAKE

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Standard free recall task



Primacy
effect

Recency
effect

Temporal analysis: Probability of first recall

1. Motivation 2. Datasets 3. Summary == Recall 4. Recall == Summary 5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPAYA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

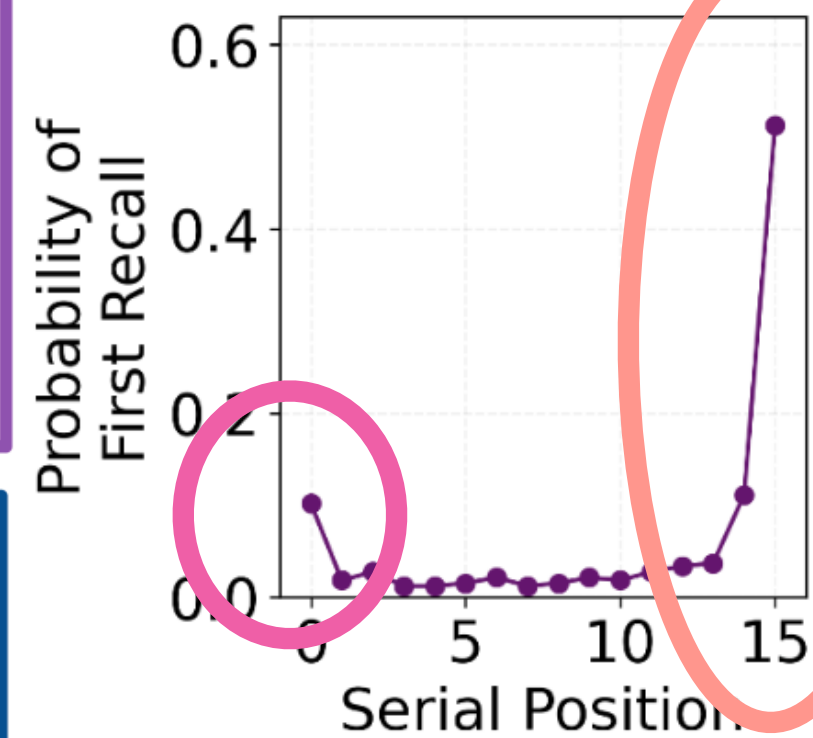
Recall list: PAPAYA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



Narrative free recall dataset

News articles dataset

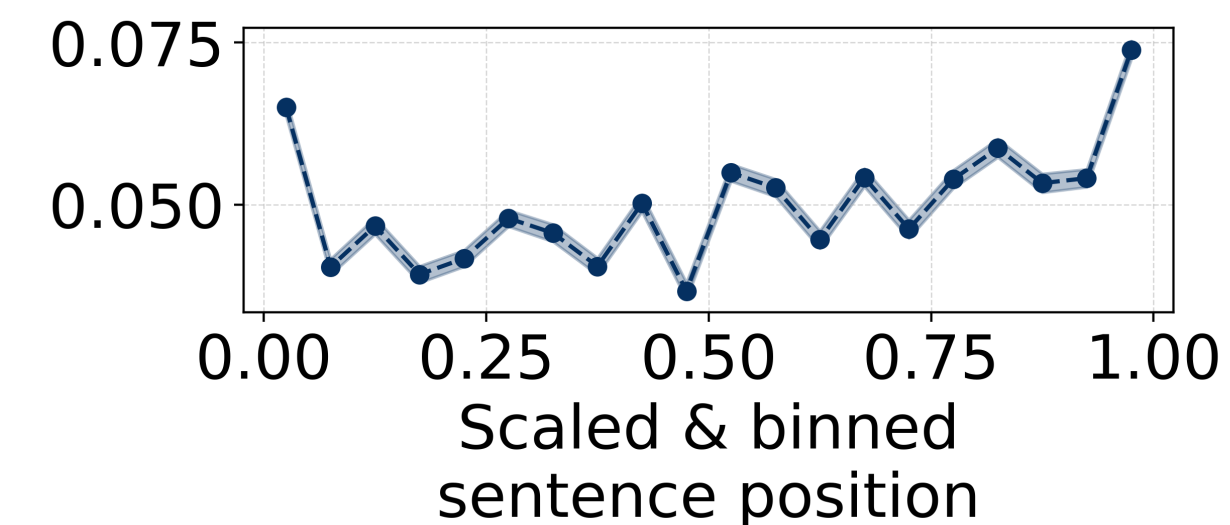
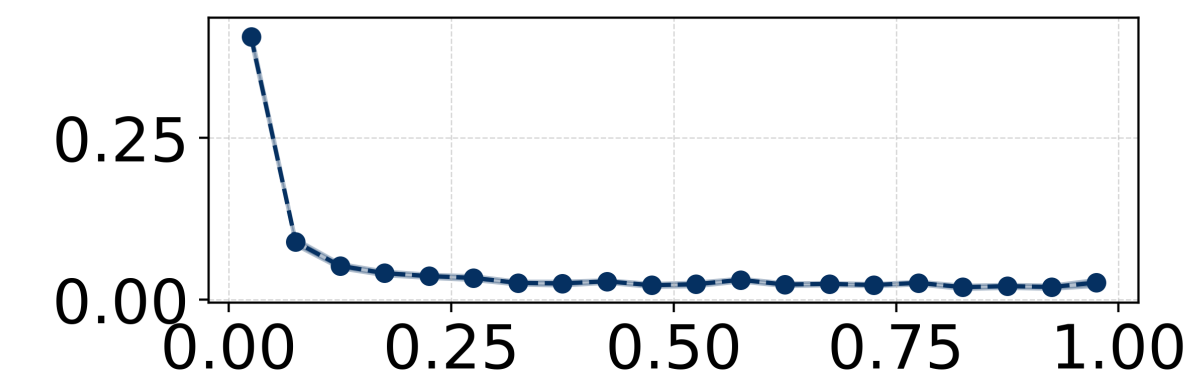
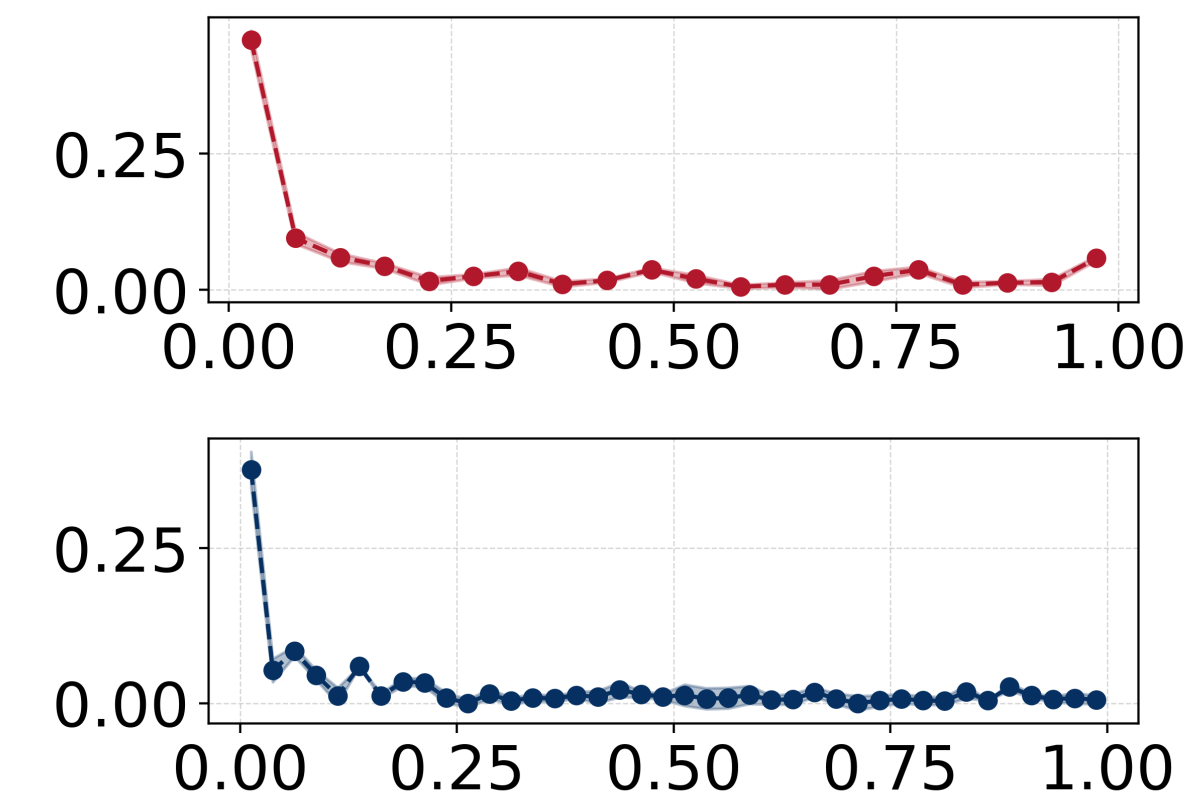
Primacy effect

Recency effect

HIPPOCORPUS dataset

Reddit TIFU dataset

Probability of first recall



Temporal analysis: Probability of first recall

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Standard free recall task

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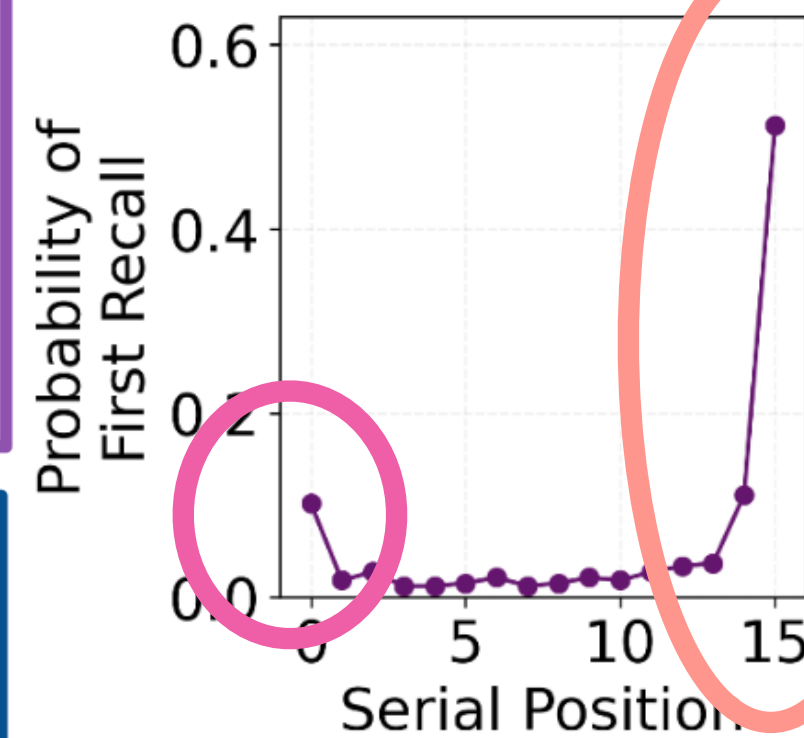
Recall list: PAPAYA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



**Narrative
free recall
dataset**

**News
articles
dataset**

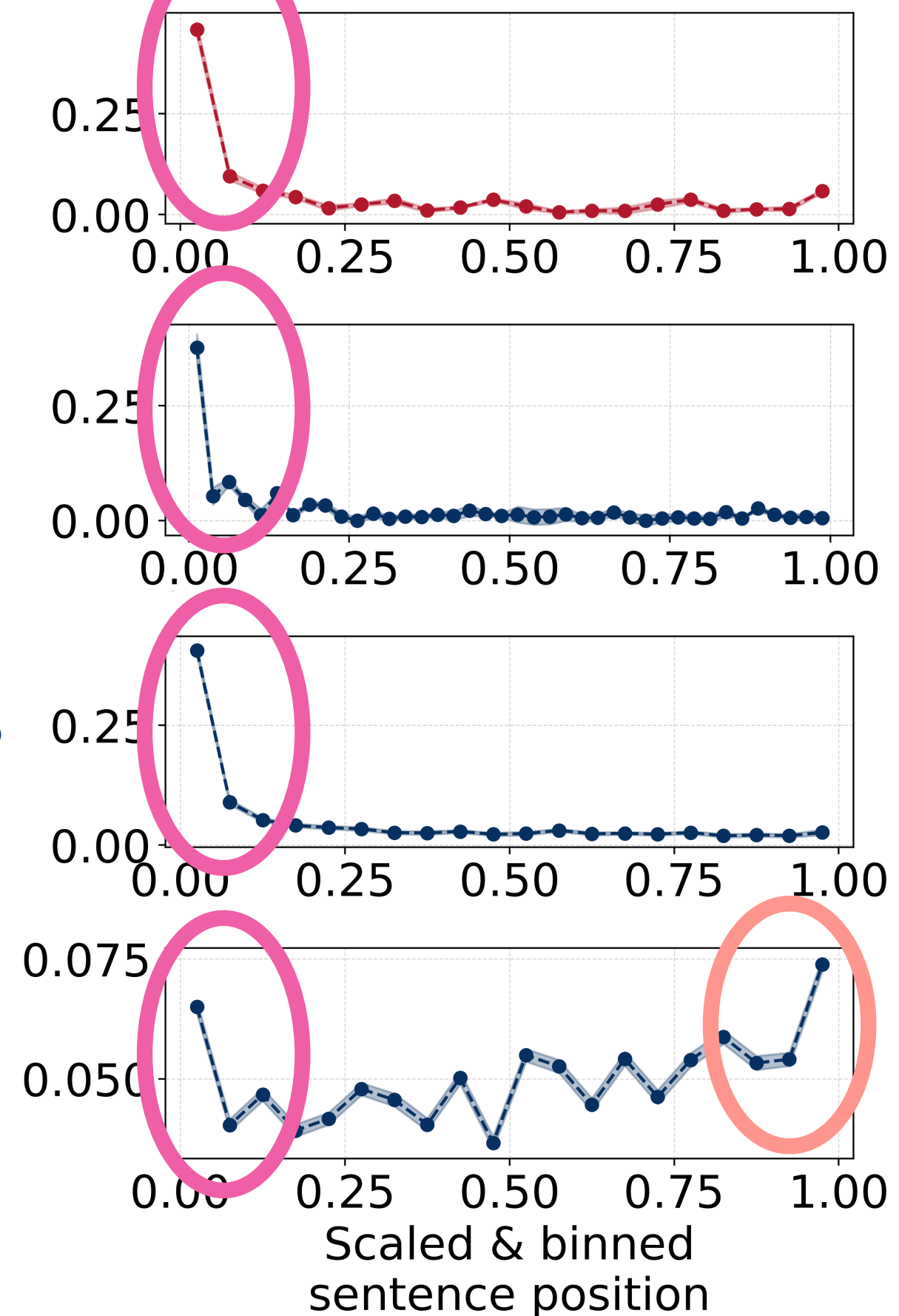
**HIPPOCORPUS
dataset**

**Primacy
effect**

**Recency
effect**

**Reddit TIFU
dataset**

Probability of first recall



Temporal analysis: Conditional response probability

1. Motivation 2. Datasets 3. Summary == Recall 4. Recall == Summary 5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPA**Y**A, PENTAC**L**E, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

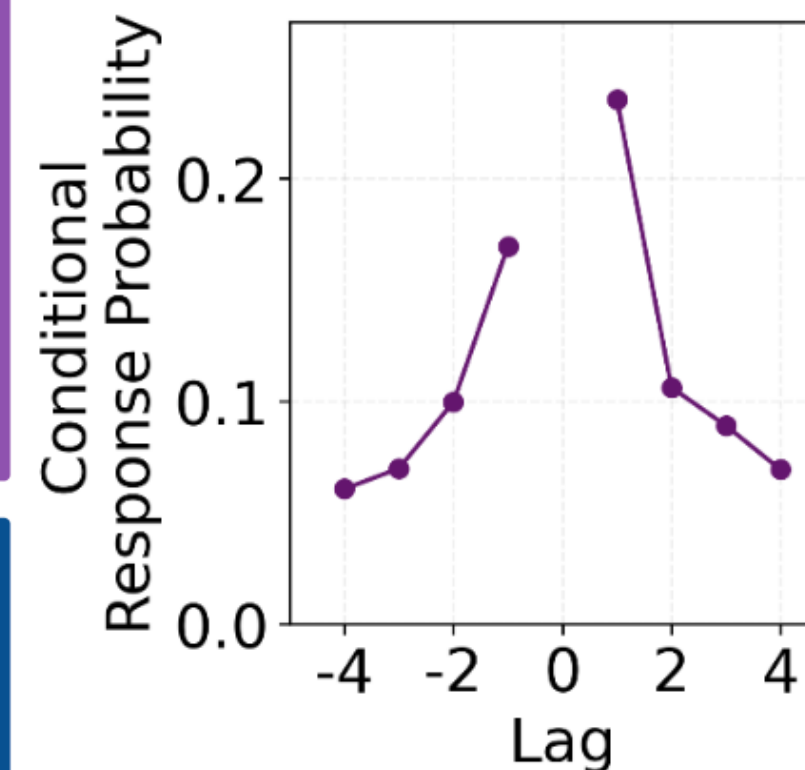
Recall list: PAPA**Y**A, PENTAC**L**E, COUCH, STAKE

Summarization task

Source: ¹Dear Diary, I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



Cornell, C.A. et al. (2024)

Temporal analysis: Conditional response probability

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPAYA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

lag +1

lag -3

lag +4

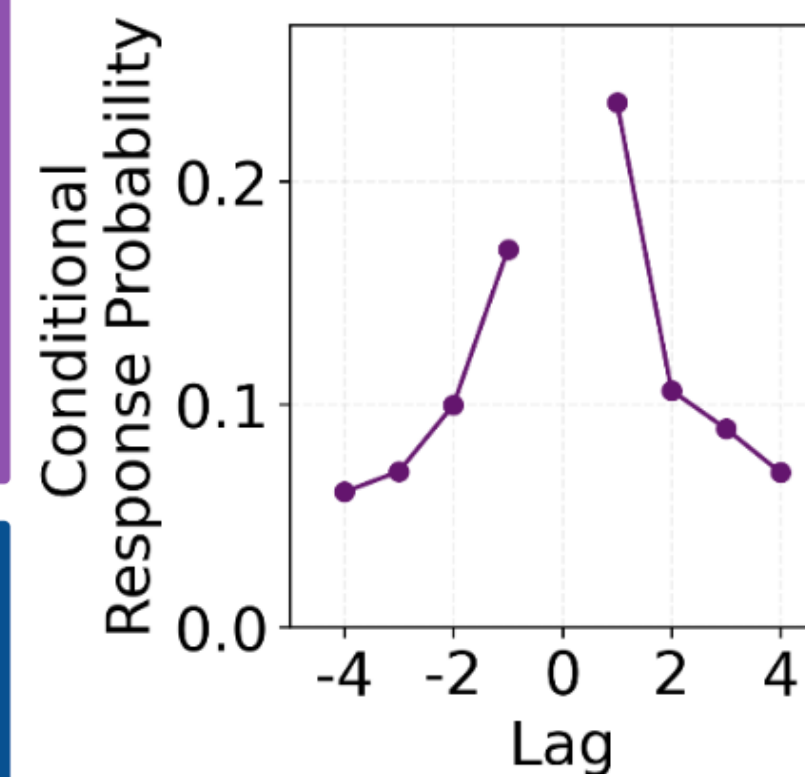
Recall list: PAPAYA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary, I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



Temporal contiguity

Temporal analysis: Conditional response probability

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPA YA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

lag +1

lag -3

lag +4

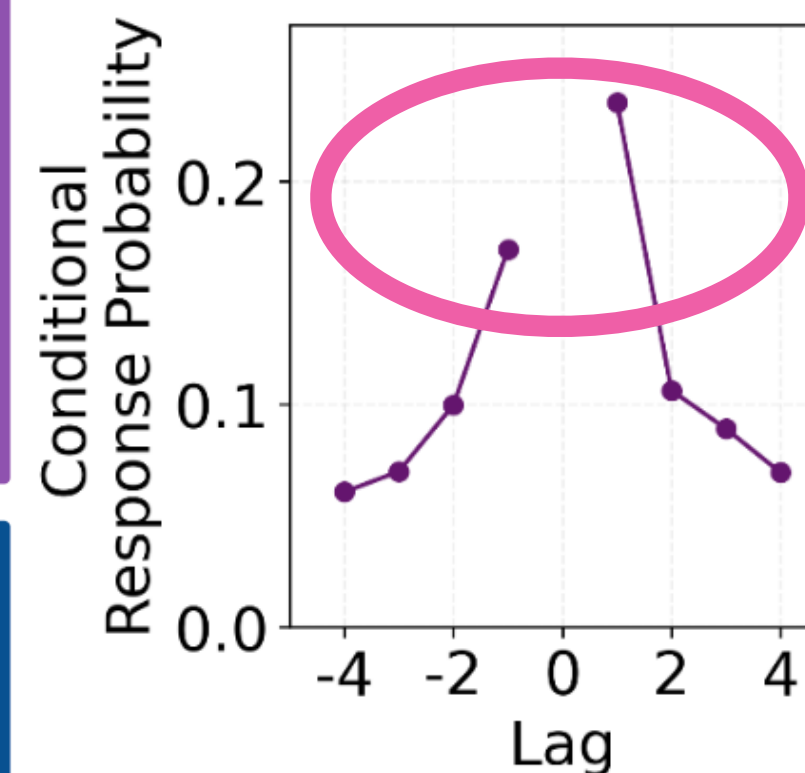
Recall list: PAPA YA, PENTACLE, COUCH, STAKE

Summarization task

Source: ¹Dear Diary, I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Standard free recall task



Temporal contiguity

Forward asymmetry

Temporal analysis: Conditional response probability

1. Motivation 2. Datasets 3. Summary == Recall 4. Recall == Summary 5. Differences

Standard free recall task

Presentation list: CAT, BAG, SKY, SIGIL, BUS, CITY, RAT, MOON, PAPA^YA, PENTACLE, STAKE, HOUSE, CHAIR, COUCH, AMULET, JAR

Recall list: PAPA^YA, PENTACLE, COUCH, STAKE

lag -3
lag +1
lag +4

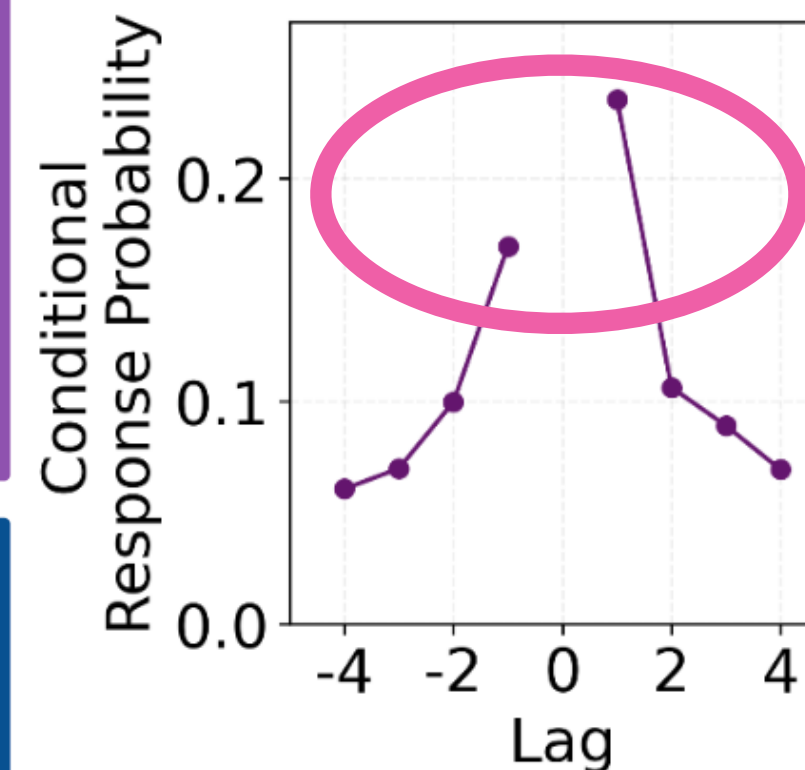
Summarization task

Source: ¹Dear Diary, I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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lag +4
lag +6

Standard free recall task



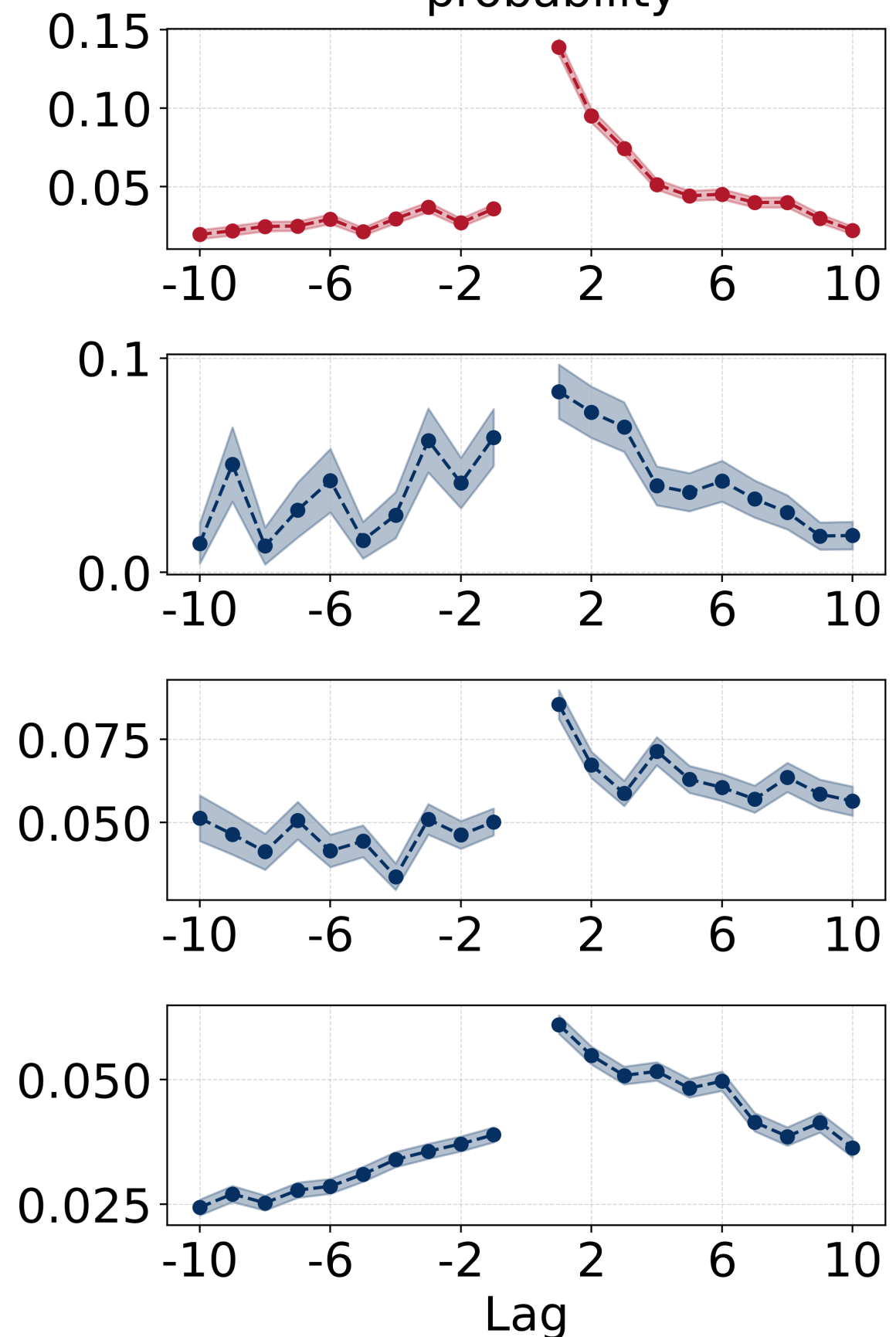
Narrative free recall dataset

News articles dataset

Temporal contiguity

Forward asymmetry

Conditional response probability



Temporal analysis of summarization

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Summarization data demonstrated effects
similar to those observed in free recall literature,
supporting our hypothesis that it involves processes of memory recall

Overview

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

1. Motivation

2. Datasets

3. Summarization reflects recall characteristics

4. Recall reflects summarization characteristics

5. Differences between recall and summarization

Semantic centrality analysis of narrative free recall and summaries

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

To test whether naturalistic recall resembles summarization,
we examine narrative free recall for the **centrality effect seen in summarization**

Semantic centrality analysis of narrative free recall and summaries

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

- Studies of summarization have shown that subjects **identify and include ‘important’ content** from the source when they summarize

Omanson, R. C. (1982), Winograd, P. N. (1984), Kintsch, W. et al. (1978), Lemaire, B. et al. (2005)

Semantic centrality analysis of narrative free recall and summaries

1. Motivation

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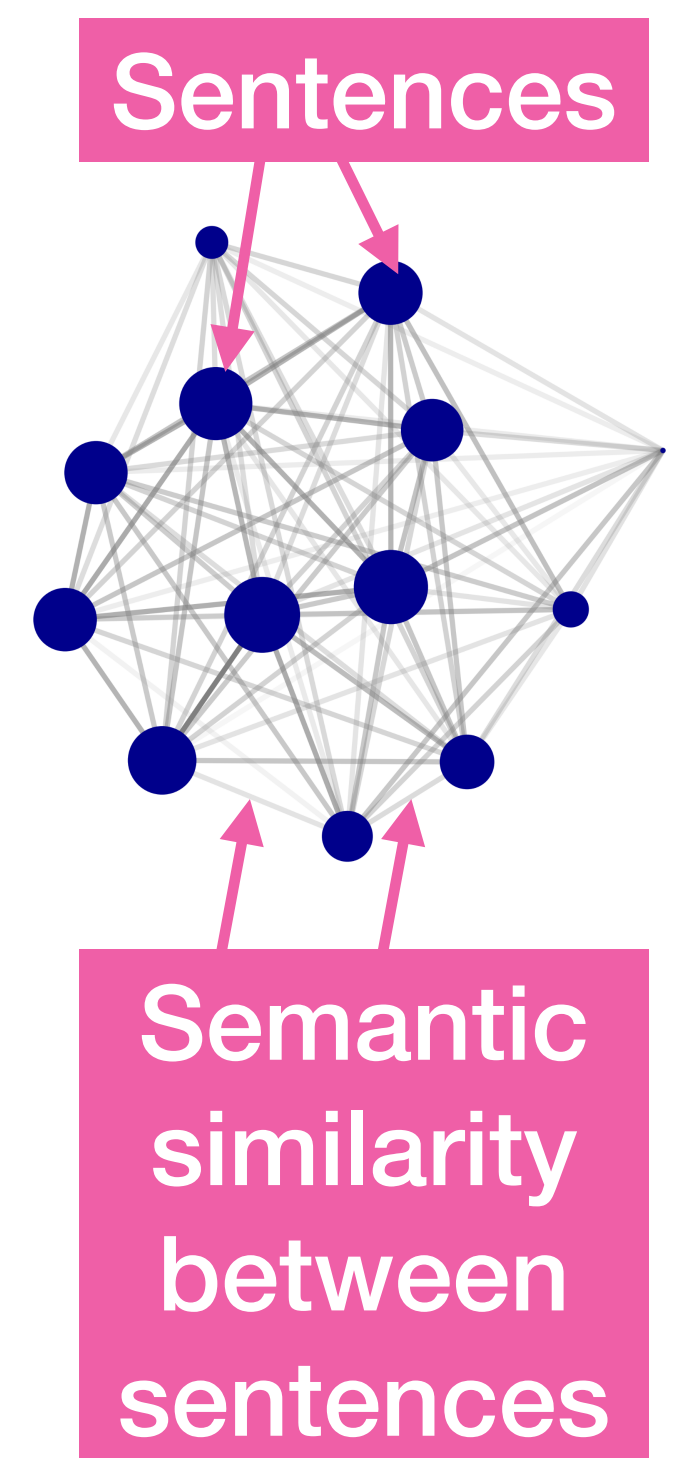
5. Differences

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Omanson, R. C. (1982), Winograd, P. N. (1984), Kintsch, W. et al. (1978), Lemaire, B. et al. (2005)

- We extract the **semantic representation of the source:**
 - The semantic similarity between all pairs of sentences is quantified using METEOR score
 - We then run PageRank on this graph to quantify how central each sentence is to the source (**Semantic centrality**)

Kintsch, W. (2002), Lee, H. et al. (2022), Anthony, J. et al. (2024), Griffiths, T. L. et al. (2007)



Semantic centrality analysis of narrative free recall and summaries

1. Motivation

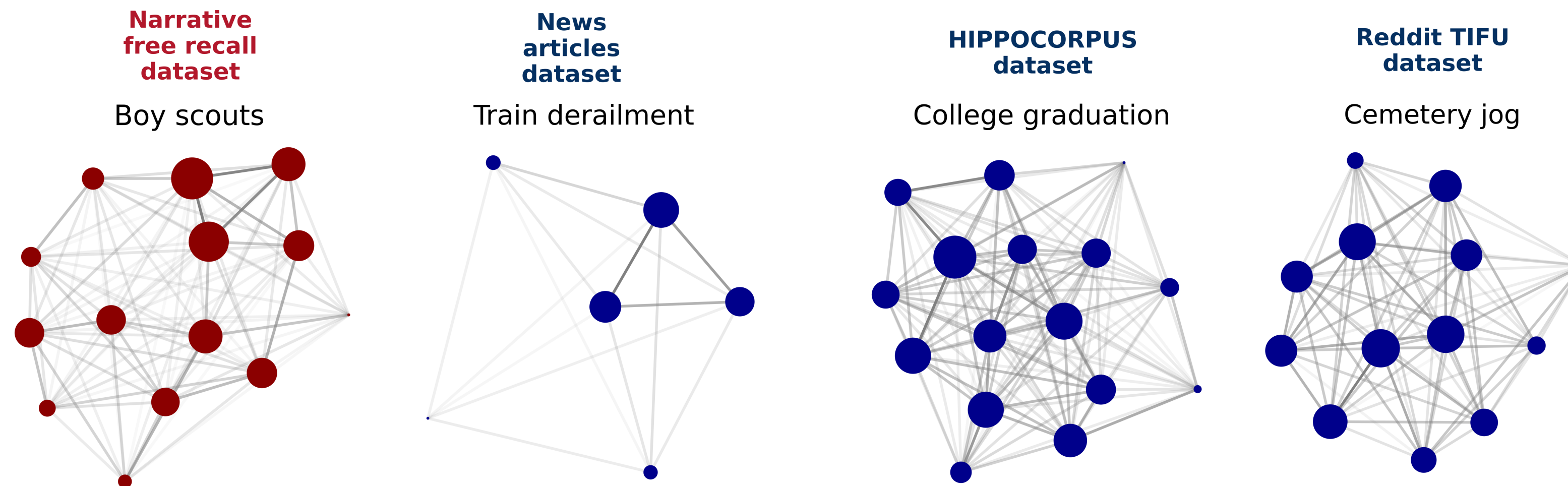
2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

- **Semantic representation of the source:**



**Edge weight = Semantic similarity
between sentences in source**

**Node size = Centrality of sentence in
source**

Semantic centrality analysis of narrative free recall and summaries

1. Motivation

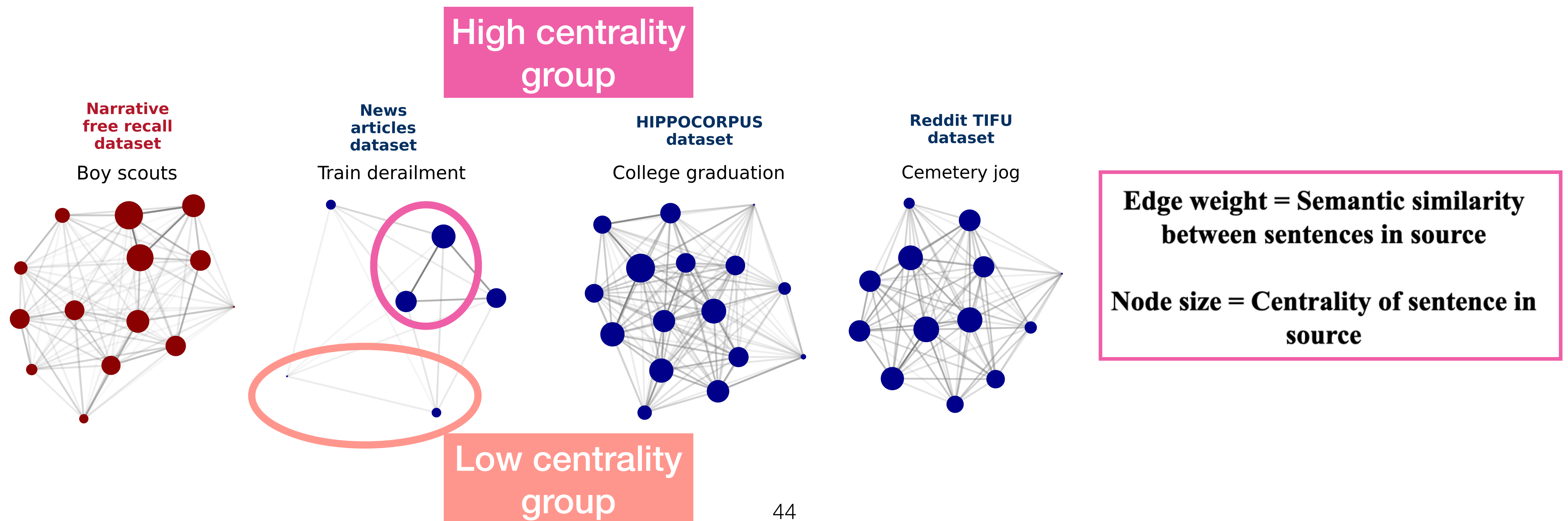
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5. Differences

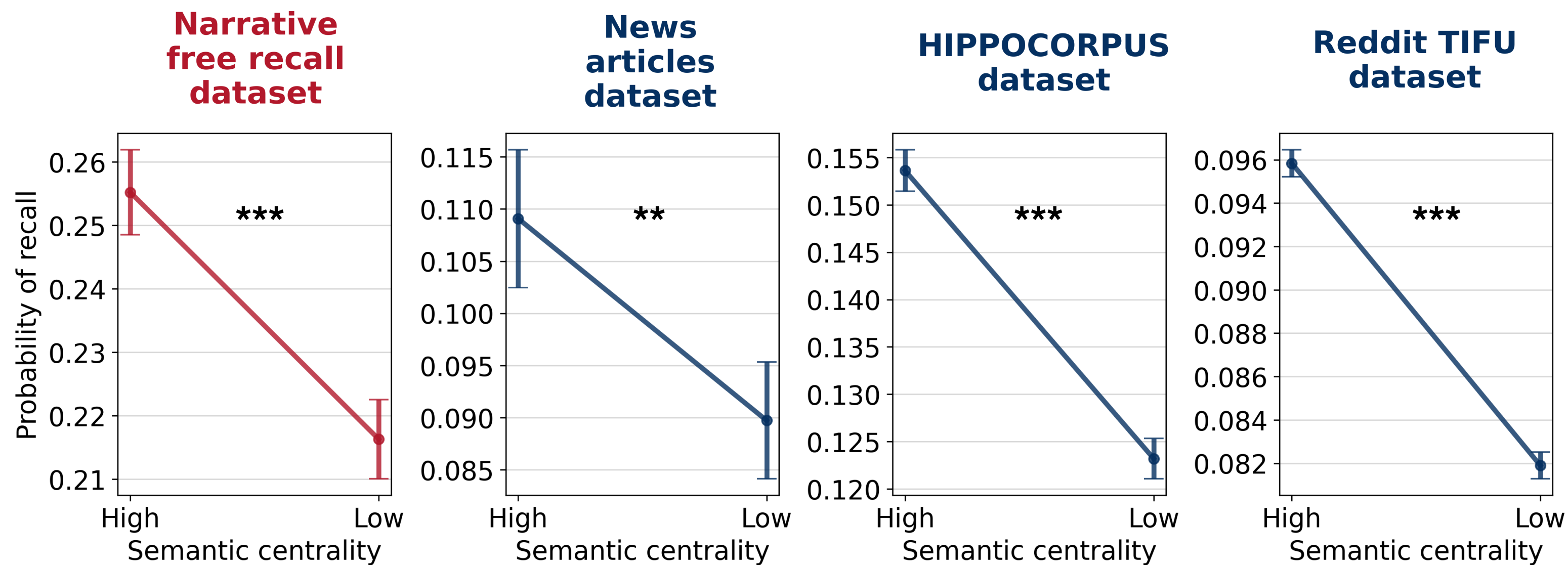
- **Semantic representation of the source:**



Semantic centrality analysis: Probability of recall

1. Motivation 2. Datasets 3. Summary == Recall 4. Recall == Summary 5. Differences

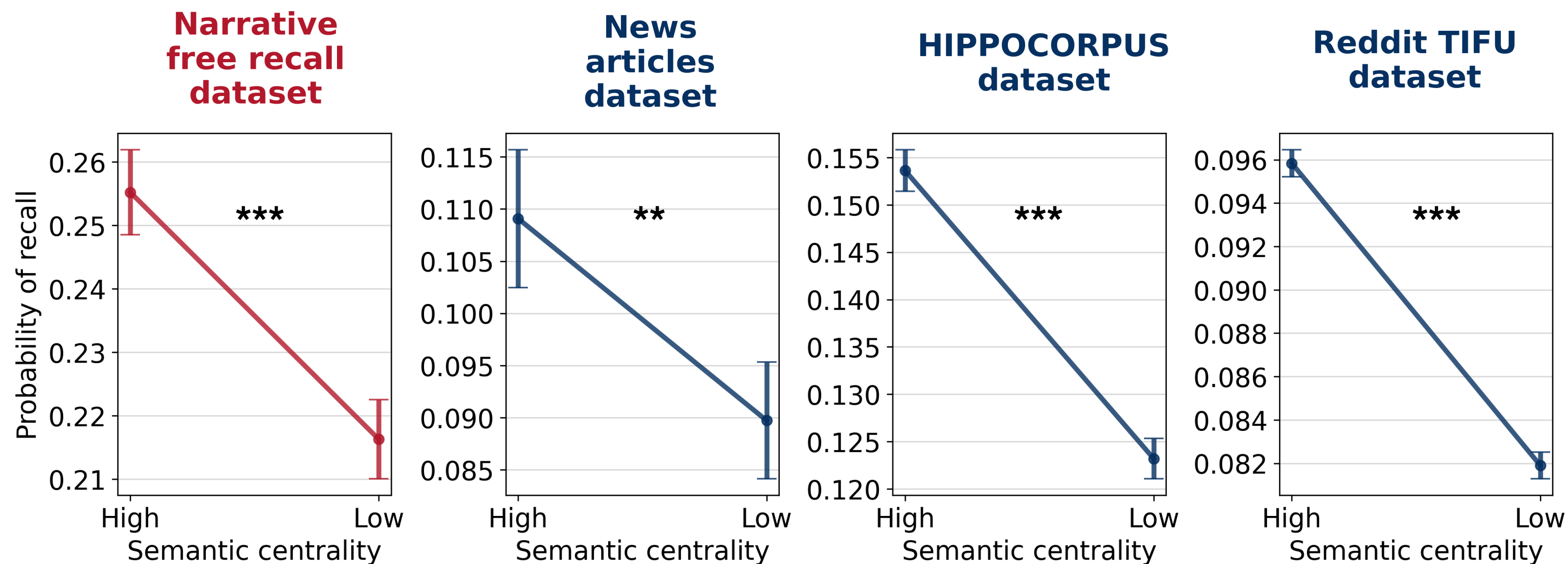
Sentences with high semantic centrality are more likely to be recalled



Semantic centrality analysis: Probability of recall

- This result aligns with existing literature that uses movies as naturalistic stimuli to explore memory behaviors Lee, H. et al. (2022), Anthony, J. et al. (2024)

Sentences with high semantic centrality are more likely to be recalled



Semantic centrality analysis of narrative free recall

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Narrative free recall data demonstrated a semantic centrality effect similar to that observed in summarization, suggesting that omitting less important details is strategic in more realistic recall settings

Overview

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

1. Motivation

2. Datasets

3. Summarization reflects recall characteristics

4. Recall reflects summarization characteristics

5. Differences between recall and summarization

Cross-scale transition analysis

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

We started with similarities, but there might be differences between the tasks:
Summarization may operate at a high level of hierarchy in the source,
whereas narrative free recall may operate at lower levels

Transition analysis

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

- We analyze **transitions** that a summary or recall makes as it unfolds

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

Summary: What happened is that I was on a trip with my friends going to Acadia National Park. During the car ride there, we got a little out of hand and the driver started to swerve, and we got pulled over by a cop and everything was fine. Just the moment itself was extremely scary.

Transition analysis

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

- We analyze **transitions** that a summary or recall makes as it unfolds

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Transition analysis

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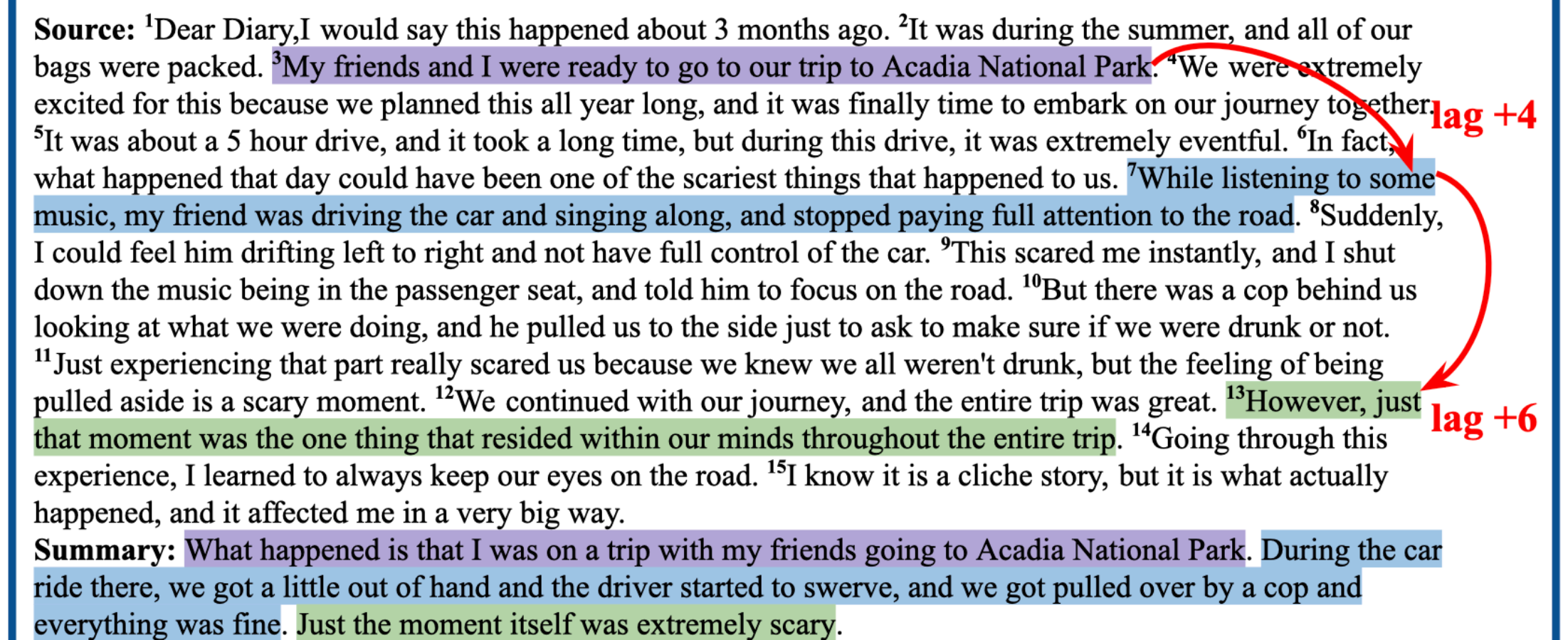
- We analyze **transitions** that a summary or recall makes as it unfolds

Previously used source sentences:

Summarization task

Source: ¹Dear Diary,I would say this happened about 3 months ago. ²It was during the summer, and all of our bags were packed. ³My friends and I were ready to go to our trip to Acadia National Park. ⁴We were extremely excited for this because we planned this all year long, and it was finally time to embark on our journey together. ⁵It was about a 5 hour drive, and it took a long time, but during this drive, it was extremely eventful. ⁶In fact, what happened that day could have been one of the scariest things that happened to us. ⁷While listening to some music, my friend was driving the car and singing along, and stopped paying full attention to the road. ⁸Suddenly, I could feel him drifting left to right and not have full control of the car. ⁹This scared me instantly, and I shut down the music being in the passenger seat, and told him to focus on the road. ¹⁰But there was a cop behind us looking at what we were doing, and he pulled us to the side just to ask to make sure if we were drunk or not. ¹¹Just experiencing that part really scared us because we knew we all weren't drunk, but the feeling of being pulled aside is a scary moment. ¹²We continued with our journey, and the entire trip was great. ¹³However, just that moment was the one thing that resided within our minds throughout the entire trip. ¹⁴Going through this experience, I learned to always keep our eyes on the road. ¹⁵I know it is a cliché story, but it is what actually happened, and it affected me in a very big way.

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Cross-scale transition analysis

1. Motivation

2. Datasets

3. Summary == Recall

4. Recall == Summary

5. Differences

Source segmentation:

- We analyze **transitions** that a summary or recall makes as it unfolds on **4 levels of source segmentation**

Cross-scale transition analysis

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Source segmentation: Coarse to fine-grained

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Cross-scale transition analysis

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- We analyze **transitions** that a summary or recall makes as it unfolds on **4 levels of source segmentation**

Source segmentation: Coarse to fine-grained

99% threshold:



Cross-scale transition analysis

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99% threshold:



98% threshold:



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Source segmentation: Coarse to fine-grained

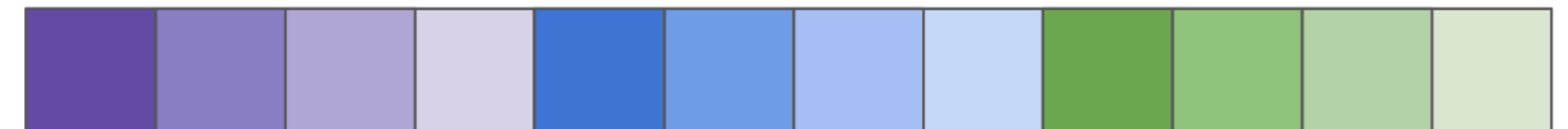
99% threshold:



98% threshold:



94% threshold:



Cross-scale transition analysis

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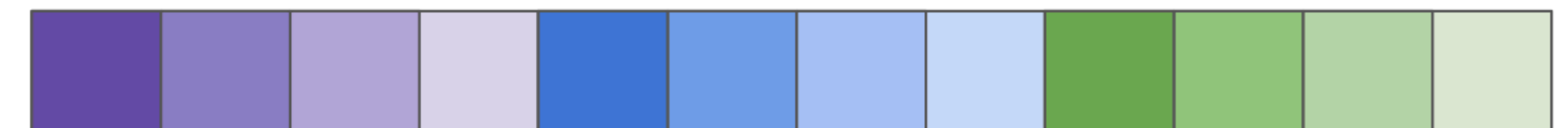
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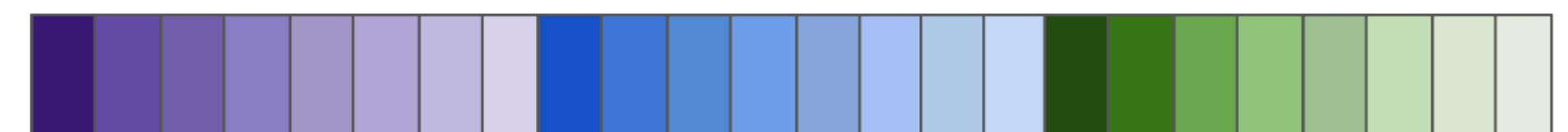
98% threshold:



94% threshold:



90% threshold:



Cross-scale transition analysis

1. Motivation

2. Datasets

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- We analyze **transitions** that a summary or recall makes as it unfolds on **4 levels of source segmentation**
- Segmentation done using probabilities from a language model (gpt-2-xl) and **Bayesian Surprise**

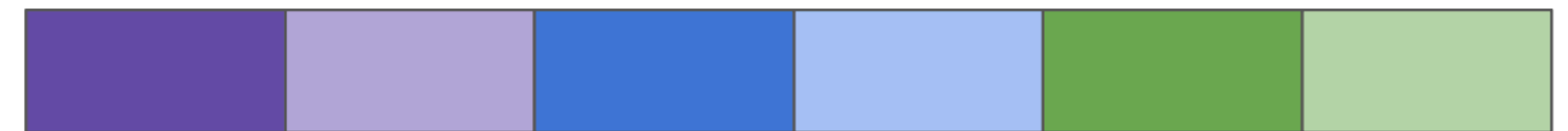
Kumar, M. et al. (2023)

Source segmentation: Coarse to fine-grained

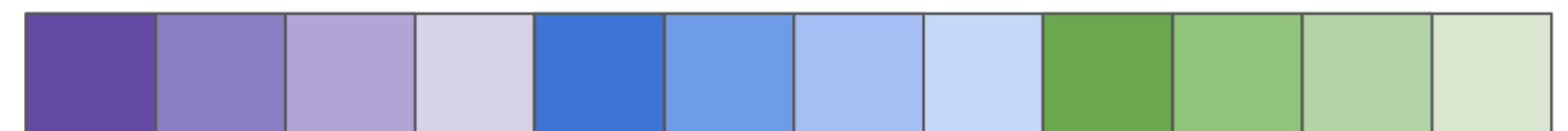
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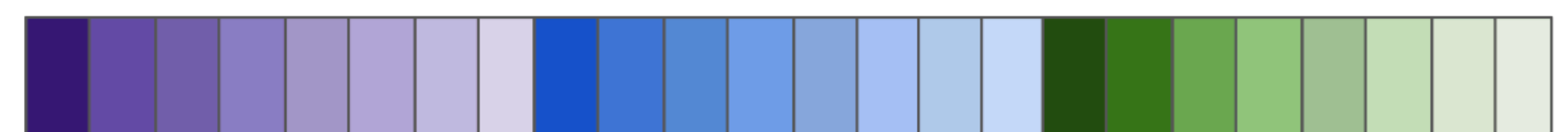
98% threshold:



94% threshold:



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Cross-scale transition analysis

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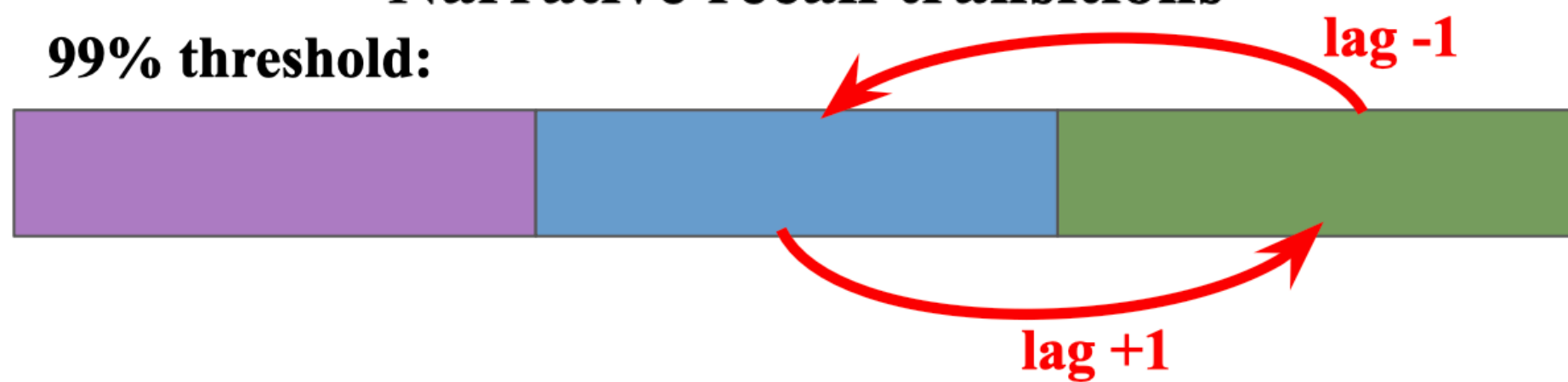
4. Recall == Summary

5. Differences

We propose that summaries operate at a coarse-grained, high level of hierarchy, skipping over minor details

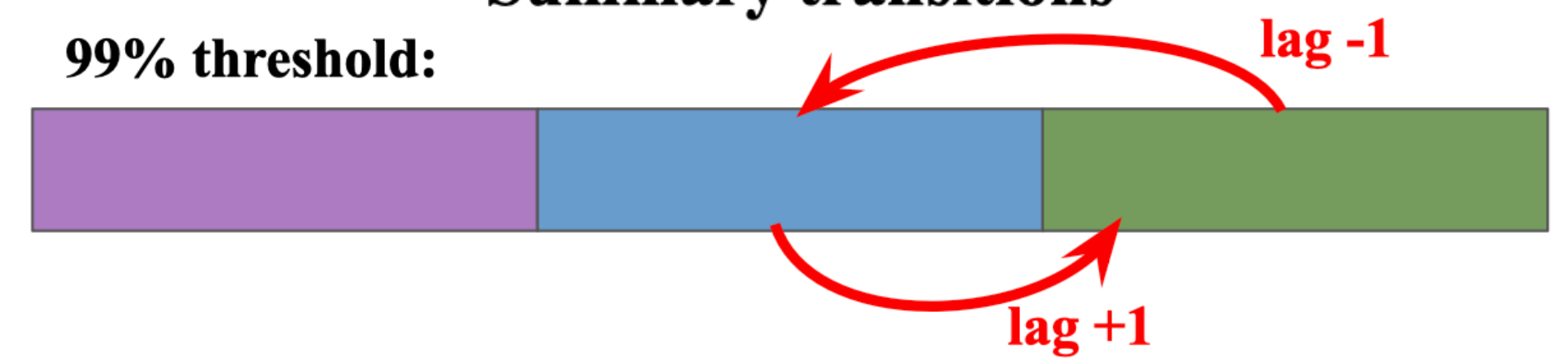
Narrative recall transitions

99% threshold:



Summary transitions

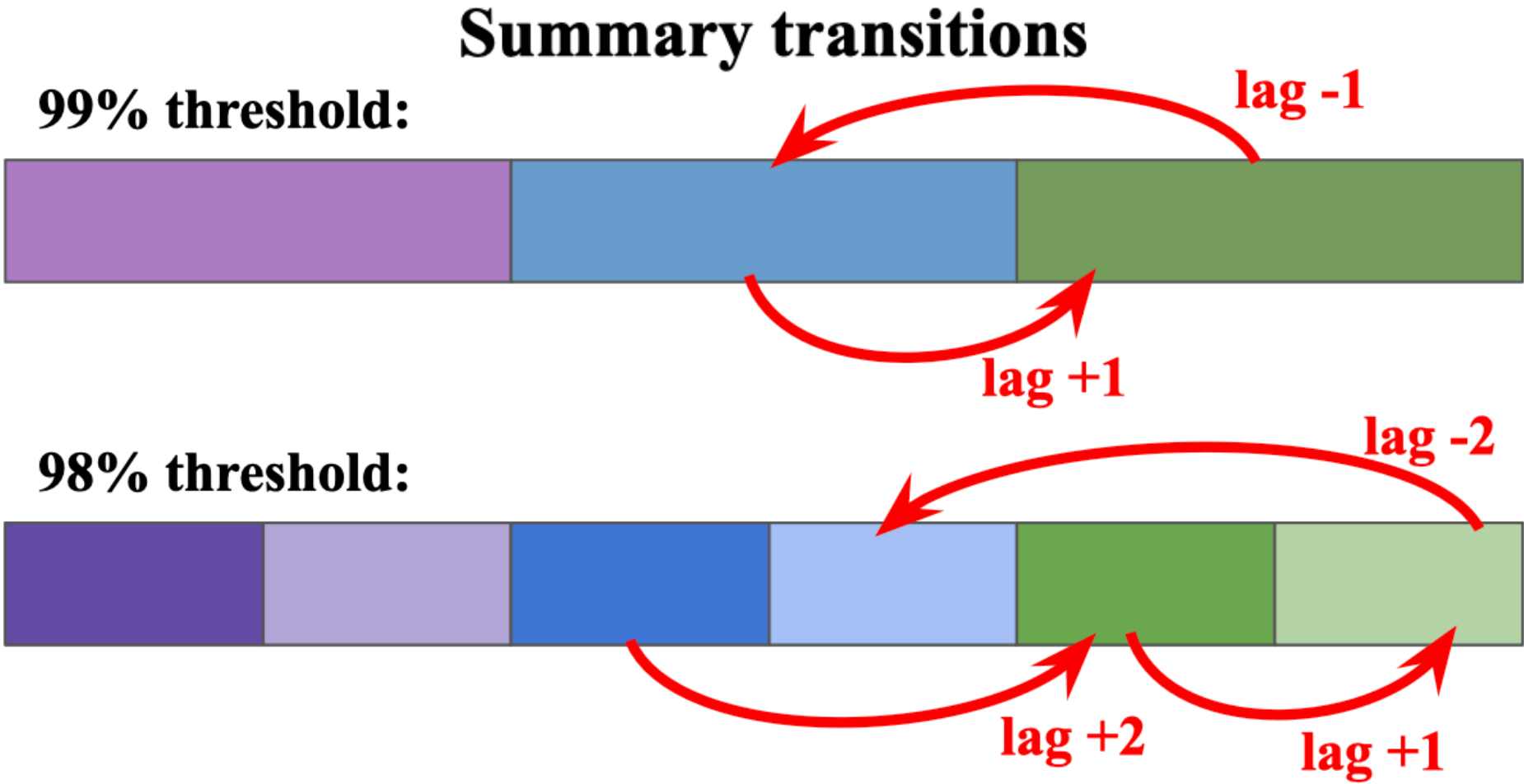
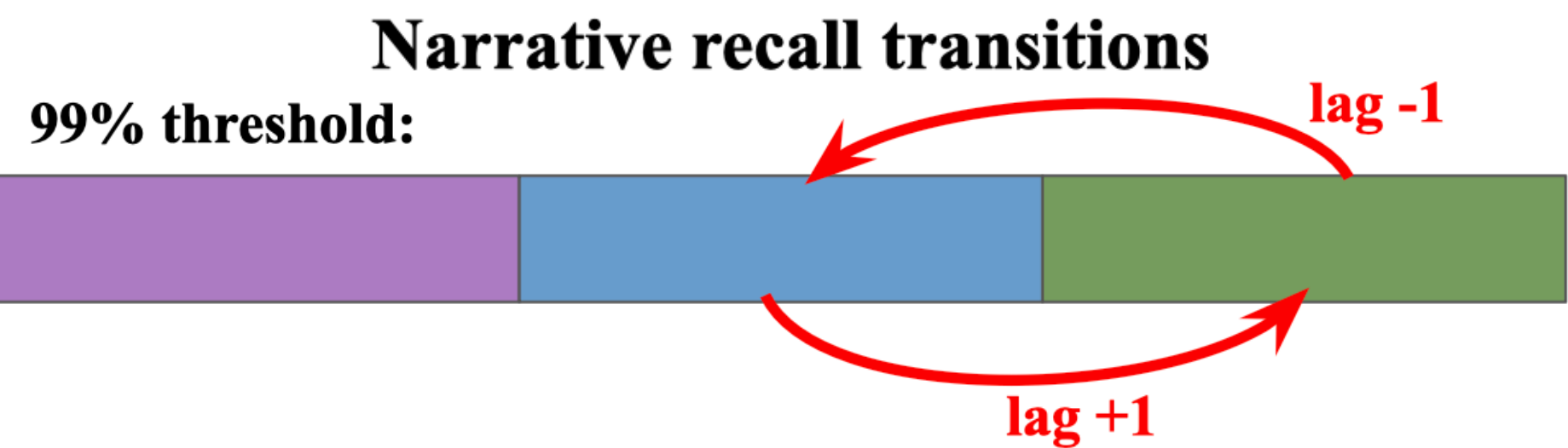
99% threshold:



Cross-scale transition analysis

1. Motivation 2. Datasets 3. Summary == Recall 4. Recall == Summary 5. Differences

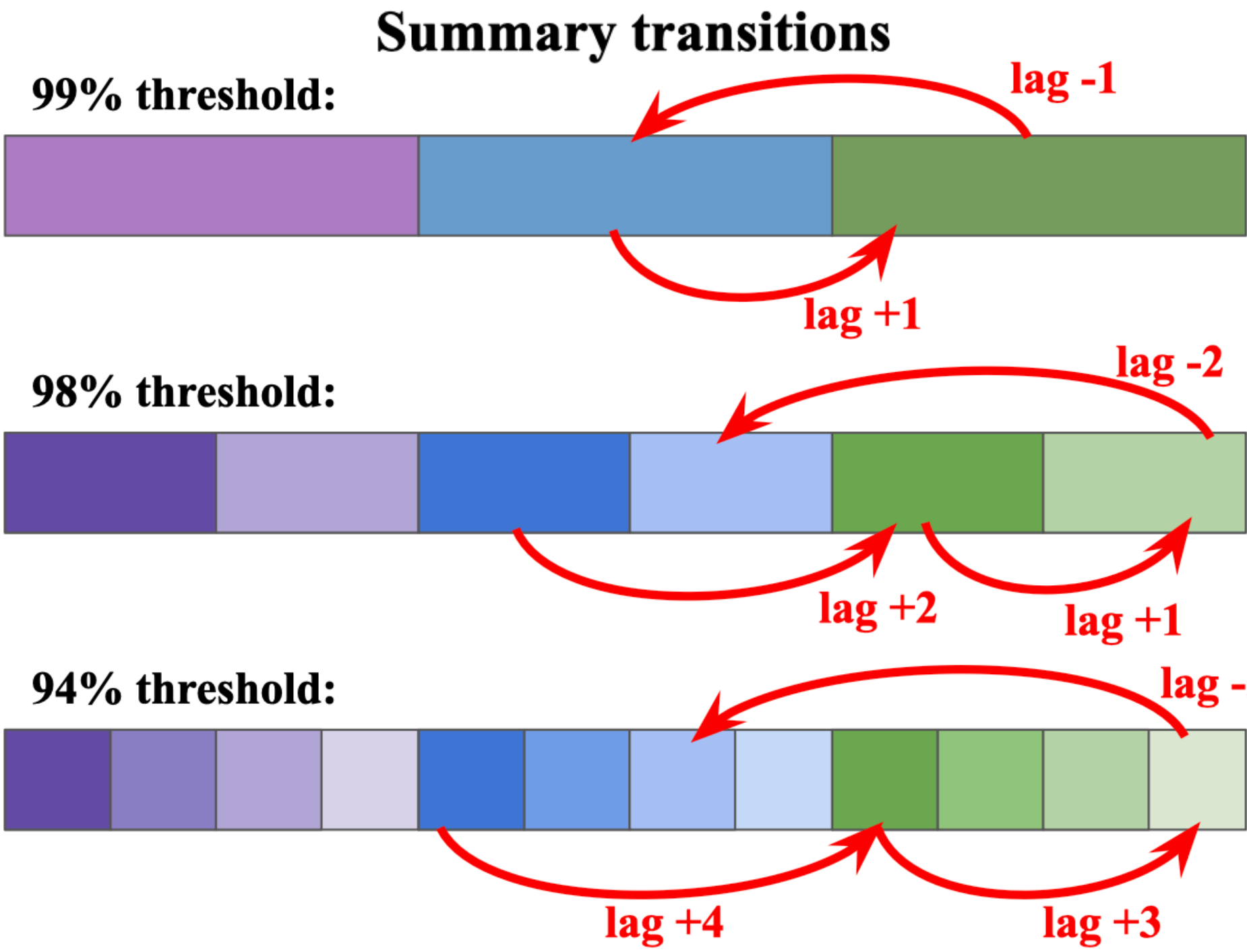
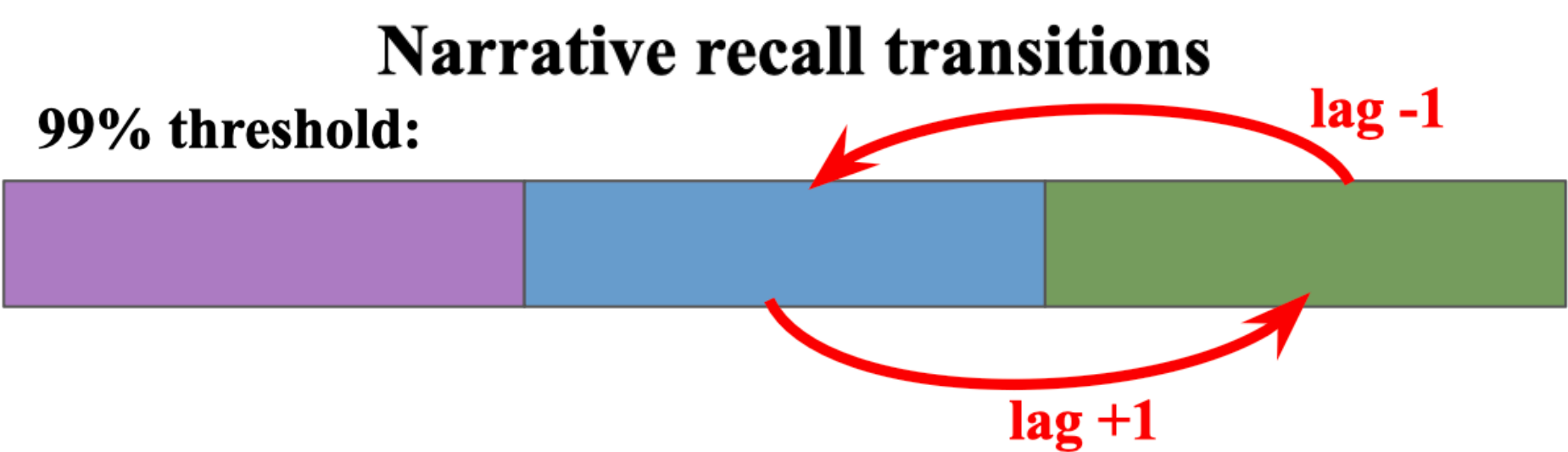
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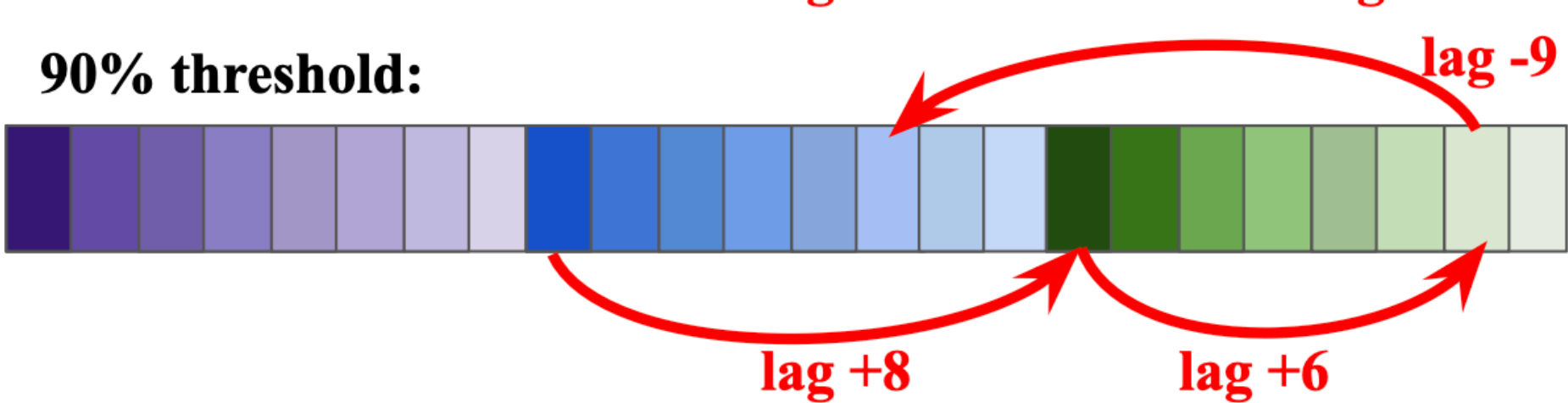
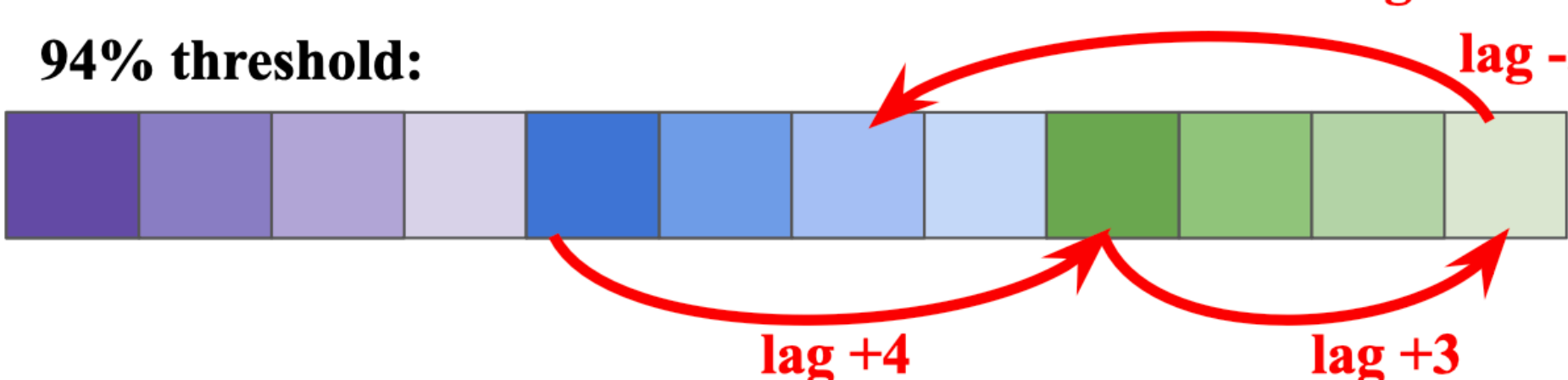
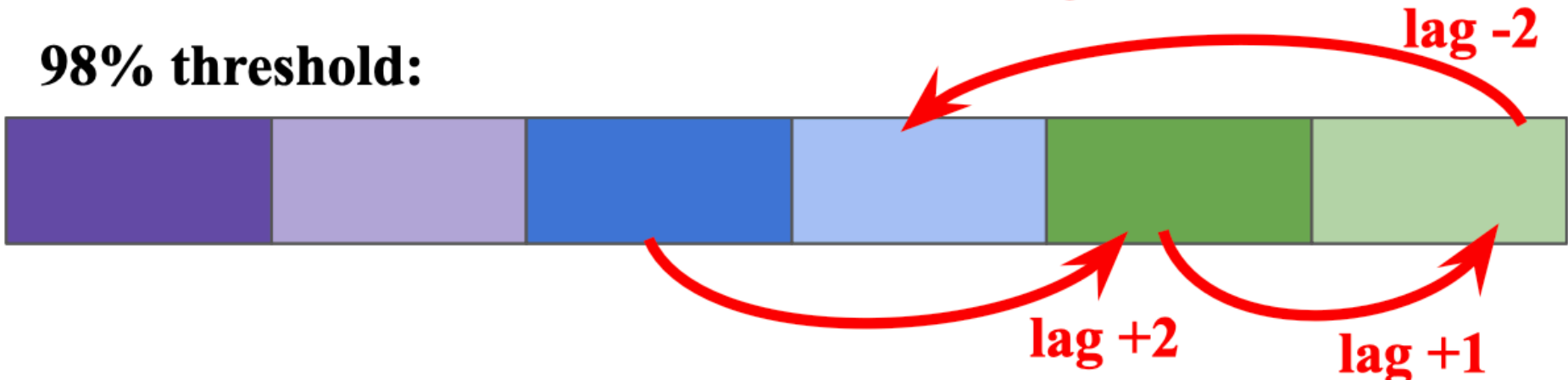
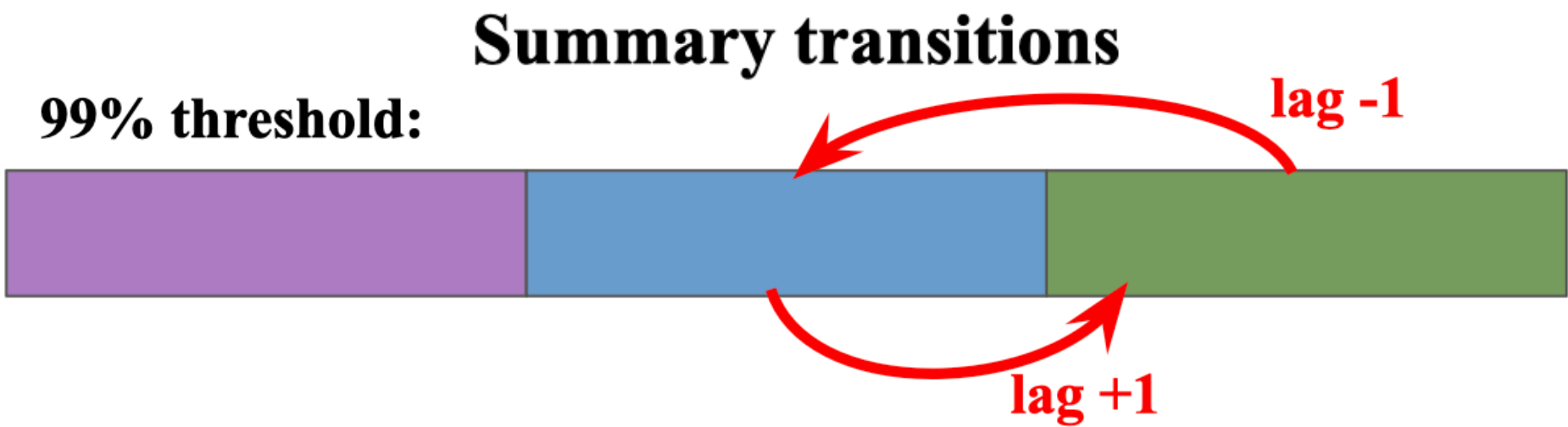
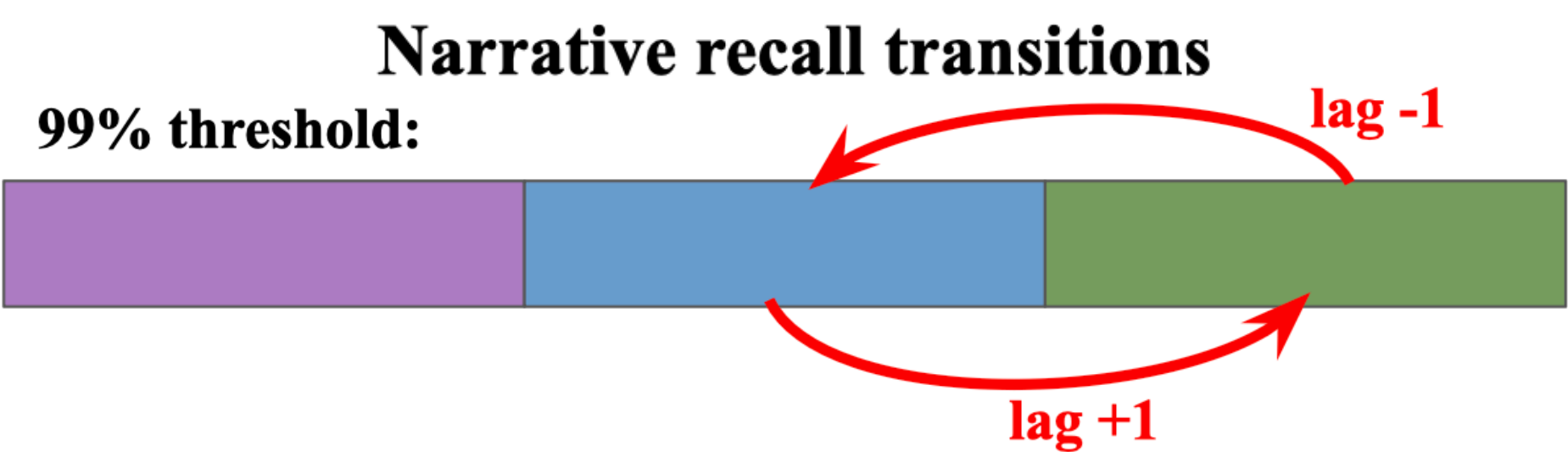
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Cross-scale transition analysis

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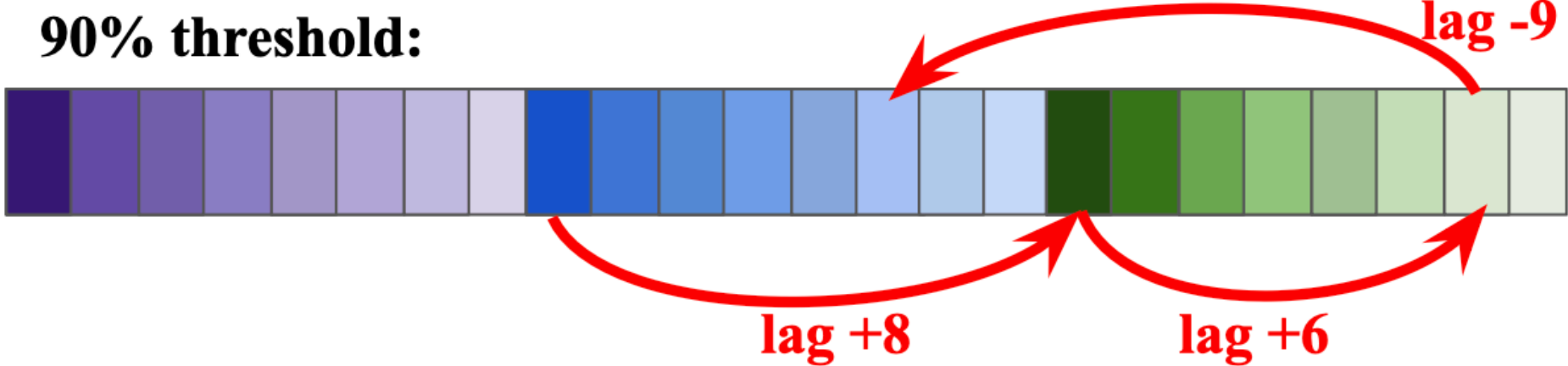
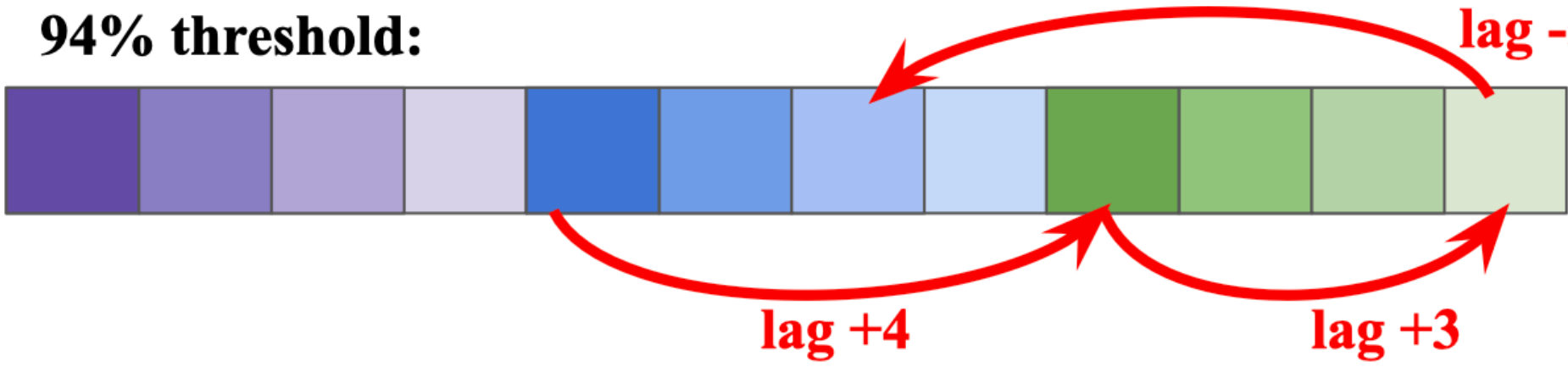
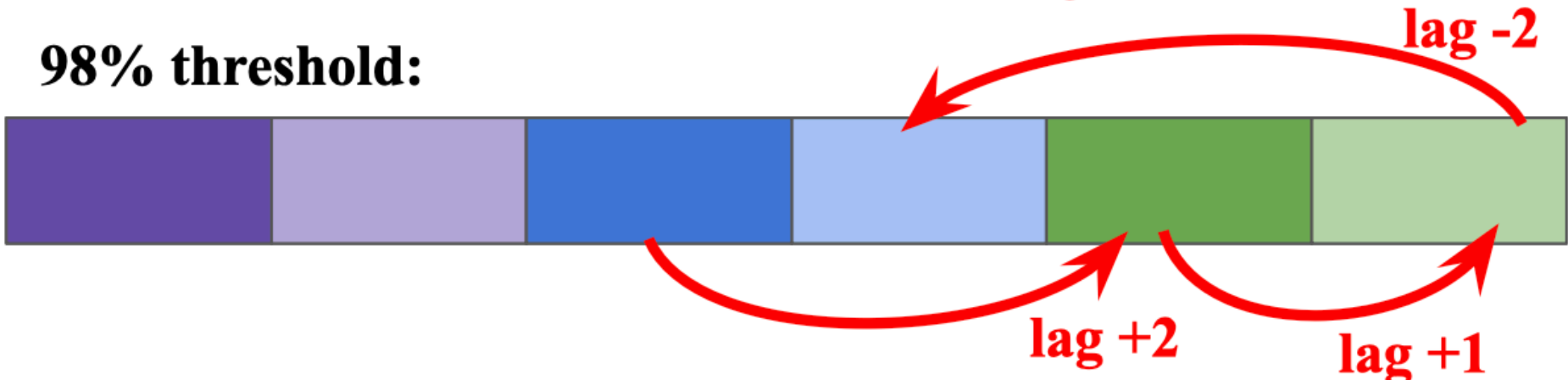
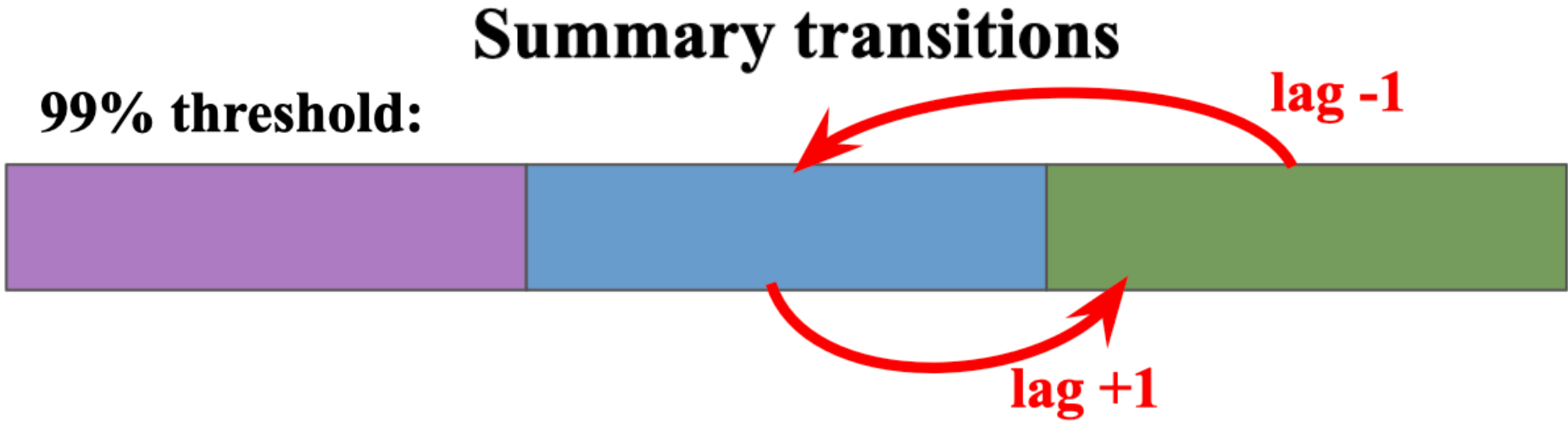
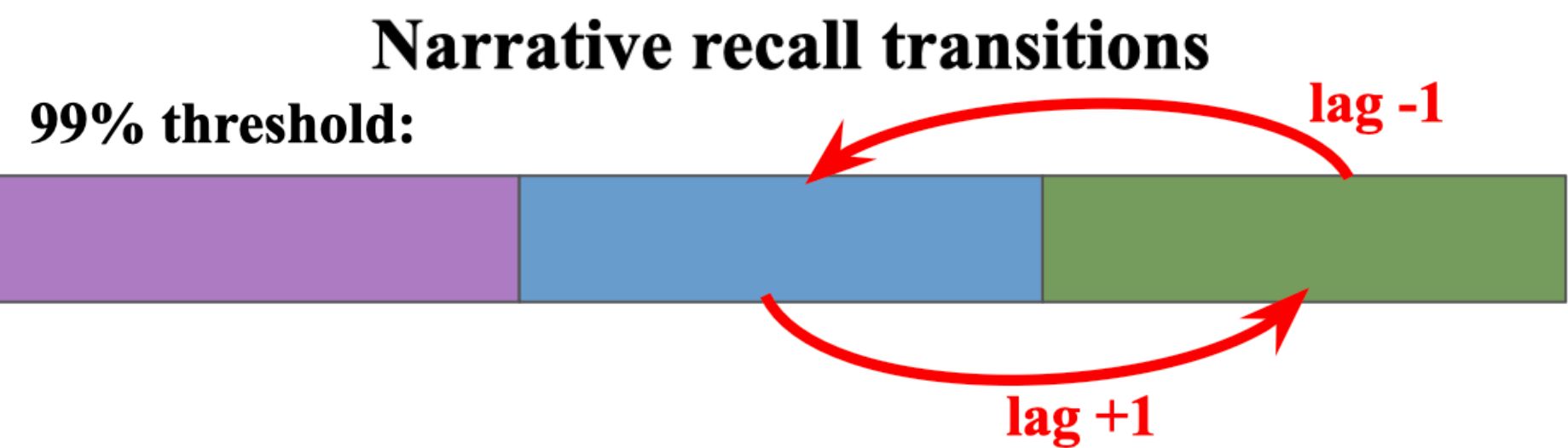
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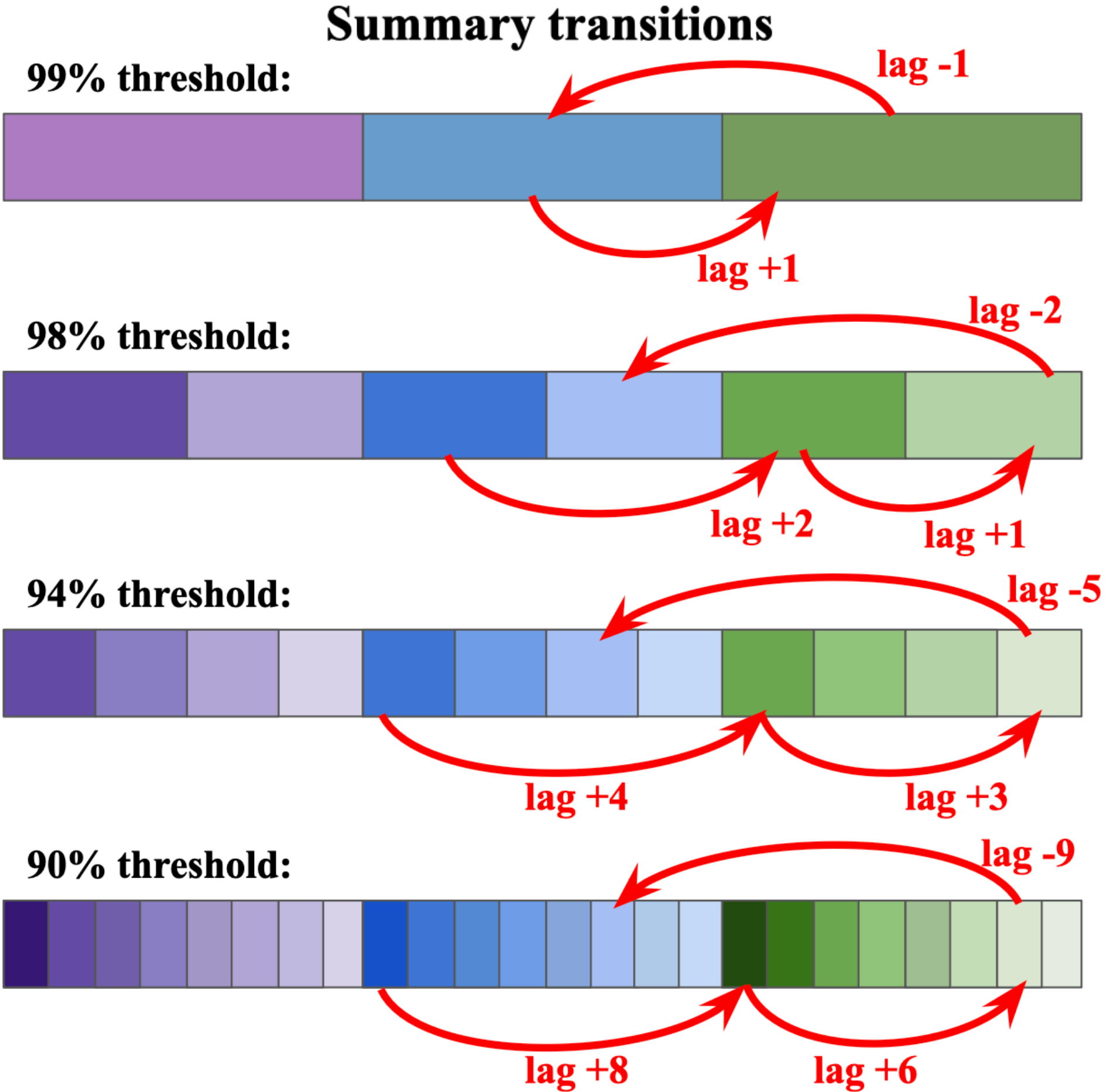
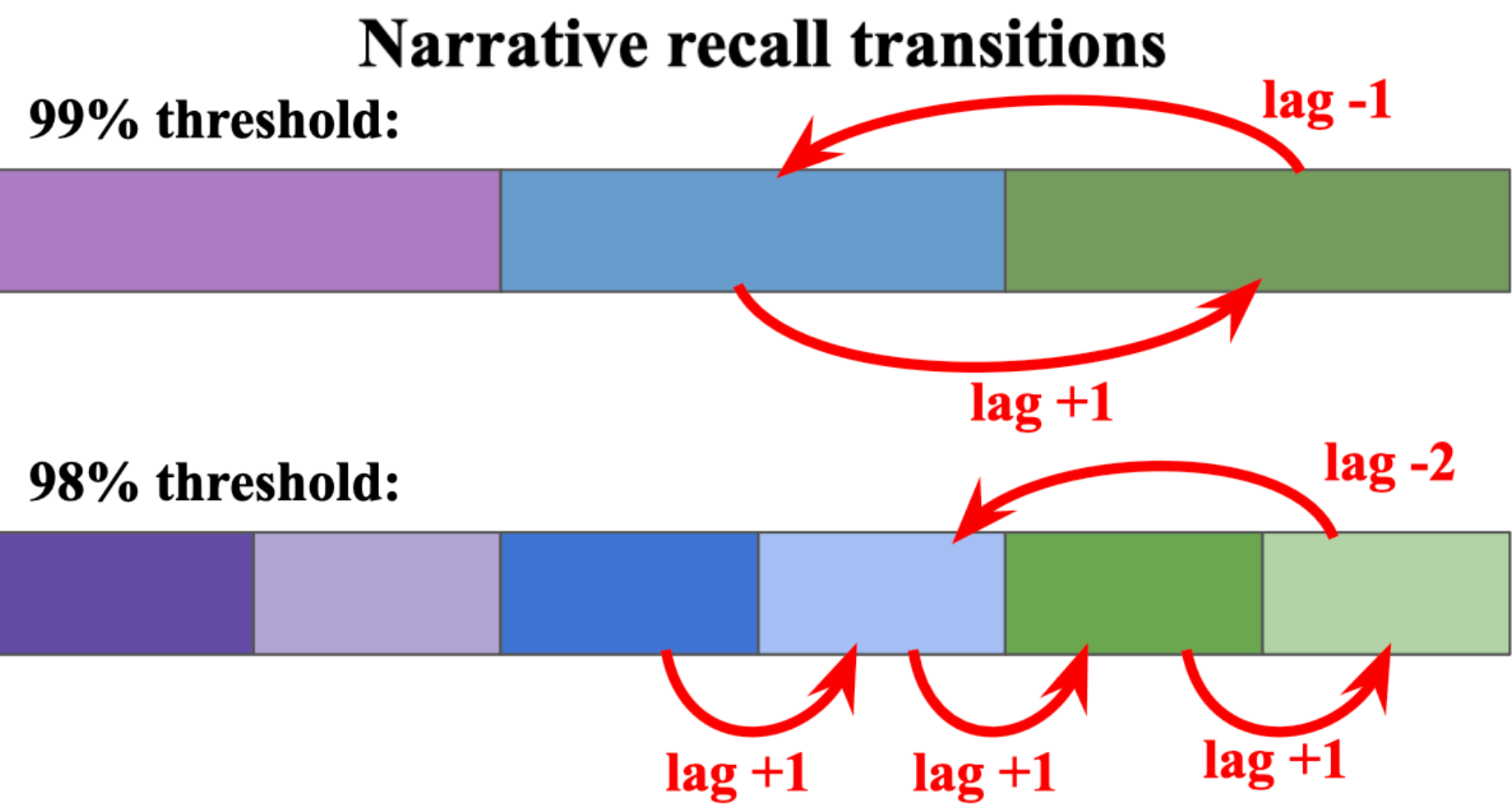
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Cross-scale transition analysis

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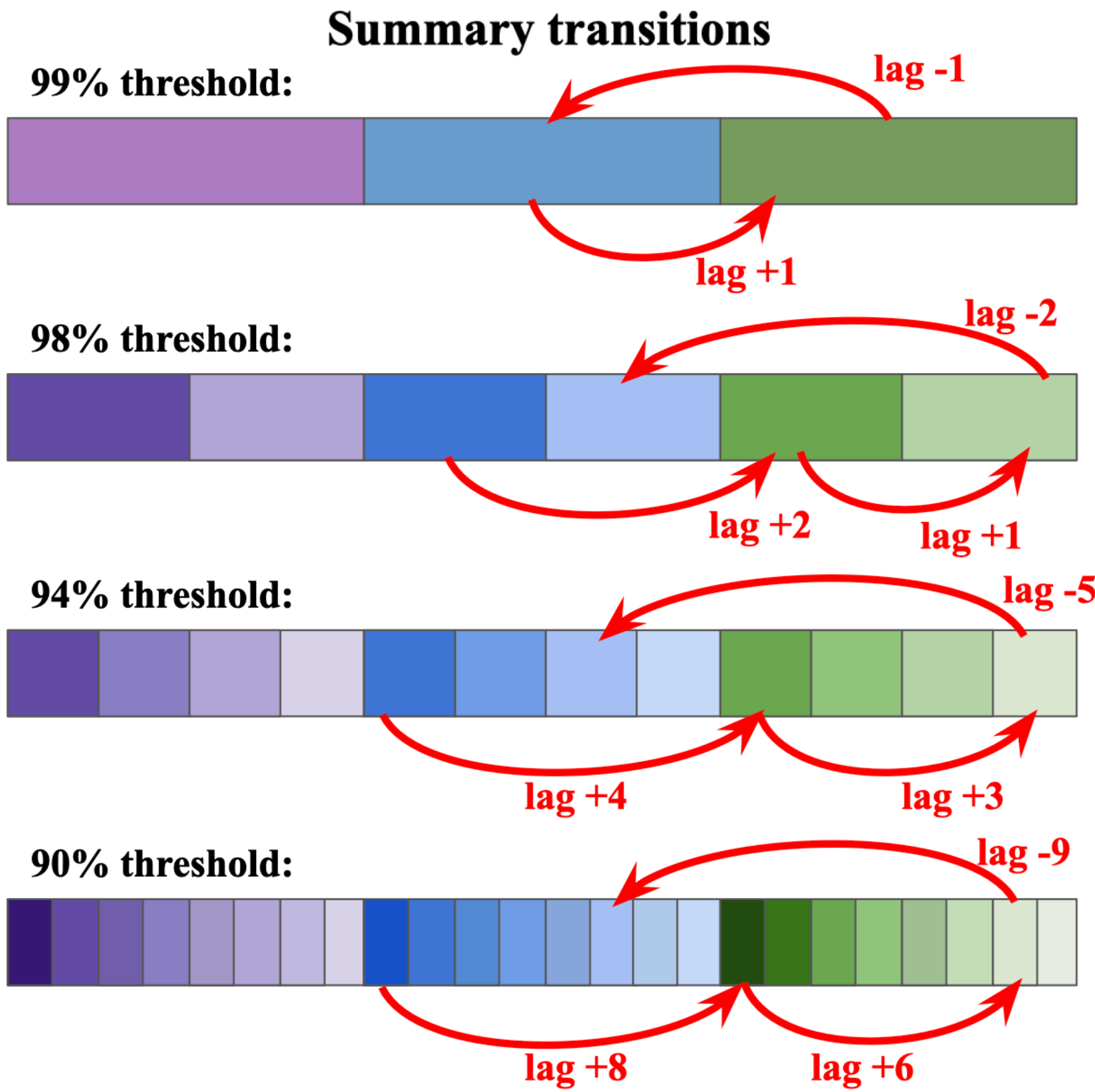
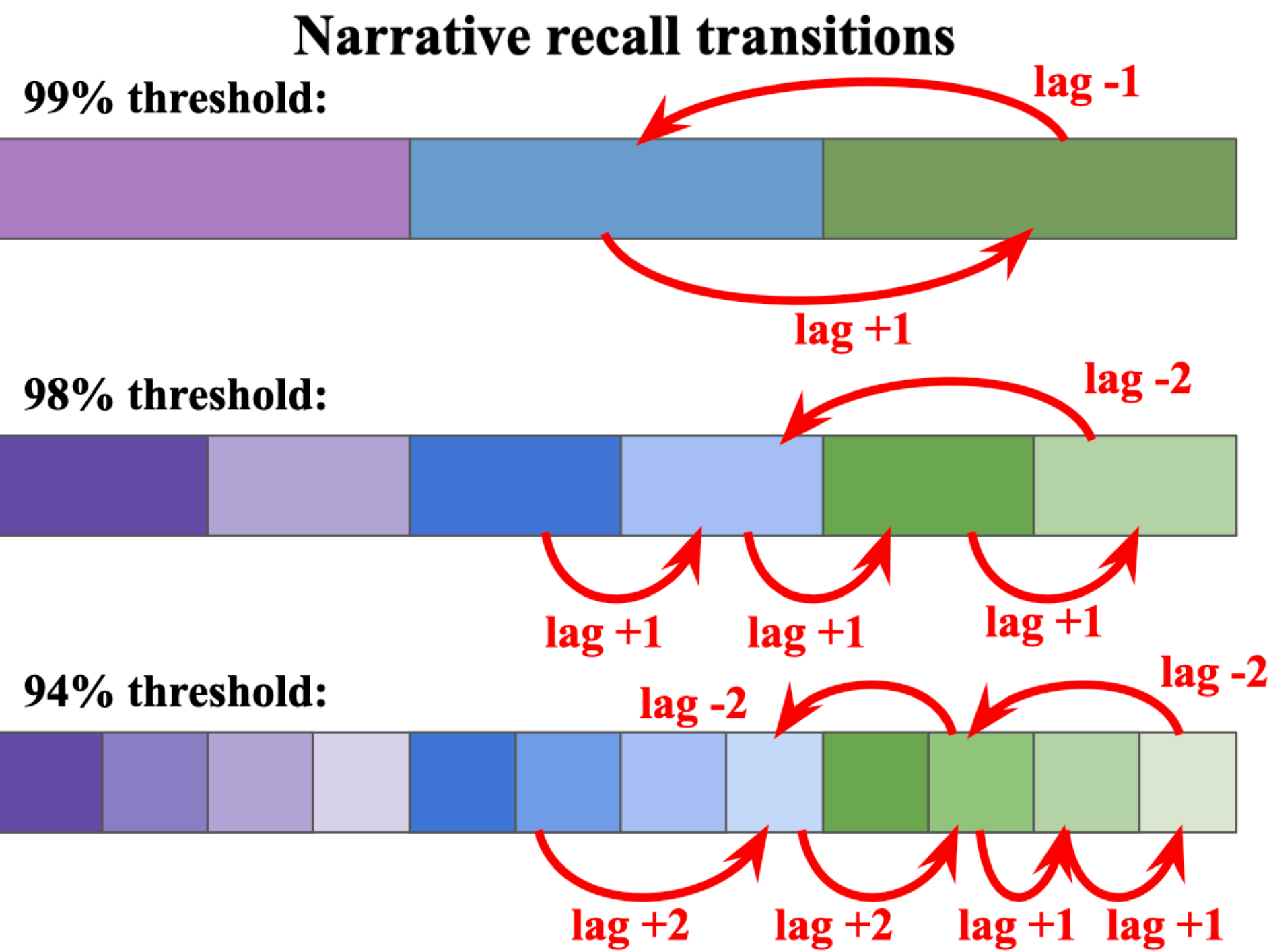
2. Datasets

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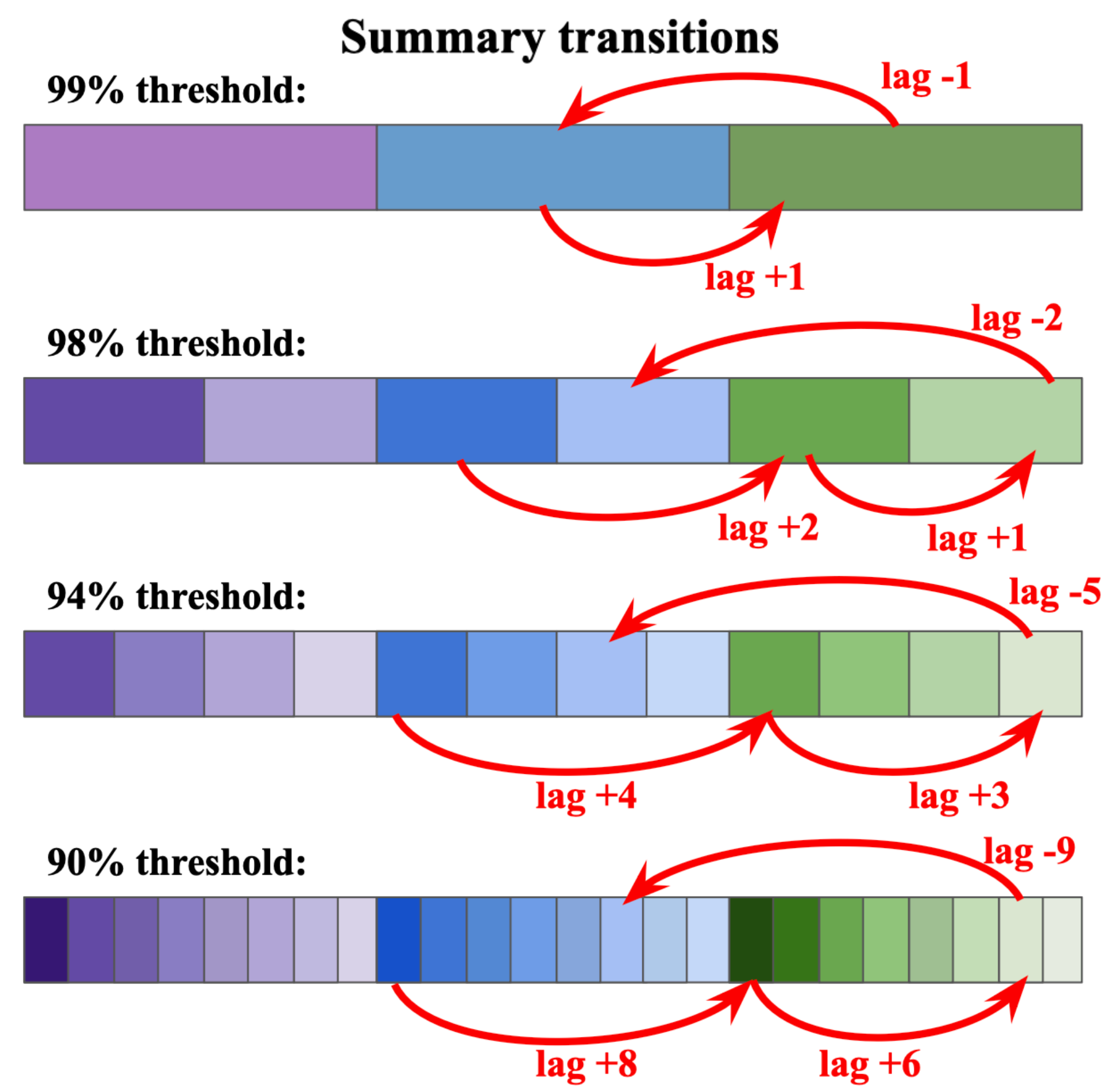
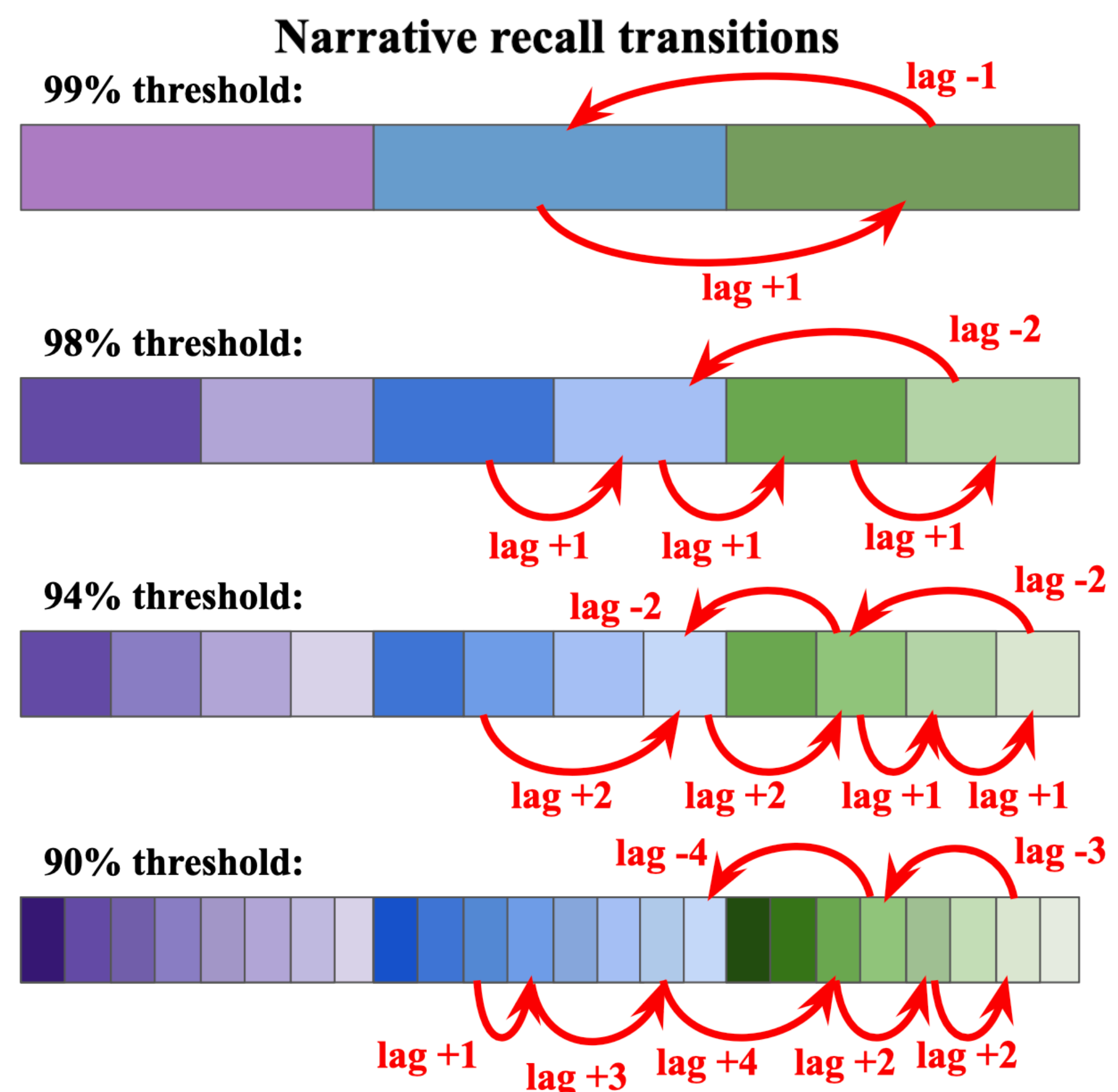
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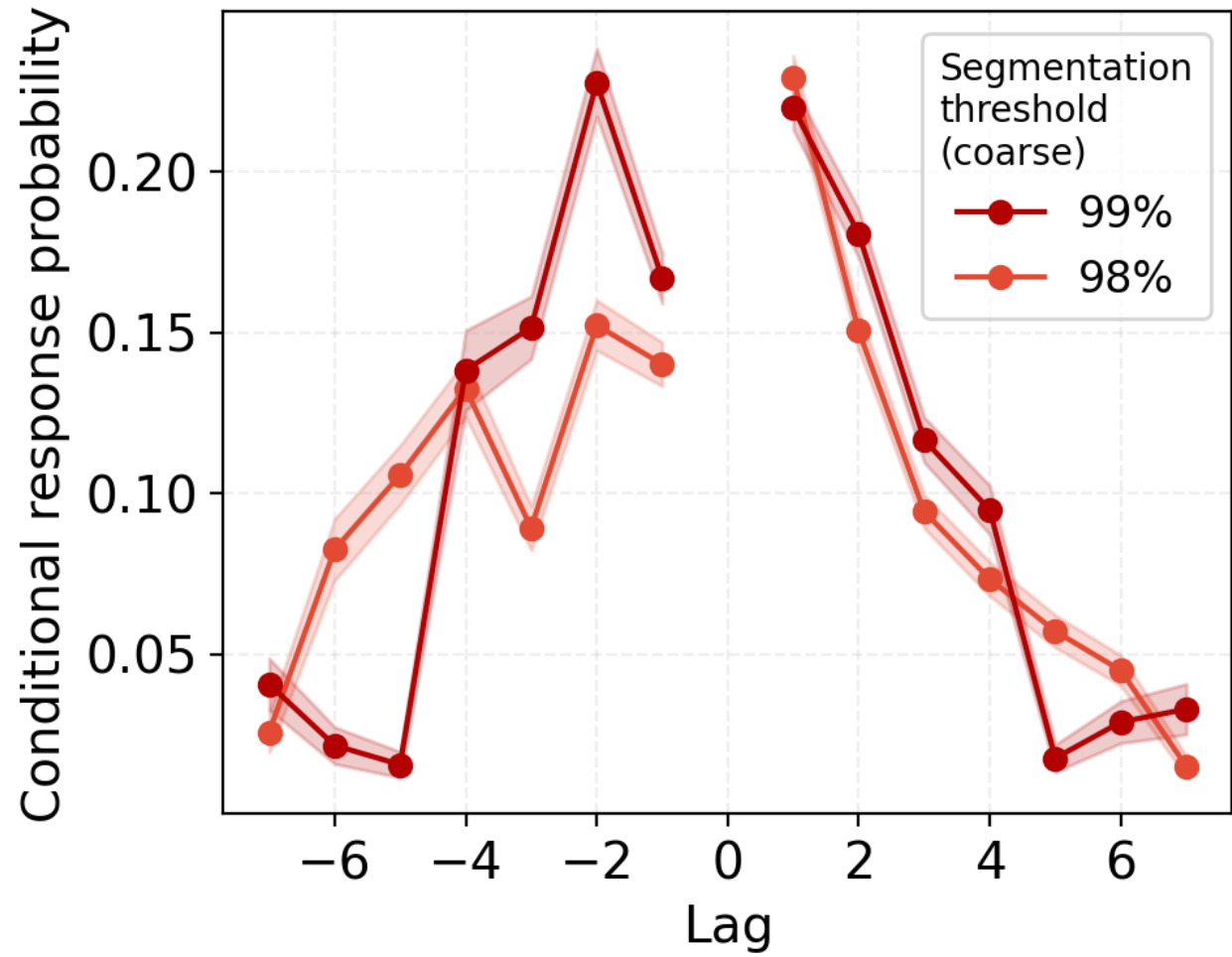
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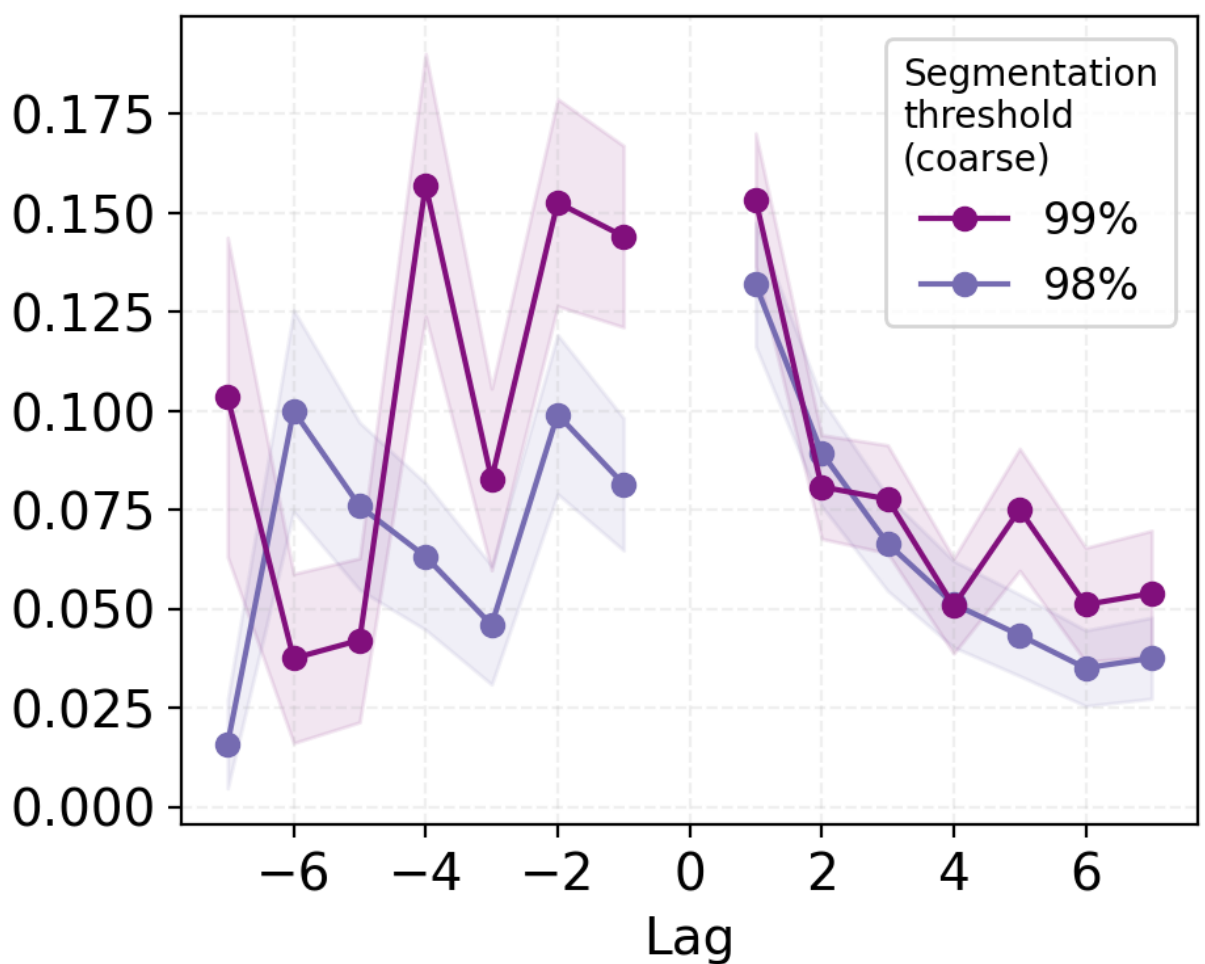
Cross-scale transition analysis: Conditional response probability

For coarse segmentation, nearby segments are recalled/summarized successively in all datasets

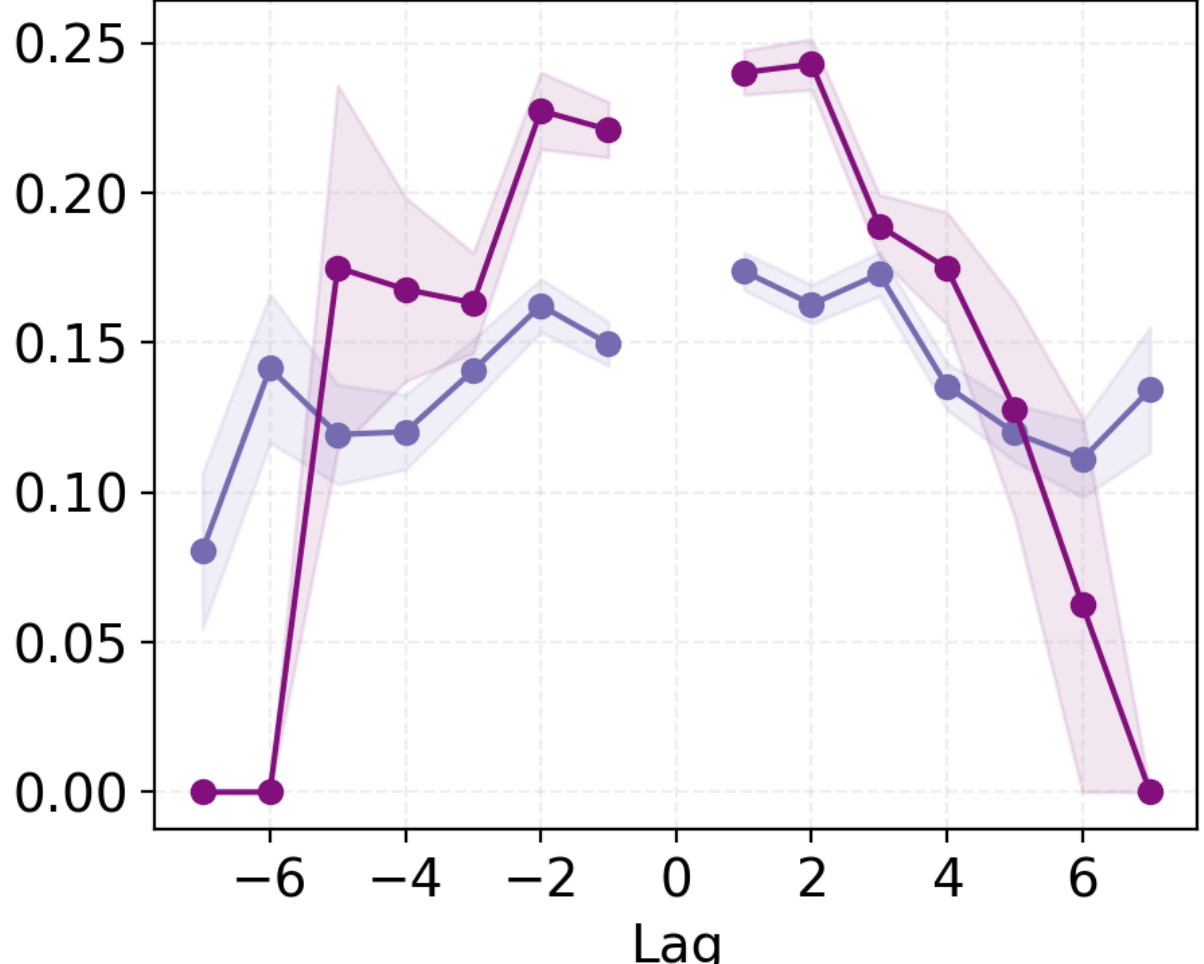
Narrative free recall dataset



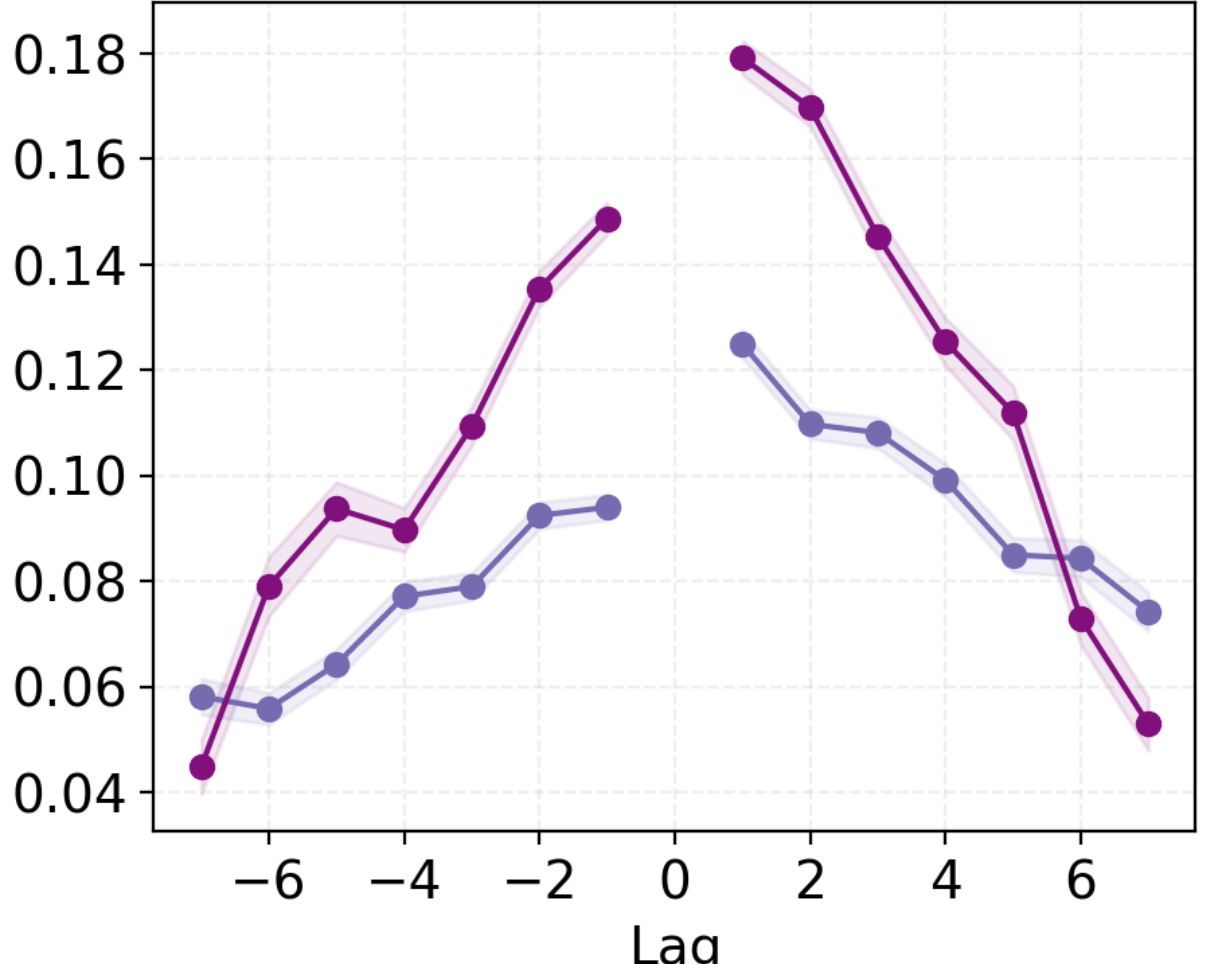
News articles dataset



HIPPOCORPUS dataset



Reddit TIFU dataset

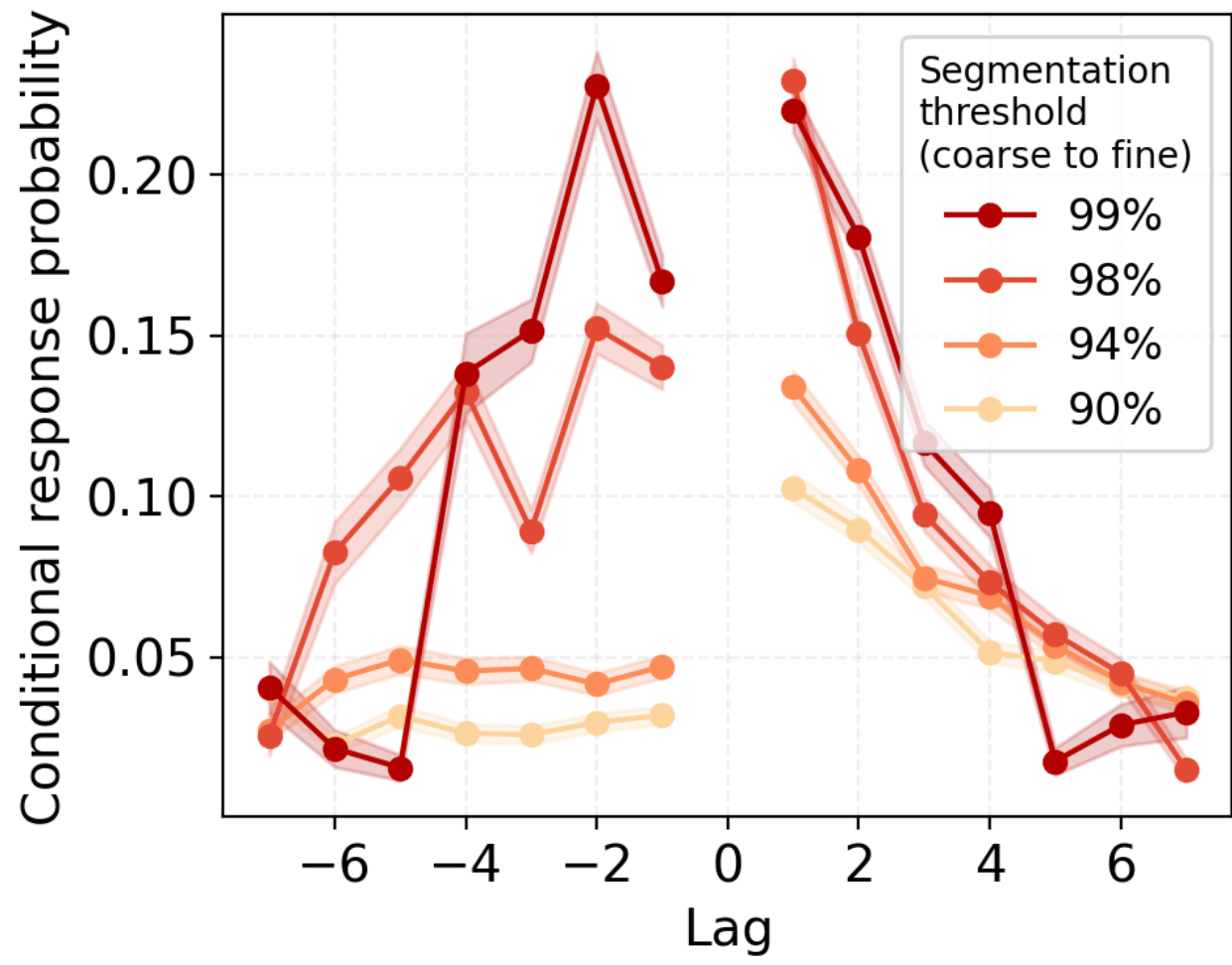


Cross-scale transition analysis: Conditional response probability

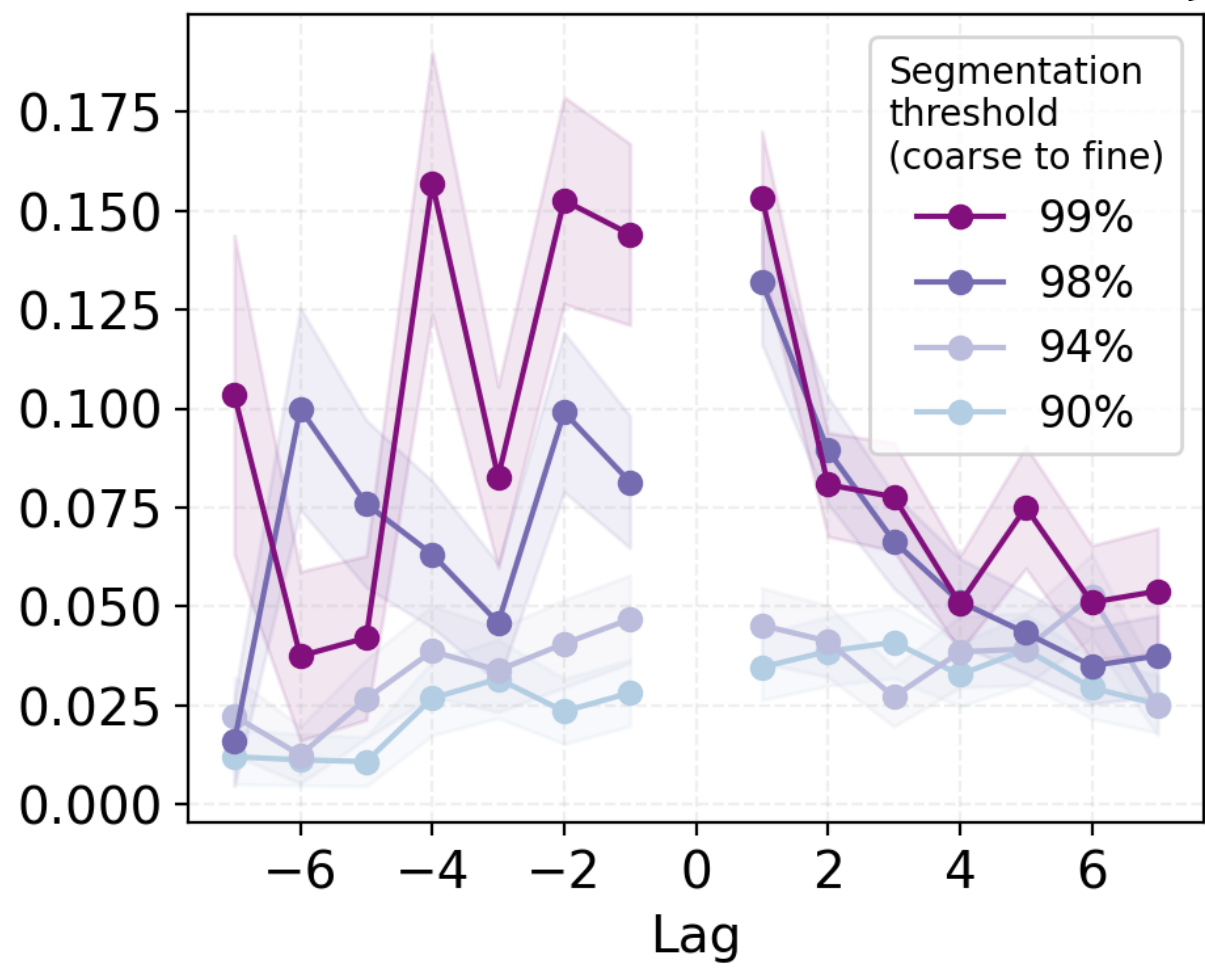
For coarse segmentation,
nearby segments are recalled/summarized successively in all datasets

For fine-grained segmentation,
strong temporal contiguity was only observed in narrative free recall

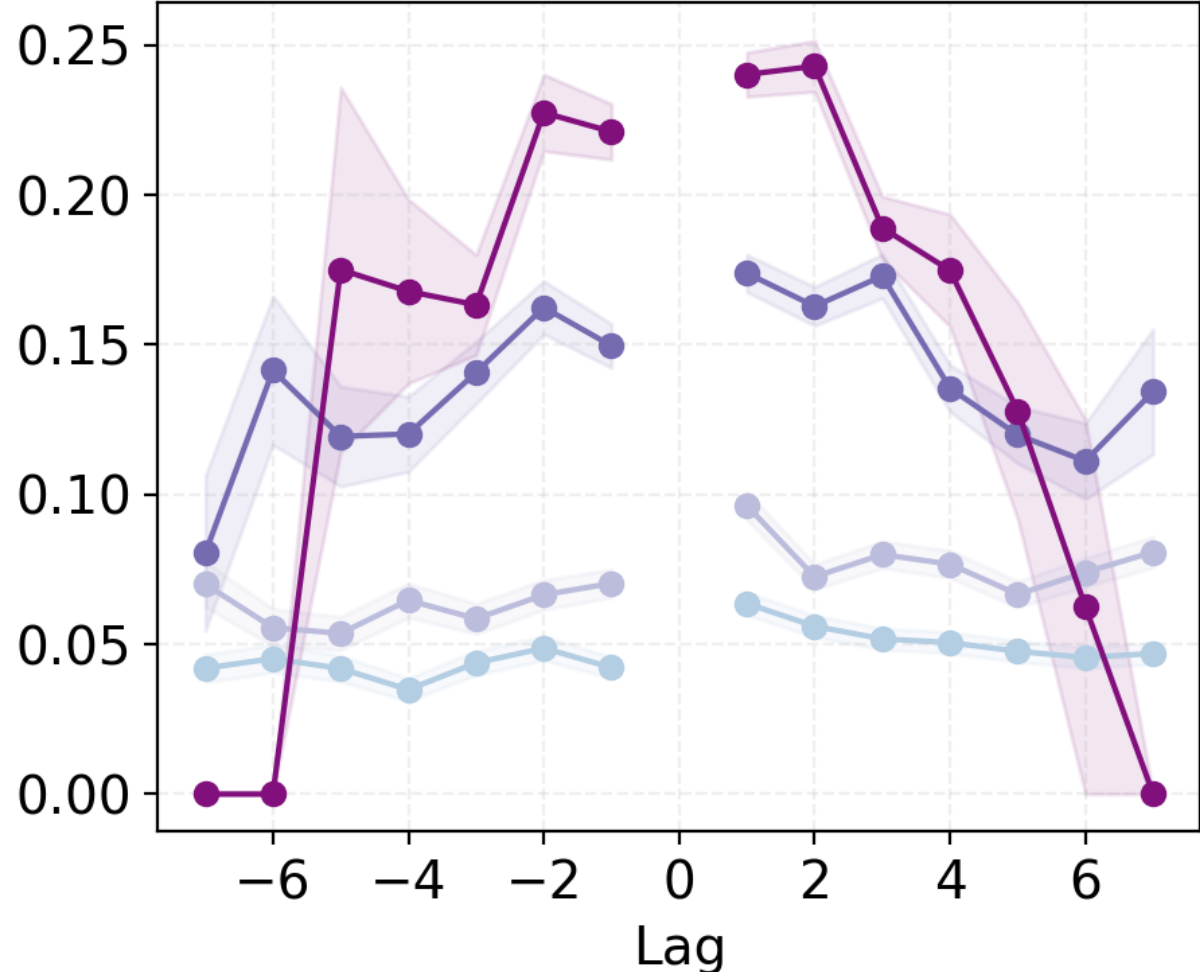
**Narrative
free recall
dataset**



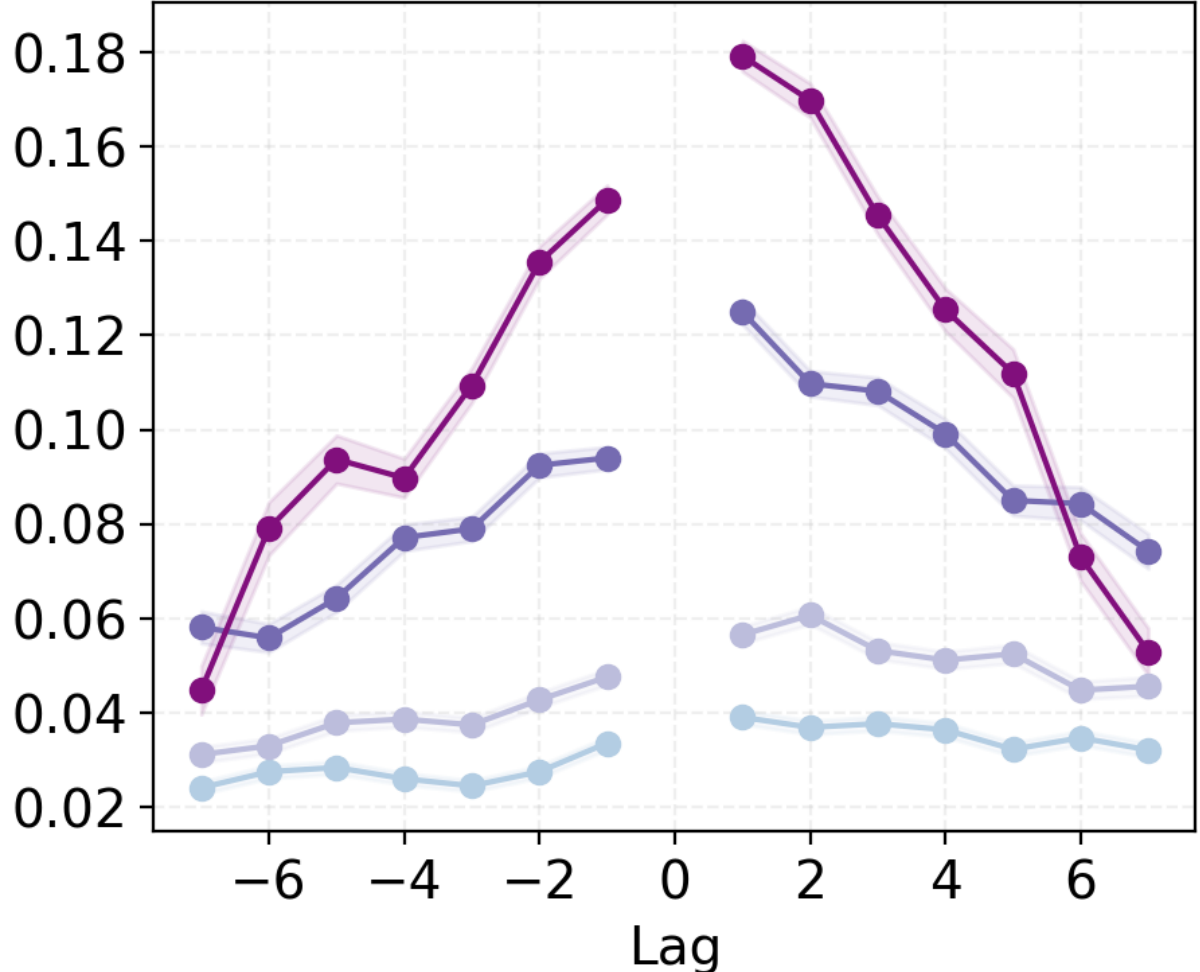
**News
articles
dataset**



**HIPPOCORPUS
dataset**



**Reddit TIFU
dataset**



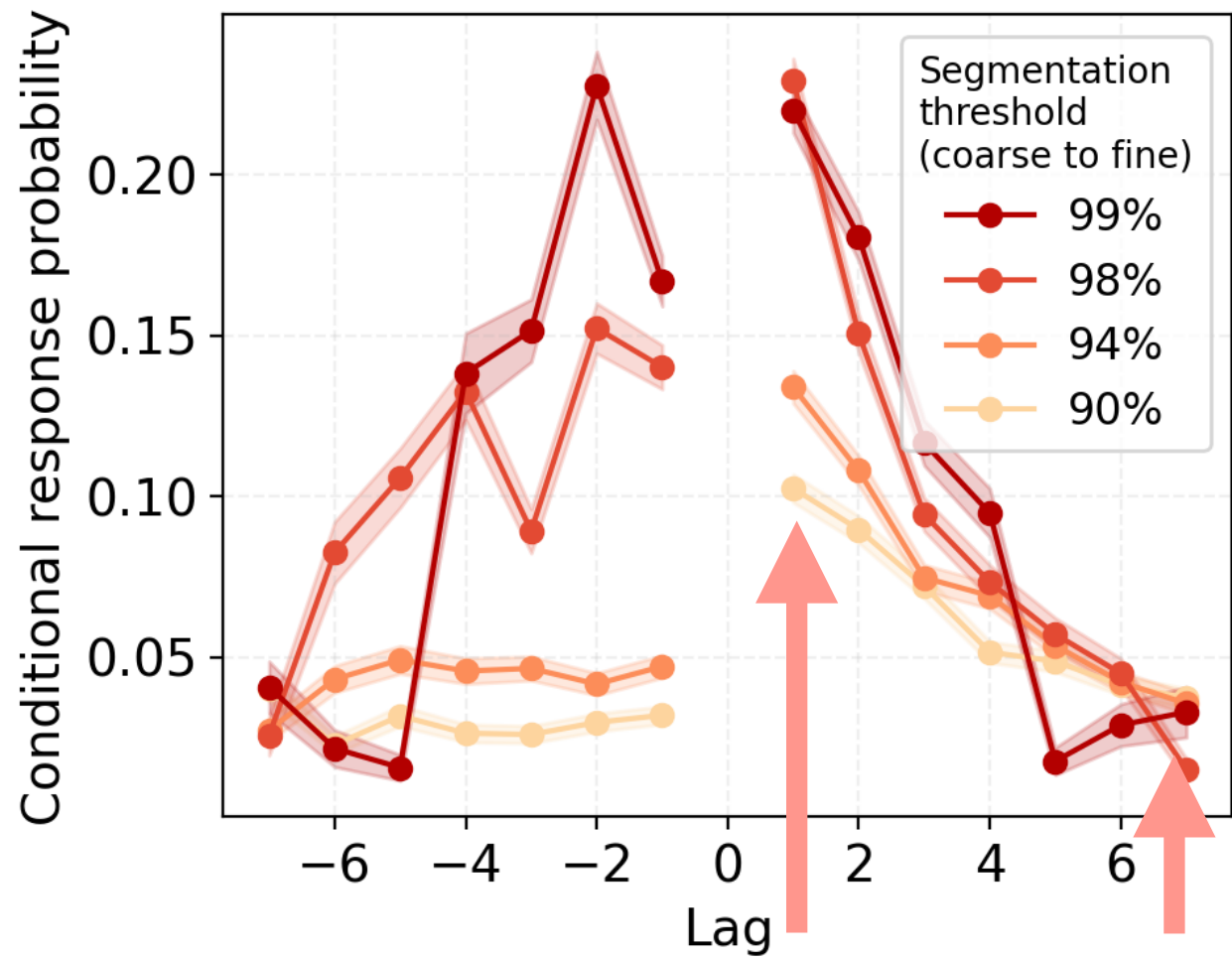
Cross-scale transition analysis: Conditional response probability

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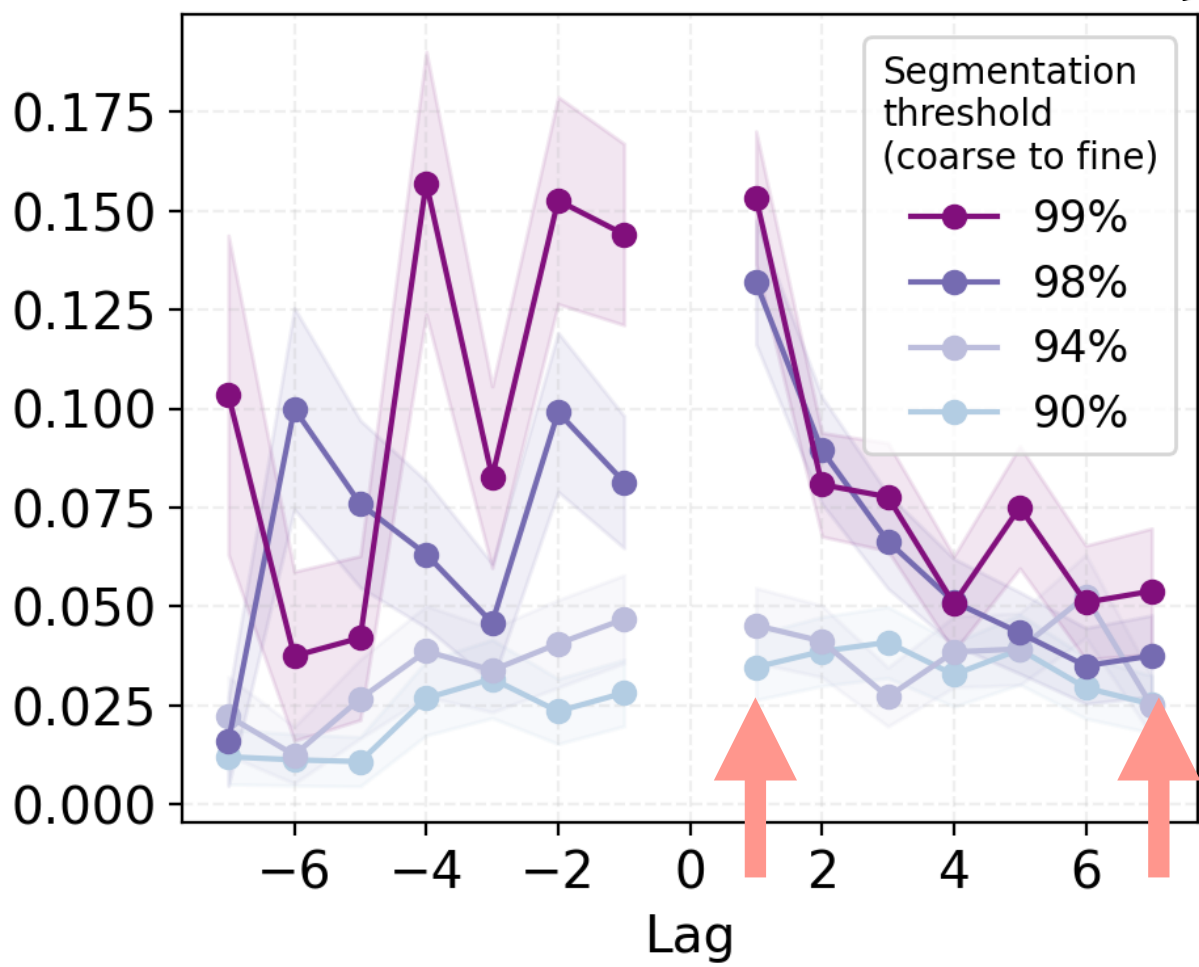
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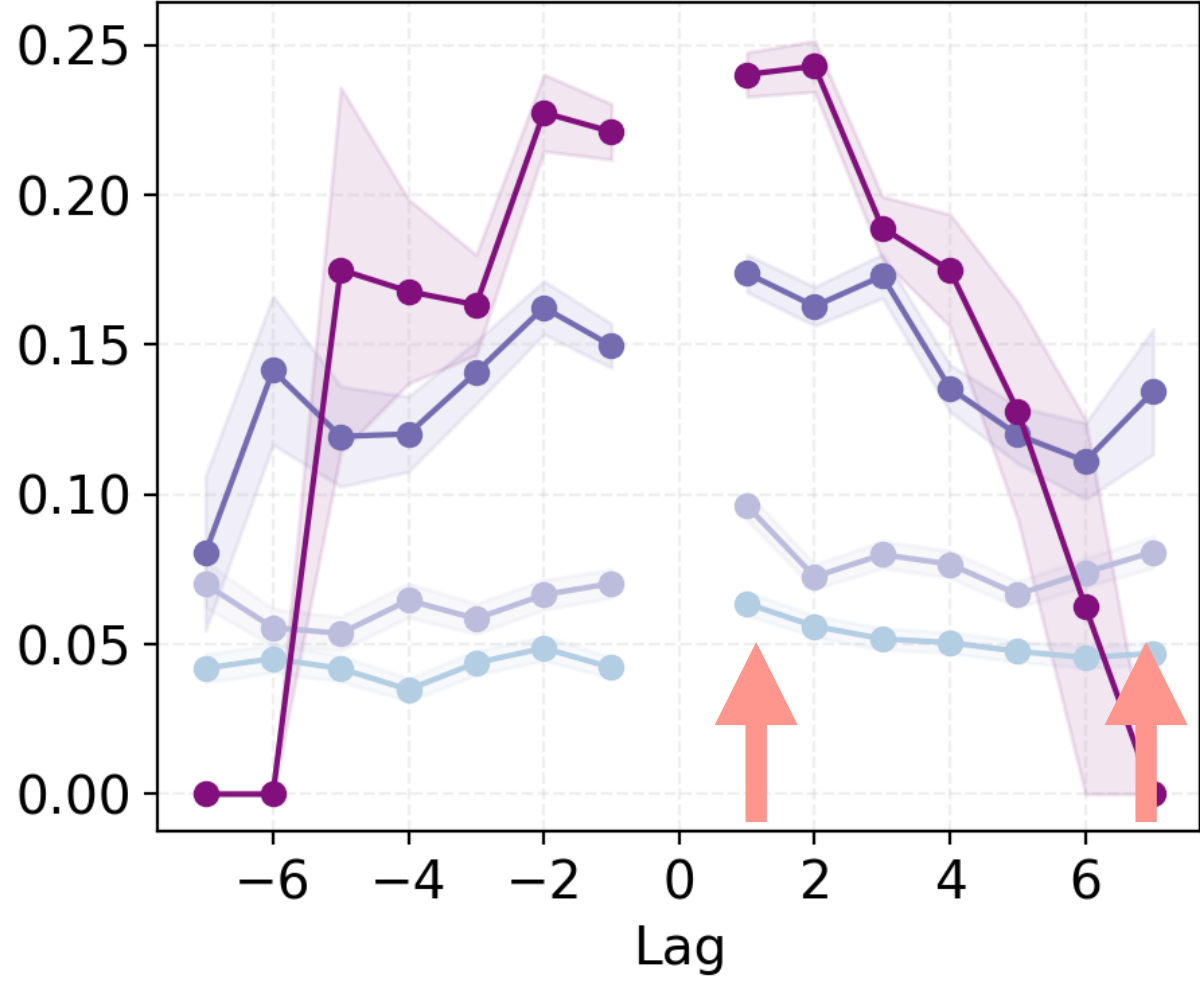
Narrative free recall dataset



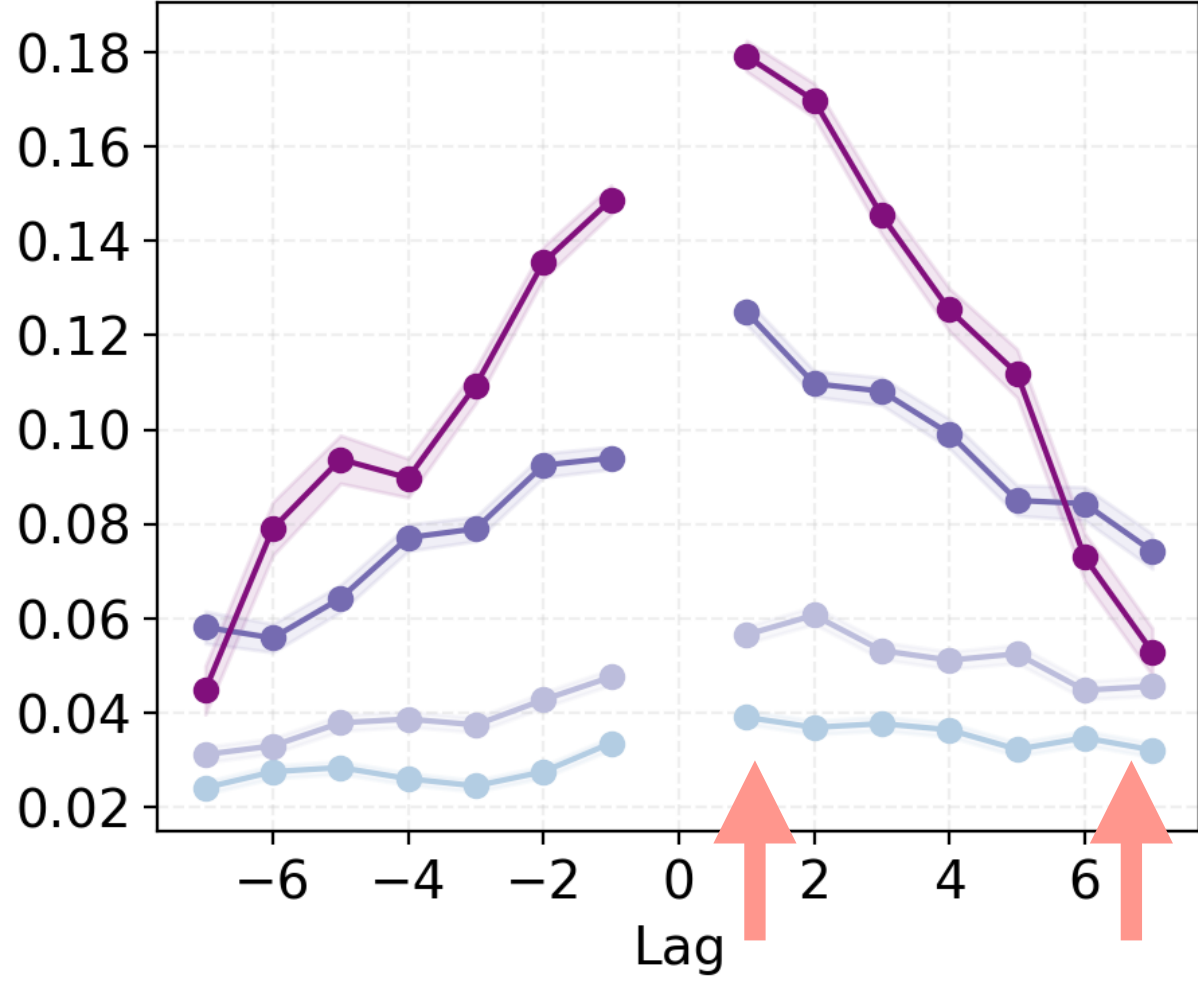
News articles dataset



HIPPOCORPUS dataset



Reddit TIFU dataset



Cross-scale transition analysis

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The Narrative free recall dataset maintains fine-grained temporal contiguity while summarization datasets operate at a coarser scale of events

Takeaways

1. Narrative recall & summarization show patterns of **primacy, recency & temporal contiguity** observed in standard free recall literature

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3. **Summarization operates at a coarse-grained, high level of hierarchy**, whereas narrative recall maintains fine-grained temporal contiguity

Takeaways

1. Narrative recall & summarization show patterns of **primacy, recency & temporal contiguity** observed in standard free recall literature
2. Narrative recall & summarization show the **centrality effect** observed in summarization literature and aligning with other memory recall studies
3. **Summarization operates at a coarse-grained, high level of hierarchy**, whereas narrative recall maintains fine-grained temporal contiguity
4. This work **links the tasks of memory recall & summarization**, providing insights into the task of summarization and opening up opportunities to use summarization as a naturalistic task to study memory recall

Acknowledgements

We're grateful to be supported by an NSF grant awarded to Qiong Zhang and the NSF SOCRATES traineeship awarded to H. Angne



Dr. Qiong Zhang



Sam Lin



**Snigdha
Sushil Mishra**



ID: 2316716



SOCRATES



**> MEMORY
OPTIMIZATION
LAB**

