

How Auditory Information Presentation Timings Affect Memory When Watching Omnidirectional Movie with Audio Guide

Objective : Finding Appropriate Audio Guide Presentation Timing for Memory Formation when Watching Omnidirectional Movie

Why “memory formation”?

- Memory formation is deeply connected with information acquisition.

Why “audio guide presentation timing”?

- Information acquisition is effectively supported by the use of multimodal presentation of information.
- Multiple threads for audio guide and visual contents should affect memory formation [1-3].

[1] Moreno, R. and Mayer, R. Interactive multimodal learning environment. 2007.
 [2] Kitajima et al. Creating memorable experience in virtual reality. 2017.
 [3] Hirabayashi et al. How auditory timing affect memory when watching movie with audio guide. 2019. (in Japanese)

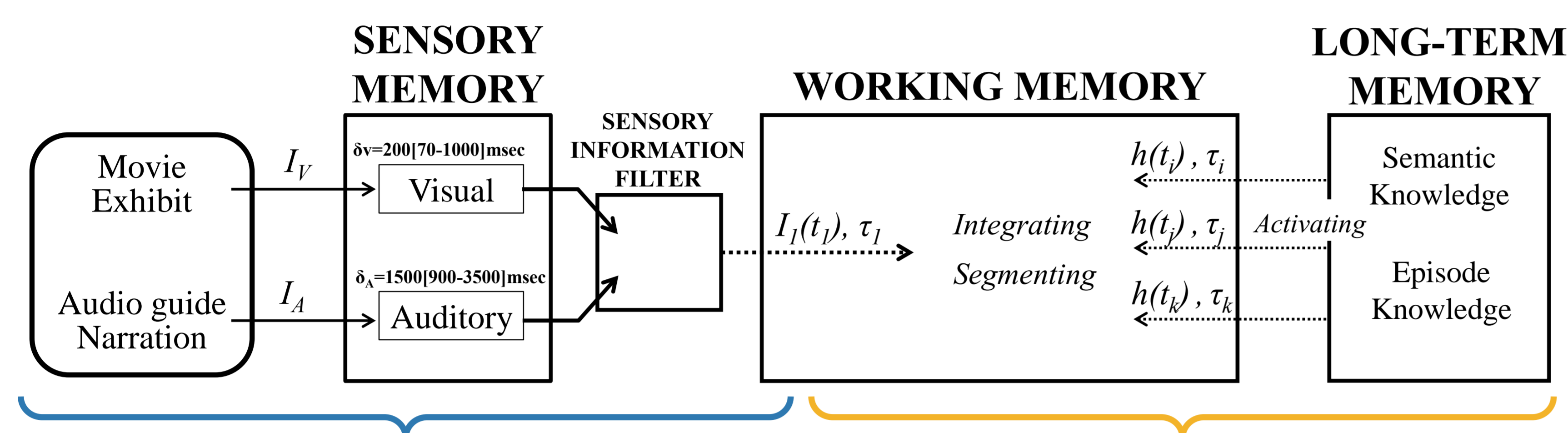
Why “omnidirectional movie watching situation”?

- Omnidirectional movie has potential to provide the richest information by projecting contents on a wide display area.
- However, the best use of its advantage is difficult because of the limitation of human attention process – cognitive bottleneck.

- **Research Question: How is effective information acquisition for memory formation possible by utilizing the potentially richest information provision environment?**

Modes concept of Audio Guide Presentation Timing

Cognitive process on memory formation

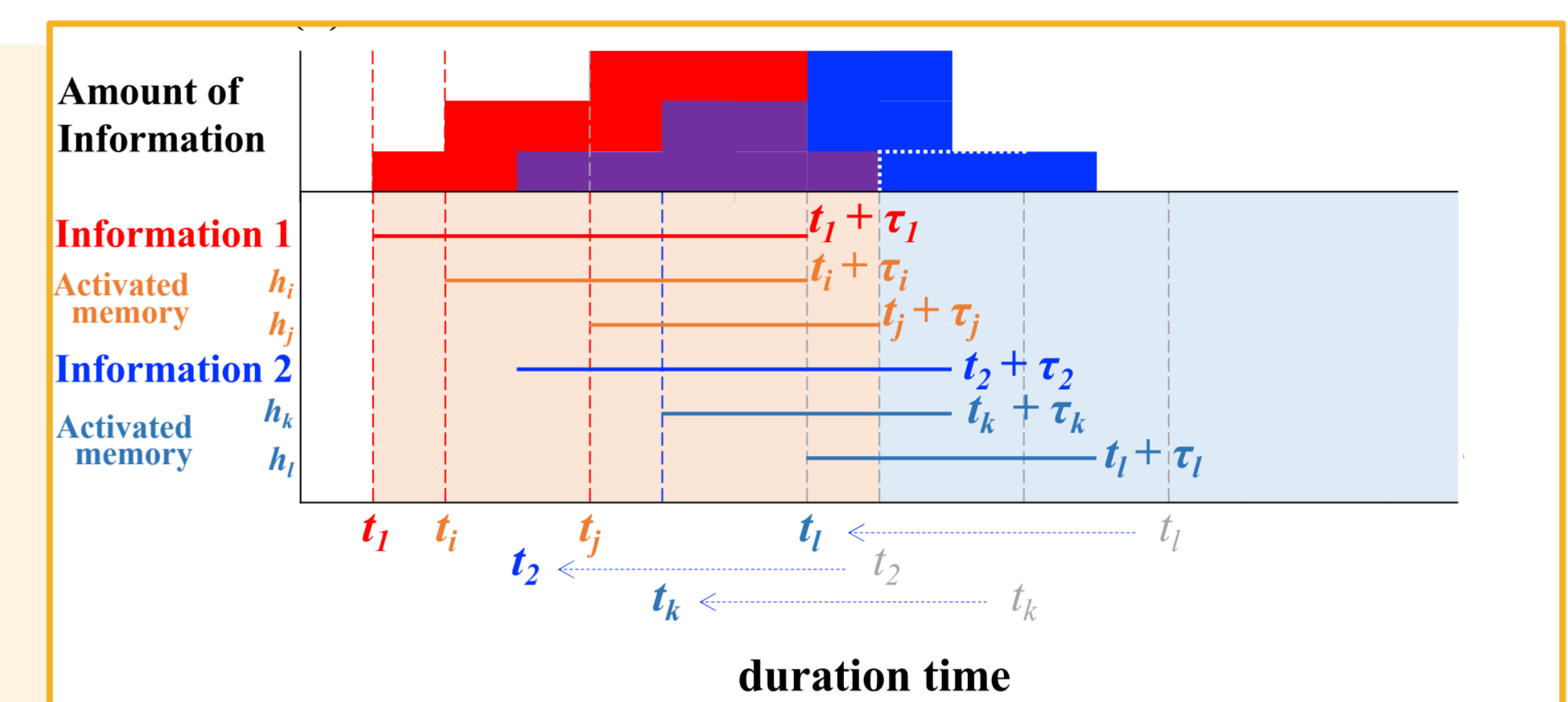


Perceptual process temporarily stores perceived information and selects its fragment for further processes.

Cognitive process triggers activation of long-term memory and makes sense of the perceived information.

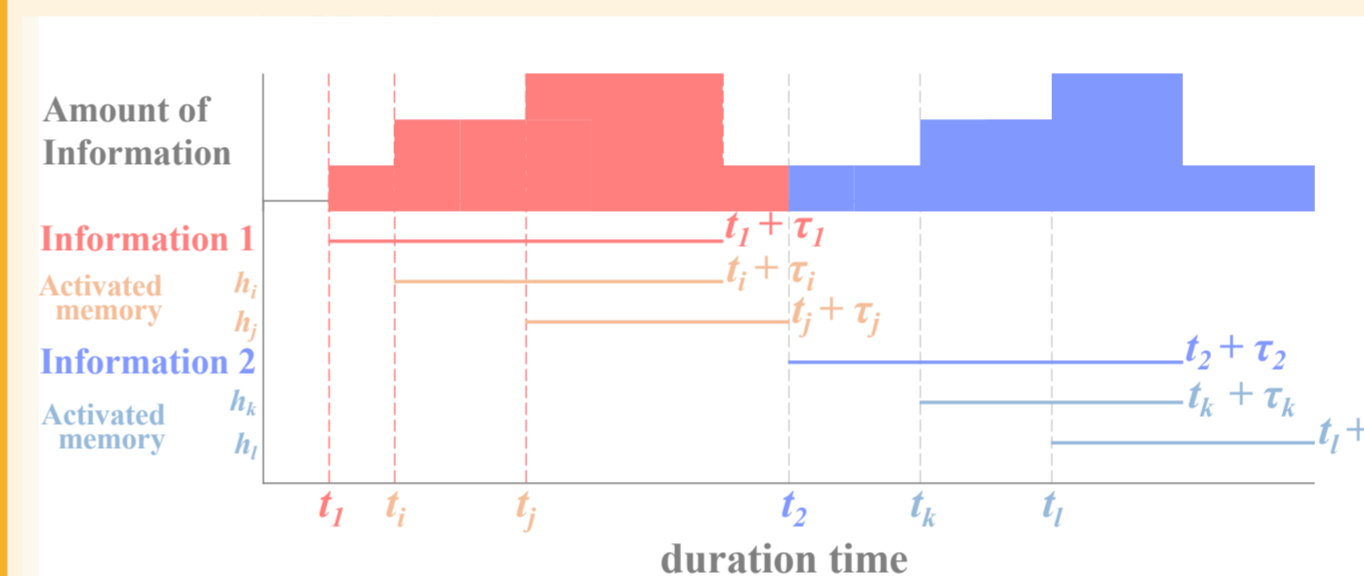
- **Memory Process:** Through these processes, perceived stimuli establish links with the existing memory networks in LTM by using Working Memory (WM), and as a result, it is memorized.
- **What Happens in Working Memory (WM):** Segmentation of perceived stimuli and integration with activated portion of LTM to create connected network for the perceived stimuli.

Modes of Audio guide Presentation Timing



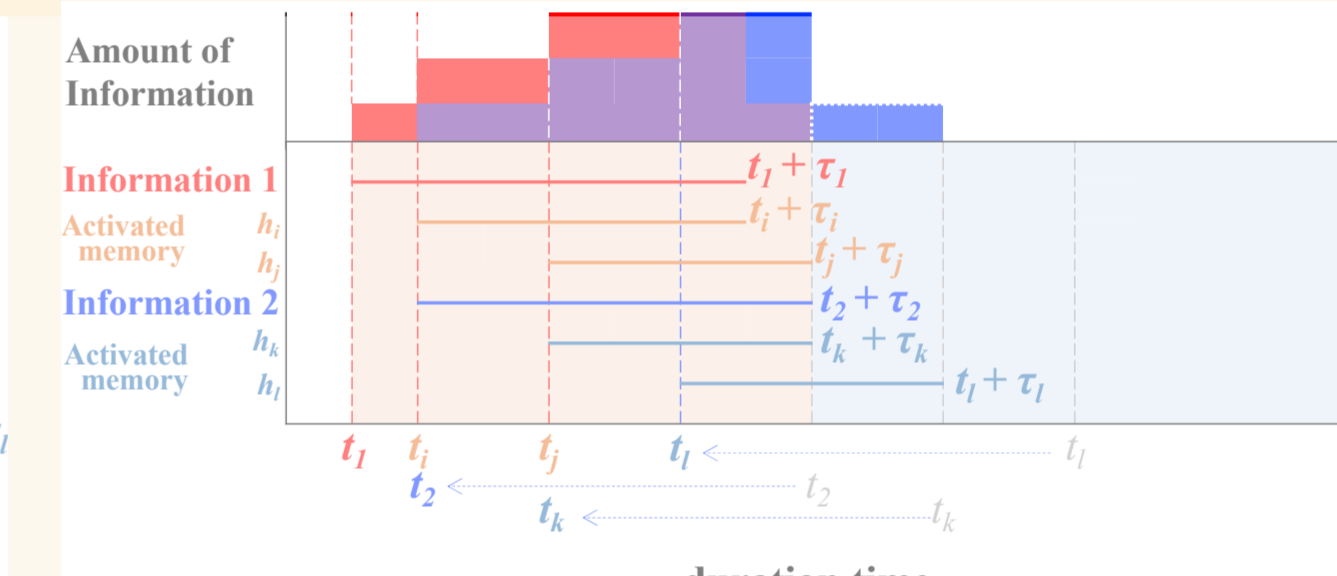
Mode 2: Moderate Overlap

- Two pieces of information (red and blue) are present at the overlapped times.
- Some pieces of information are available for integration (purple).



Mode 1: No Overlap

No overlap exists for the two sources of information and two pieces of information are integrated independently.



Mode 3: Large Overlap

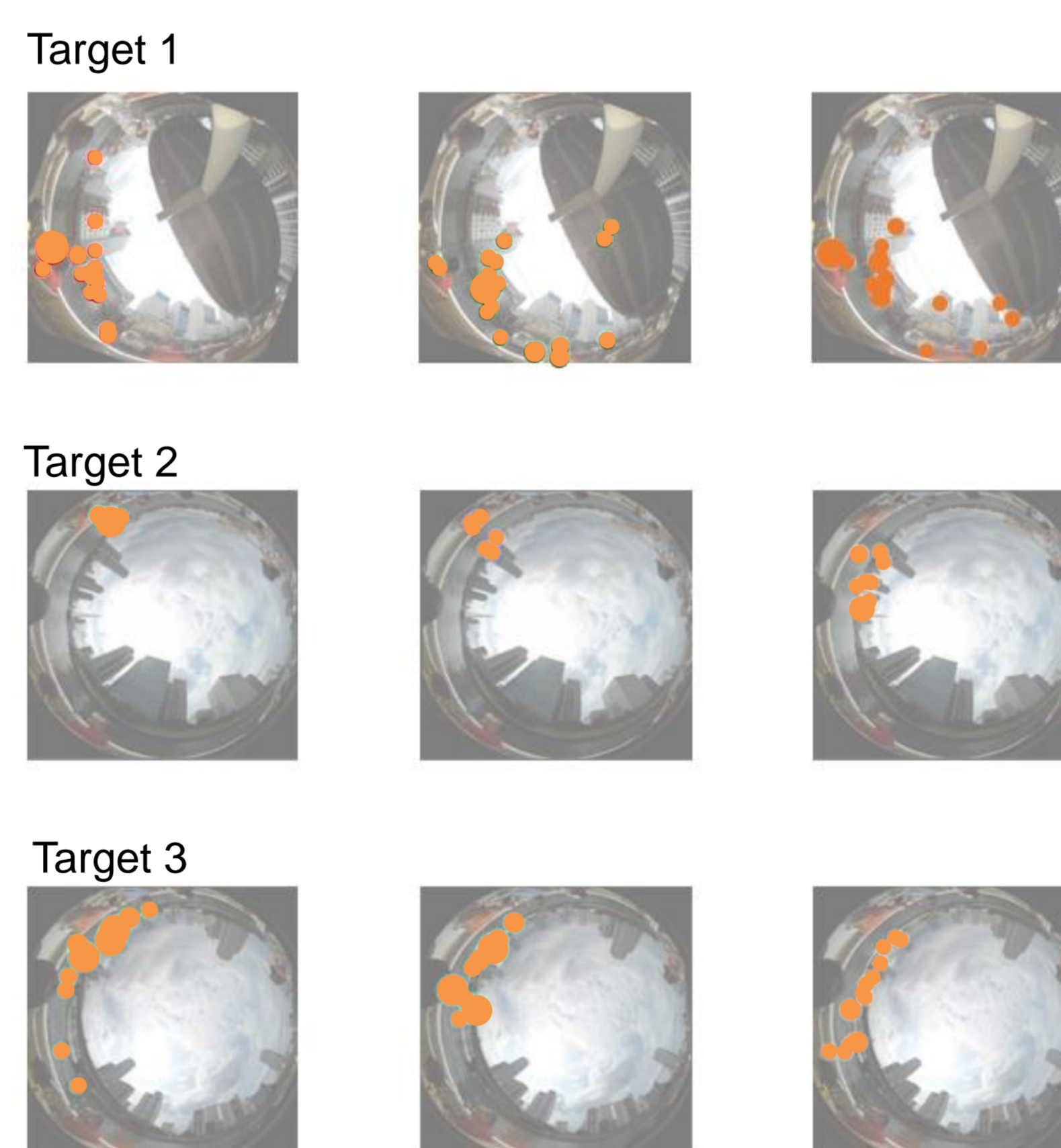
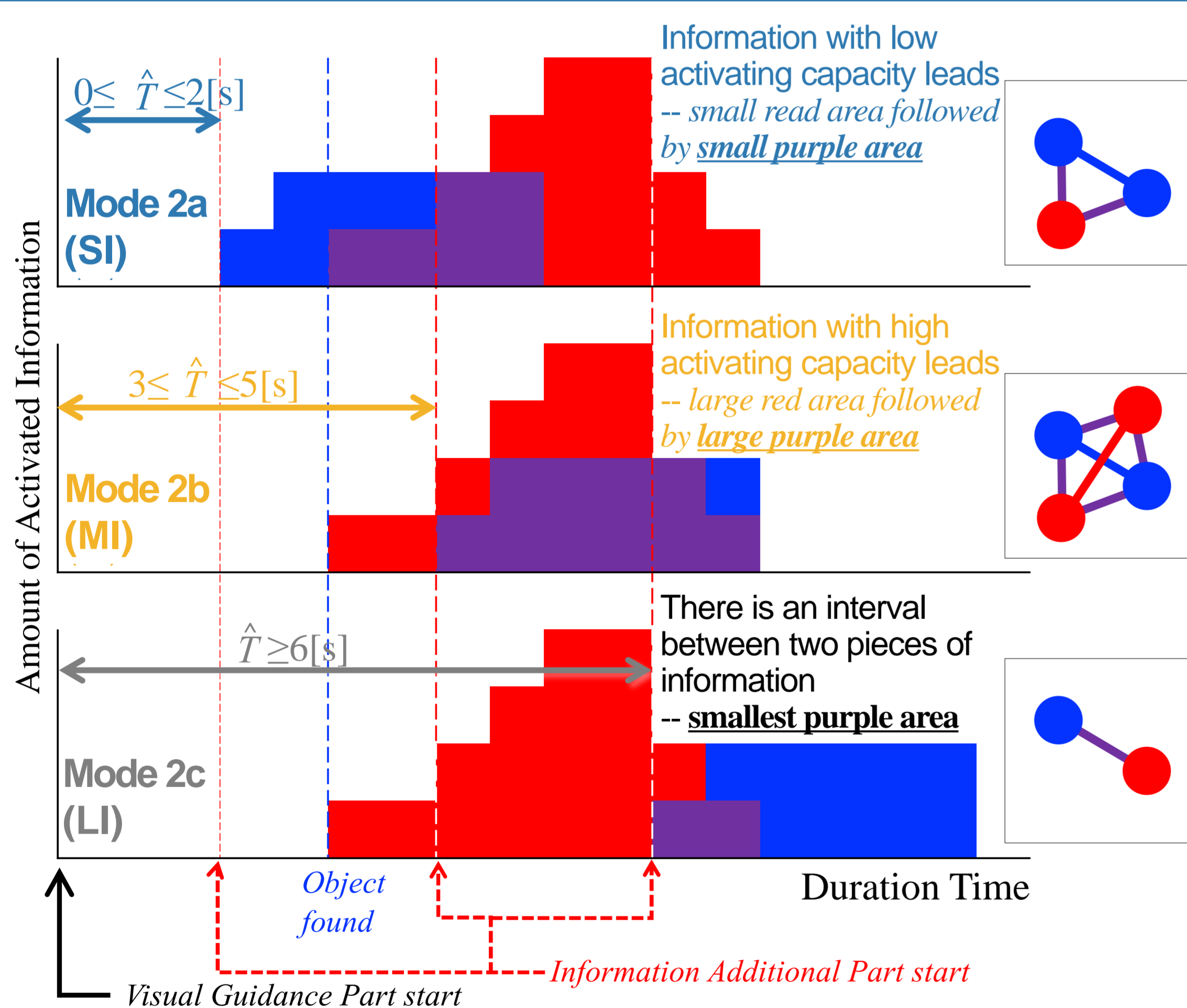
Two pieces of information is present at the overlapped times and many pieces of information are available for the integration.

Experiment for Examining Effectiveness of Audio Guide on Memory by using the Modes Concept

1. Manipulate Information Provision Interval

2. Analysis of Eye Movements

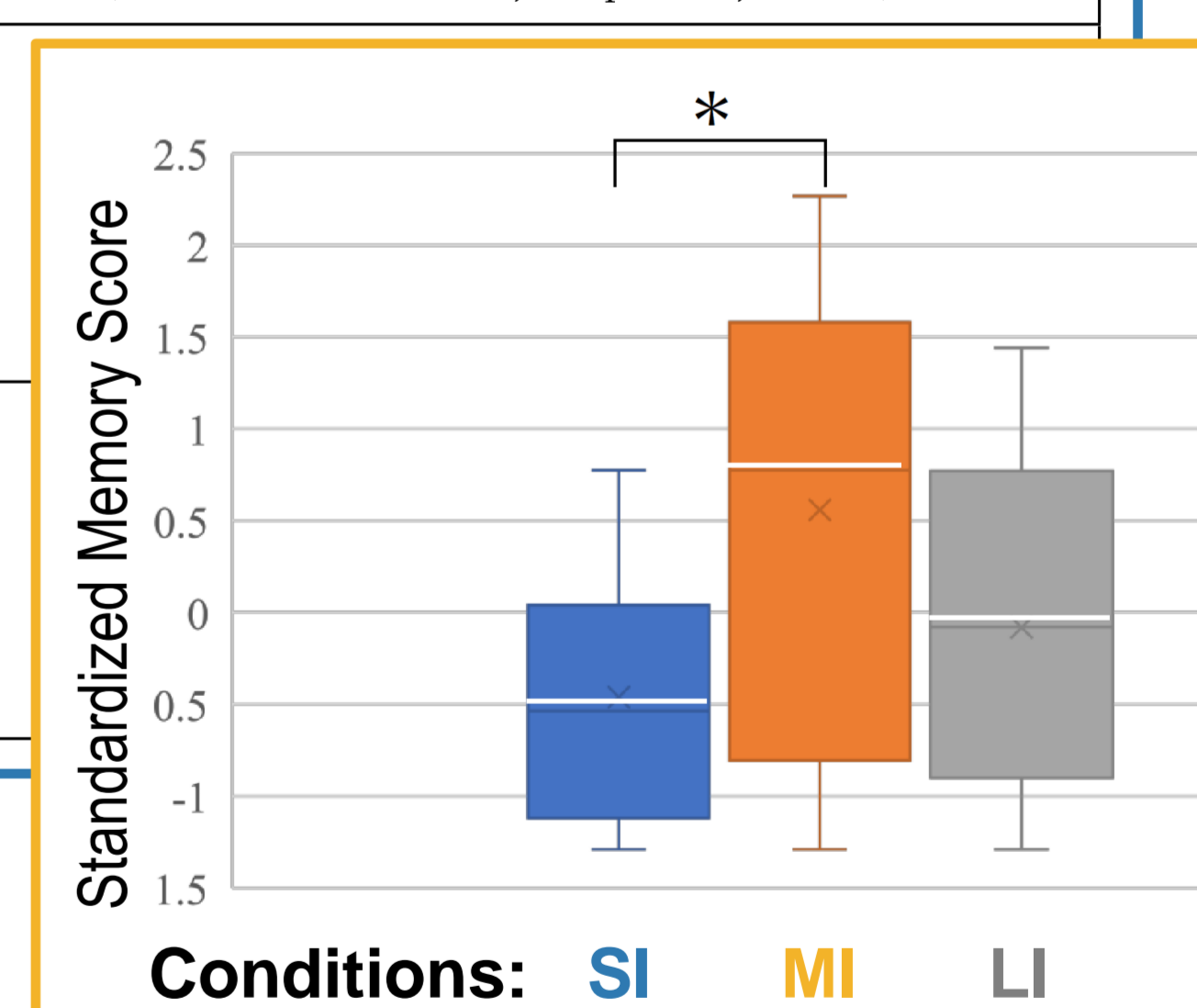
3. Evaluate Memory Score



Evaluation of memory : Written answers were broken down into meaningful units and given scores (1 point for noun and verb; 2 points for pronoun).

Please write out everything you can recall about the movie. If you could write out why you remember them, please write those reasons next to them in (). If those are phrases you listened it in audio guide, please draw circle around them.

Example	Running cars (came out now here, surprised, white)
Movie 1	
Movie 2	



Result

Effect on memory and behavior

- Participants began to look at the target 0.94 [s] (SD=0.90) after the visual guidance part started.
- **MI condition** should have successfully **induced Mode 2b**, and **resulted in the highest memory score, consistent with the prediction.**

Outline of Experiment

- **Number of Participants:** 8 (all males, average age: 23.25).
- **Procedure:** 1) Watched omnidirectional movie with audio guide. 2) Wrote out all they remembered about the movie afterward.
- **Obtained Data:** Eye movements, written report for memory, ...

* This experiment was conducted under the approval of the ethics committee of UT.

Conclusion

- Appropriate presentation timing of multiple threads of information for memorable experience was sought.
 - Presentation timing was categorized into distinctive modes in terms of the amount of memory integration by using multiple information sources (Mode 1, Mode 2a, 2b, 2c, and Mode 3).
 - Provision of explanatory information in audio with about a second delay after the target object being visually captured was most effective for memory formation (the MI condition in the experiment).
 - Provision of visual guidance in audio was effectively used for the participants to capture the target in 0.94 sec.
- Provide visual guidance part of audio guide 3 ~ 5 sec prior to information addition part of audio guide would be most effective for the viewers to memorize the contents.