HOW BRAIN PREDICT THE FUTURE?

박 기 은

최 윤 정

I N D E X

Why is future prediction necessary?

What are you going to do tomorrow?

HMM...

Why is future prediction necessary?

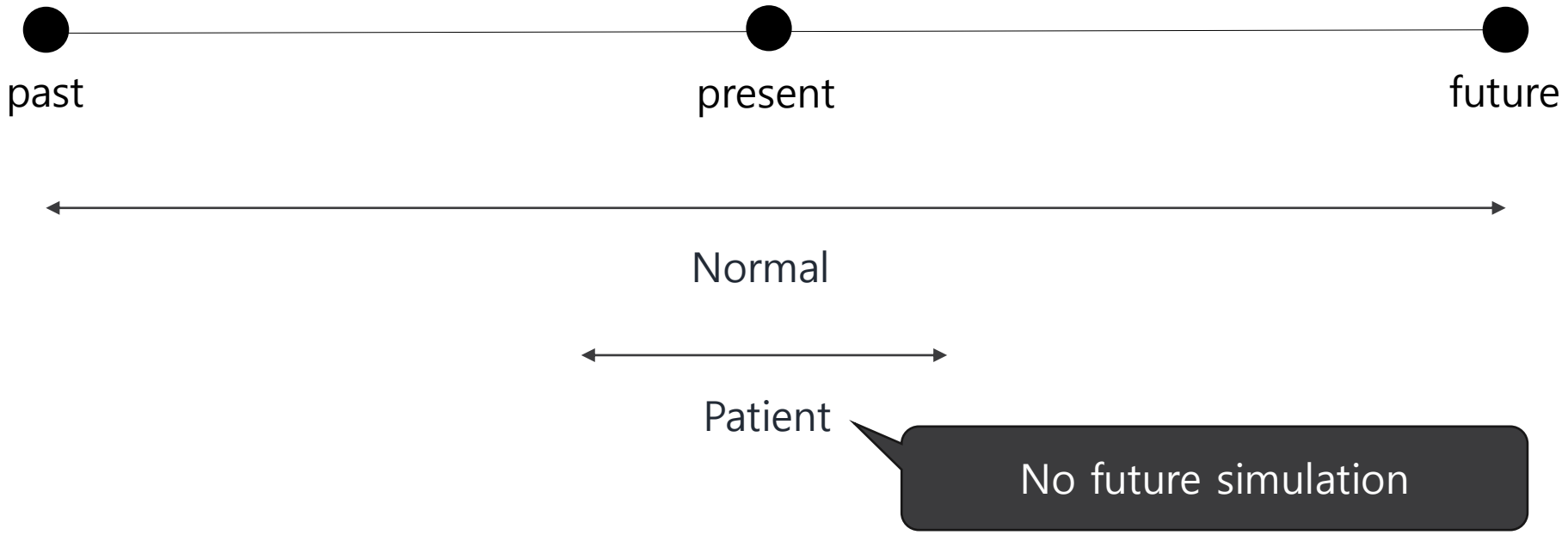
OUR HYPOTHESES TO DIE IN OUR STEAD

- Karl Potter

MEMORY-DEPENDENT FUTURE SIMULATION

MEMORY-DEPENDENT FUTURE SIMULATION

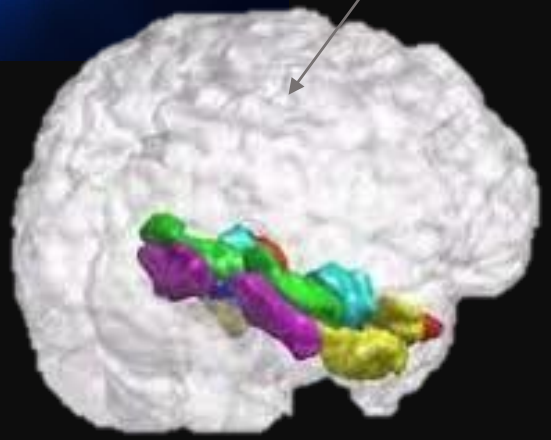
Normal VS Frontal Lobe Injury Patient



MEMORY-DEPENDENT FUTURE SIMULATION

FRONTAL LOBE

MEDIAL TEMPORAL LOBE



- COMMON POINT
- WHEN IT ATIVATE?

MEMORY-DEPENDENT FUTURE SIMULATION

Can humans predict the future from birth?

About 3 or 4 years old

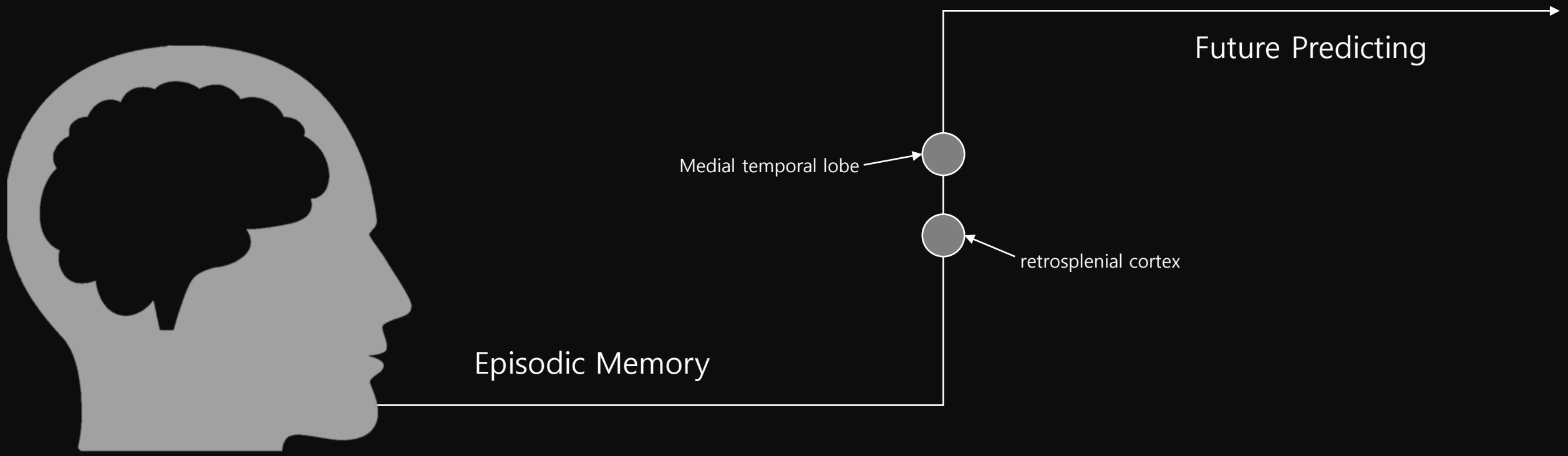
MEMORY-DEPENDENT FUTURE SIMULATION

Memory & Future Simulation

'Memory is a tool for successfully predicting the future.'
- Aristotle

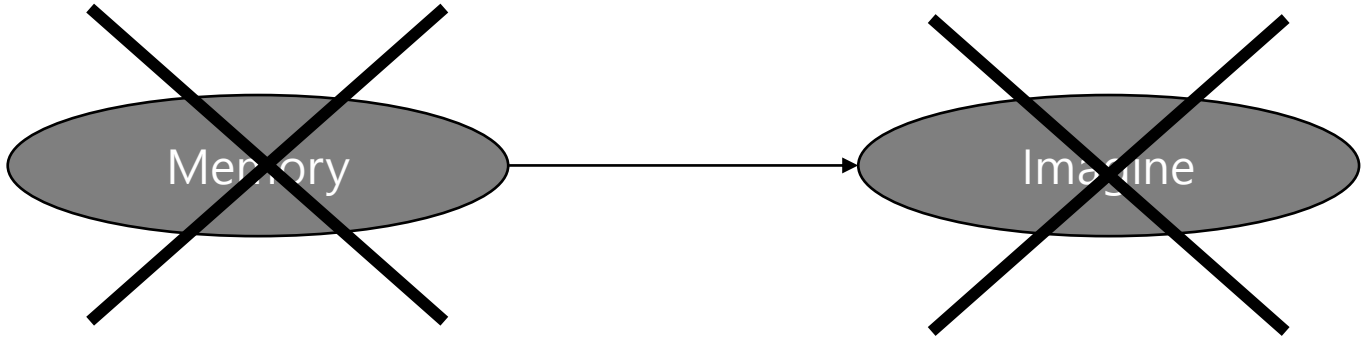
MEMORY-DEPENDENT FUTURE SIMULATION

Memory & Future Simulation



MEMORY-DEPENDENT FUTURE SIMULATION

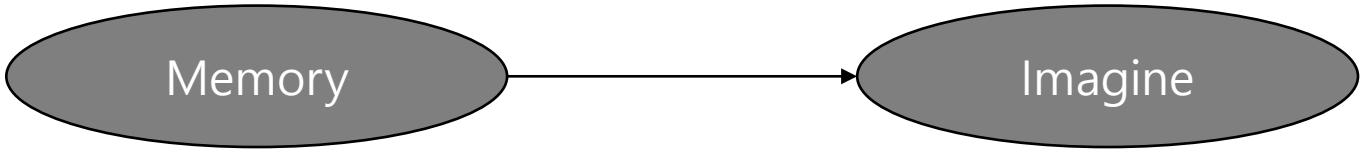
Amnesiac



Can't imagine future.

MEMORY-DEPENDENT FUTURE SIMULATION

Simulation is reflected with the past inflated.



Ex. Have you ever missed a train?

Imagine missing the train in the future

MEMORY-DEPENDENT FUTURE SIMULATION

Emotional and Future Simulation

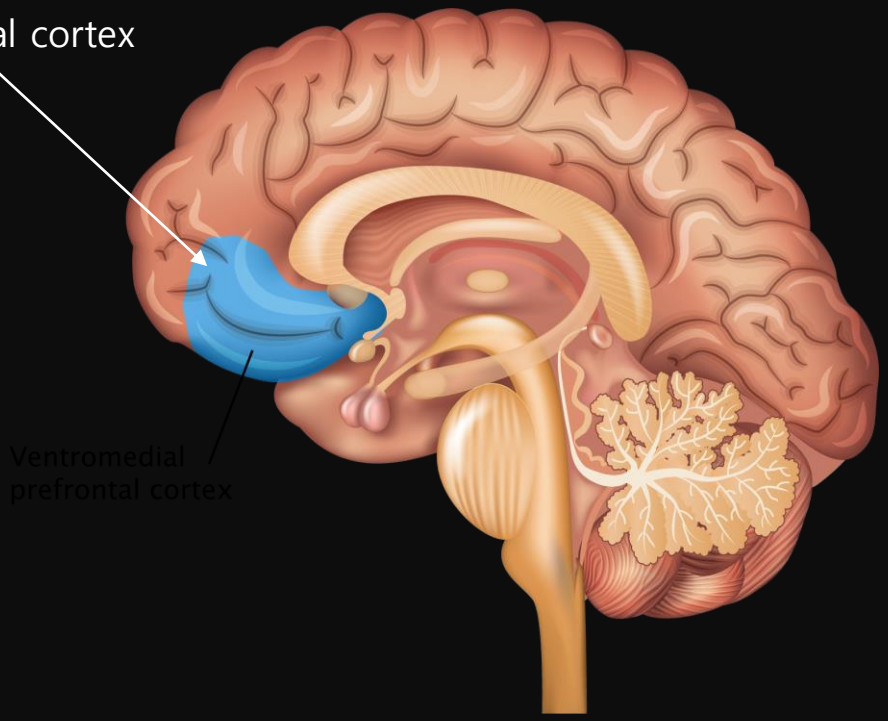
MEMORY-DEPENDENT FUTURE SIMULATION

Emotional and Future Simulation

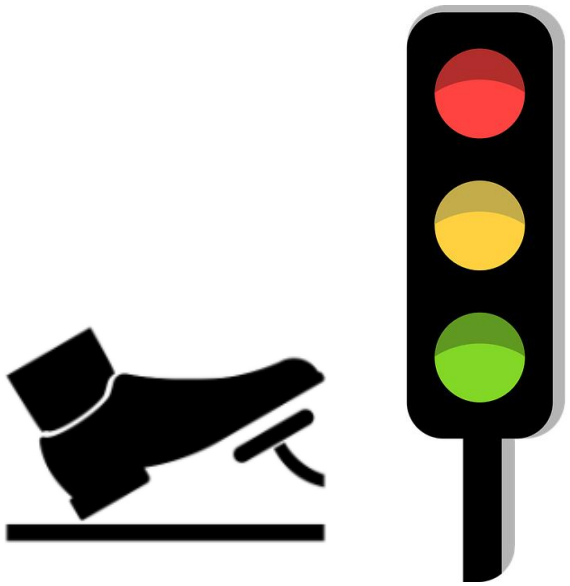
Good? Bad?

Ventromedial Prefrontal Cortex Injury Patient

Can’t predict emotion.



Temporal Prediction



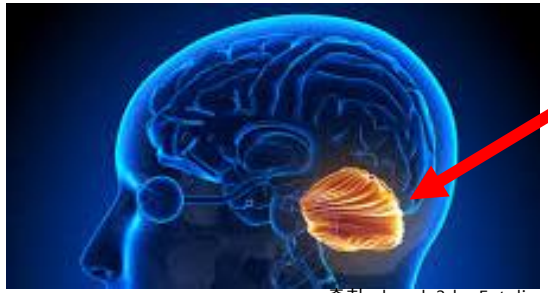
A n t i c i p a t o r y T i m i n g

Temporal Prediction

Anticipatory timing

Basal ganglia
: rhythmic timing

출처: decade3d - Fotolia



출처: decade3d - Fotolia

Cerebellum
: interval timing

rhythm

Memories from
past experiences

< Study of anticipatory timing >
People with Parkinson's disease & people with cerebellar degeneration

Temporal Prediction

1

출처: https://news.berkeley.edu/2018/11/19/brainclocks/

Temporal Prediction

2

출처: https://news.berkeley.edu/2018/11/19/brainclocks/

Temporal Prediction

1

출처: https://news.berkeley.edu/2018/11/19/brainclocks/

Steady rhythm

→ Cerebellar degeneration patients responded well

Red → White → Green

2

출처: https://news.berkeley.edu/2018/11/19/brainclocks/

Differing intervals between Red-Green

→ Patients with Parkinson's disease responded well
(basal ganglia degeneration - Parkinson's disease)

There are at least two different ways in which the brain has evolved to anticipate the future!
There are relation between rhythm-basal ganglia interval timing-cerebellum.

Mental Time Travel

Frontal lobe

출처: https://www.psychologytoday.com/

Mental Time Travel

=

Foresightedness (선견지명)

: the ability to judge correctly what is going to happen in the future and plan your actions based on this knowledge

Mental Time Travel

도전받는 인간의 유일한 특성

사람도 마찬가지로 이 능력을 갖고 있다. 그러나 사람은 동물에게 없는 또 다른 능력도 소유하고 있다. 사람은 과거에 전혀 경험해보지 않은 일을 마음속으로 그려보고선 그 결과를 예측하는 선견지명을 갖고 있는 것이다.

→ Foresightedness was unique property of human.

...중략...

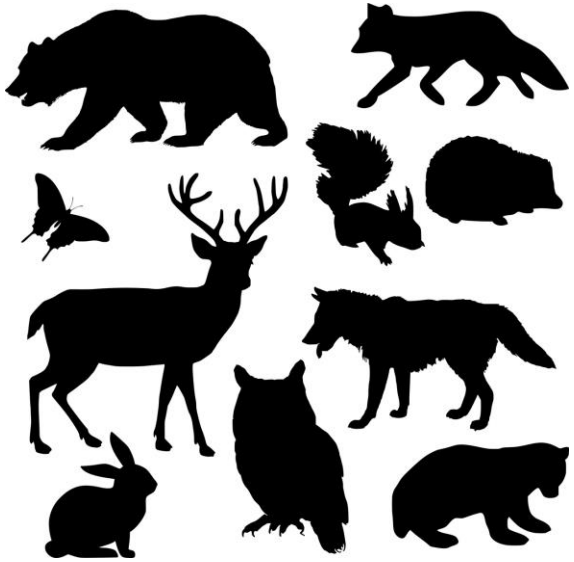
이 같은 선견지명은 인간만이 갖는 유일한 능력으로 여겨지고 있다. 그런데 지난해 2월 22일자 네이처지에는 Aphelocoma californica라는 서양 어치새가 먹잇감이 떨어지는 미래의 상황에 대비해 식량을 분산해서 보관한다는 연구결과가 발표되었다(Nature, vol 445, p919). 이로써 인간만이 갖는 능력들 가운데 또다른 하나가 도전을 받게 된 셈이다. 하지만 어치류가 미래의 상황을 시뮬레이션해서 이런 행동을 했을 것으로 보이지 않는다고 하버드 대학 심리학자 다니엘 길버트 교수는 말한다.

→

Bischof-Kohler hypothesis

: planning for a future need is outside the abilities of non-humans

<->



Mental Time Travel

anthropoid

출처:
https://terms.naver.com/entry.nhn?docId=1132694&cid=40942&categoryId=32633

scrub jay

Summary

Reference

1)Remembering the past to imagine the future: the prospective brain Daniel L. Schacter, Donna Rose Addis & Randy L. Buckner

2)https://www.theatlantic.com/science/archive/2017/10/imagining-the-future-is-just-another-form-of-memory/542832/

3)The Future of Memory: Remembering, Imagining, and the Brain , Neuron. Author manuscript; available in PMC 2013 Nov 3., Daniel L. Schacter,1,* Donna Rose Addis,2 Demis Hassabis,3 Victoria C. Martin,2 R. Nathan Spreng,4 and Karl K. Szpunar1

4)https://www.pnas.org/content/115/48/12283 (Double dissociation of single-interval and rhythmic temporal prediction in cerebellar degeneration and Parkinson's disease)

5)https://www.cambridge.org/core/journals/behavioral-and-brain-sciences/article/evolution-of-foresight-what-is-mental-time-travel-and-is-it-unique-to-humans/85E9D236BCAE38AF71442FA31E4F2E3B#fndtn-information (The evolution of foresight: What is mental time travel, and is it unique to humans?)

6)https://www.sciencetimes.co.kr/news/%EC%9A%B0%EB%A6%AC%EB%8A%94-%EC%96%B4%EB%96%BB%EA%B2%8C-%EB%AF%B8%EB%9E%98%EB%A5%BC-%EC%8B%9C%EB%AE%AC%EB%A0%88%EC%9D%B4%EC%85%98-%ED%95%98%EB%8A%94%EA%B0%80/

Thank

You


Q n A